

URBAN ECONOMIES AND GLOBALIZATION: EXPLORING EXTERNALLY-INDUCED
URBAN EXPANSION AND IMPACT ON PERI-URBAN LAND IN ACCRA, GHANA

By

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To the memory of our beloved late brother, Dr. Kwadwo Konadu-Agyemang

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LIST OF ABBREVIATIONS

| | |
|--------|--|
| FDI | Foreign direct investment |
| FSA | Firm-specific asset |
| GAMA | Greater Accra metropolitan area |
| GIPC | Ghana investment promotion center |
| GIS | Geographic information systems |
| GSS | Ghana statistical service |
| IUCN | International union for conservation of nature |
| IUSEEM | Integrated urban spatial expansion estimation method |
| MNC | Multi-national corporation |
| MNE | Multi-national enterprises |
| OLS | Ordinary least squares |
| SAP | Structural adjustment program |
| SFF | Spatial financial flow |
| TNC | Trans-national corporation |
| UN | United nations |
| UNCTAD | United nations conference on trade and development |
| UNDP | United nations development program |
| WCED | World commission on environment and development |

Abstract of Dissertation Presented to the Graduate School
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Mainstream urban expansion theorizing and modeling neglect influences of major economic forces associated with globalization, indicating a less than comprehensive understanding, given the current era of intensifying globalization. This dissertation explores the theoretical underpinnings and methodological approach to understanding and quantifying globally induced urban spatial expansion and implications for peri-urban lands in Accra, Ghana. The major outcomes are three-fold: (1) FDI induced urban spatial expansion theory is proposed as an extension to the Thunen-Alonso theoretical framework; (2) The Integrated Urban Spatial Expansion Estimation Method (IUSEEM, hereafter) is proposed as an appropriate method for quantifying FDI induced urban spatial expansion; (3) The study demonstrates that integration of geographical concepts and themes and urban economic theory help place FDI induced urban spatial expansion in the broader context of human-induced environmental change.

FDI and remittances were 'inserted' in current extensions of Alonso's theory. Propositions developed were tested using log transformed multiple regression, for a sample of 107 cities. FDI, remittances, city population and GDP per capita explained

82% of the variation in built up area. More importantly, FDI correlated positively with urban built area, statistically significant at the 95 percent confidence level; a 10 percent increase in FDI corresponded to almost 1 percent (0.087) increase in the urban built up area. This co-efficient is non-trivial since FDI can multiply dramatically within a short time, affecting urban expansion through multiple pathways. Remittance was found to be negatively correlated with built up area, contrary to literature and theoretical analyses in this dissertation. Results from the IUSEEM formulated to quantify FDI induced expansion indicate that the method could be useful.

This dissertation provides the theoretical foundations and methodological framework for analyzing contemporary urban land expansion as induced by FDI; facilitates a theoretically grounded geographical analysis of FDI induced urban land expansion; with implications for urban planning, policy and conservation.

CHAPTER 1 GENERAL INTRODUCTION

Globalization, Spatial Financial Flows and Urban Spatial Expansion

This dissertation proposes the theory of FDI induced urban spatial expansion as well as the Integrated Urban Spatial Expansion Estimation Method to quantify the impact of FDI on built up area expansion over time. The cardinal reason for this effort is that mainstream urban expansion theorizing and modeling neglect influences of major economic forces associated with globalization, indicating a less than comprehensive understanding of how globalization related economic forces such as foreign direct investment (FDI) and remittances influence urban land use values and have spatial ramifications. In effect, therefore, the central underlying argument of this dissertation research is that rapidly increasing levels of FDI and remittances flows, when significantly concentrated in an urban location, drive urban land values up, increase the opportunity cost of holding lands in agricultural and natural uses in peri-urban areas, thereby boosting rapid land conversion to urban uses which could lead to loss of urban ecological resources and contribute to environmental degradation. Consequently, it has been suggested that these global economic forces be incorporated in the classical Alonso theory to help account for current realities of economic globalization.

In the view of many researchers, including geographers, increasing globalization is rapidly shaping our world (Dicken, 2003). As Peter Dicken rightly puts it

We live in a world of increasing complexity, interconnectedness and volatility; a world in which the lives and livelihoods of every one of us are bound up with processes operating at a larger geographical scale.
(Dicken, 2003: 13).

Not surprising, therefore, understanding how spatial economic flows across the earth's surface have, and continue to impact localities and regions, is emerging as one of the

key issues of concern among geographical scientists as indicated in NRC's (2010) report, for example. In this regard, the overall aim of this dissertation resonates with the NRC's strategic direction question number 7 "How is the movement of people, goods, and ideas transforming the world?" (NRC, 2010: 75). Essentially, therefore, this dissertation has sought to link contemporary urban spatial expansion in a primate city, as a dynamic geographical system, to external economic forces-FDI and remittances-as globalization related external funds flow, seeking to ground the process in standard urban economic theory along the lines espoused by William Alonso (1964). By so doing the study would have linked global economic processes to local spatial changes, with the potential to increasing our understanding of human-induced environmental change, albeit in urban areas in developing countries. In very broad terms, therefore, this dissertation research has attempted to answer the question: to what extent are FDI and remittances (described as spatial financial flows in this work - SFF, hereafter), potent drivers of contemporary urban spatial expansion and urban environmental degradation?

It is widely recognized that globalization has defied complete and precise definition even though the word has become a common usage among researchers, policy makers, development agencies and ordinary people alike (Lim, 2010 and Carmody, 2010). Lim notes

Globalization has become one of the most frequently talked about subjects in academia, the mass media and the public policy arena in recent years. And yet what it means is not clear. (Lim, 2010: 13).

However, lack of concise definition has not prevented globalization discourses from attracting increasing attention from researchers. Some authors have alluded to three main components of globalization – cultural, political and economic-(Short & Yeong-Hyun, 1999) others posit an integrated view, arguing that

Although a highly contested term, globalization is often defined as the increased interconnectedness between places in terms of trade, investment, and information flows in particular. (Carmody, 2010: 2).

In this regard, it is obvious that the lives of many people in distant places are being affected by globalization as Dickens (2003) has argued. This notwithstanding, globalization has not been accepted wholeheartedly by all, in that there have been proponents on one hand who tout the benefits of globalization. Consequently, whereas supporters have suggested that foreign investment (associated with globalization) can bring capital and technology, develop skills and linkages and increase employment and incomes; there are opponents on the other hand who lament the negative consequences of globalization, especially on the plight of the poor or low income households in developing countries, suggesting that globalization has led to dependent, or restricted, development (Lim, 2010). Even though important, this contentious debate is on-going and is not the focus of this work per se. What is less contentious, however, is the realization that increasing levels of international trade, foreign investments as well as the dramatic growth in multinational corporations and firms have come to be closely associated with the globalization phenomenon. In this respect, this study shares the assertion that

The debate on globalization usually surrounds economic globalization. In this line of thinking, it refers to an integration of the world economy, removing trade barriers and allowing freedom of interaction. (Lim, 2010: 14).

Focusing on the economic aspect of globalization, O'Brien and Leichenko (2000) argue that "Economic globalization describes a set of processes whereby production and consumption activities shift from the local or national to the global scale" (p. 225). From a geographical perspective, therefore, increasing spatial interconnectedness and rising

levels of spatial financial flows have characterized the global economy, making spatial financial flows cardinal aspects of globalization (Dickens, 2003). Two main forms of spatial financial flows which form the focus of this study are (1) Foreign direct investment –which may be simply described as: “When a firm from one country buys a controlling investment in a firm in another country or where a firm sets up a branch or subsidiary in another country” (Dickens, 2003: 51); and (2) Remittances, also simply defined as - “that portion of migrant’s earnings sent from migration destination to the place of origin” (Addison, 2004: 5). In effect, therefore, this dissertation research asserts that these two forms of external economic ‘impulses’ could have significant spatial ramifications in distant localities and regions other than their origins, giving impetus for systematic geographical analysis of this emerging globalization-induced urban spatial expansion process.

Spatial Financial Flows in a Globalizing era. Africa in Context

Increasing foreign investment can be used as one measure of growing economic globalization, as noted above. Whereas world output has approximately doubled since 1970, FDI has quadrupled during the same period (Dickens, 2003; 1997). And according to the World Investment Report (2007), FDI increased from US\$400 billion in 2000 to a record US1, 833 billion in 2007 (UNCTAD, 2007; Bank of Ghana, 2009). The current global economic downturn notwithstanding, the global economy as a whole is predicted to experience a rebound soon. In this regard, the United Nations note that “After a contraction of 2 per cent in 2009, the global economy is projected to grow by 3 per cent in 2010”. (UNCTAD, 2010: xxiii). UNCTAD further noted that

Global inflows are expected to pick up to over \$1.2 trillion in 2010, rise further to \$1.3–1.5 trillion in 2011, and head towards \$1.6–2 trillion in 2012 (UNCTAD, 2010: xvii).

But UNCTAD tempered this optimism with some caution stating that: “However, these FDI prospects are fraught with risks and uncertainties, including the fragility of the global economic recovery. (UNCTAD, 2010: xvii). Consequently, even though not a ‘smooth ride’ the rebound of the global economy is not totally doubtful and it seems reasonable to assume that associated FDI flow levels will be sustained, if not enhanced, albeit with varying concentration levels for different countries.

Traditionally, developed or industrialized countries are known to receive the largest proportion of global FDI flows, with the bulk occurring between North America, North West Europe and Japan (Hoogvelt, 1997). As a result, in 1970 - 1980, large parts of Asia, Africa and Latin America had little or no FDI inflows (Hanink, 1994). The situation back then has been aptly captured by authors such as Ankie Hoogvelt (1997) who described the global economy as “imploding capitalism”, reasoning that capital flows and trade almost invariably were concentrated in the rich / industrialized countries and some parts of Asia. However, the situation is rapidly changing. For example, according to the World Investment Report, FDI inflows and outflows of developed countries plunged in 2008, with inflows declining by 29%, to \$962 billion, and outflows by 17%, to \$1,507 billion (UNCTAD, 2010; 2009). The UNCTAD continues that developed countries did not return to FDI growth in 2010. UNCTAD’s latest estimates show that FDI flows to this group of economies fell some 7% to \$527 billion, despite the robust recovery in some countries such as the USA. What is even more revealing is the gradual increase in receipts of FDI in developing and transition economies and its resilience even in the face of global economic crisis (UNCTAD, 2010). Thus, noted UNCTAD, despite worldwide economic downturn, the global FDI inflows to developing

and transition economies rose to 43% in 2008, after six years of continued growth (UNCTAD, 2009). This compares favorably with the general situation for developed countries as a group in terms of resiliency. In this regard, UNCTAD asserts that these countries saw a decline in FDI of about 44% (UNCTAD, 2010). Moreover, according to UNCTAD, referring to developing and transition economies as a group “their share in global FDI inflows kept rising: for the first time ever, developing and transition economies are now absorbing half of global FDI inflows” (UNCTAD, 2010: xviii-xix). Hence, it appears that contemporary FDI flows are becoming more geographically diversified with increasing flows to countries traditionally described as the ‘Global South’. Whereas some may argue that the increasing volumes of FDI flows to the Global South point to increasing global economic integration, others such as Sutchcliffe (2001), however, caution that the bulk of this expansion may be accounted for by the privatization of state enterprises, rather than the setting up of new factories as the definition of FDI implies. It is to be noted that this debate is not the focus for this dissertation research. The relevant question for this work is: are FDI flows to developing and transition economies merely ephemeral or enduring? The United Nations seem to support the latter view, stating that

There are some major changes in global FDI patterns that preceded the global crisis and that will most likely gain momentum in the short and medium term. Firstly, the relative weight of developing and transition economies as both destinations and sources of global FDI is expected to keep increasing. These economies, which absorbed almost half of FDI inflows in 2009, are leading the FDI recovery (UNCTAD, 2010: xvii).

However, these flows exhibit remarkable geographical inequality with some regions and countries attracting more FDI than others. For example, it has been estimated that in 1997 about 71% of the foreign direct investment in developing

countries, described generally as the Global South was received by only 9 countries, with China topping the list with receipts of about 30% of the FDI inflows (UNCTAD, 2010). Globalization in general has been highly uneven and so has associated FDI flows (Dickens, 2003). So with the inequality characterizing global FDI flows, how has Africa fared? In other words, has Africa been bypassed by globalization and FDI flows?

Africa has had a long history of interactions and interconnections with places far and beyond, ostensibly predating the current era of global economic integration (Cooper, 2001) - from slave trade, colonization to economic exploitation- as argued by Bond (2006). In contemporary development discourses, two main views on Africa prevail (Bond, 2006). The first view asserts that Africa has been bypassed by economic globalization; with the second alluding to the fact that Africa has suffered from globalization (Bond, 2006; Carmody, 2010:1). It must be noted that until recently independent countries in Africa were suspicious of their former colonial masters, fearing that the Global North would seek to recolonize them under the guise of economic reforms. Thus, after gaining independence, following the end of the Second World War, most countries in Sub-Saharan Africa suspected that foreign investments in the form of foreign ownership of production in their economies were neocolonial strategies that have been instituted in order to recolonize the region (Killick, 2010; Carmody, 2010: 41-42; Broadman, 2007; Voltoirenet, 2006;). This prompted many leaders of the newly independent countries to nationalize companies with foreign ownership; in some cases privately owned companies by citizens were not spared. For example, Tony Killick (2010) has noted that the first independent government of Ghana followed this path to some degree. To a very large extent, this hostile attitude towards foreign business

interests in their domestic economies and the general aversion for private entrepreneurship effectively restricted FDI inflows (Killick, 2010; Carmody, 2010). Currently, however, the general consensus emerging among developed countries and developing ones alike is that FDI is desirable, if not essential for both economic growth and poverty reduction (Carmody, 2010: 41-42; Broadman, 2007; Voltoirenet, 2007). Indeed, at its inception in 2001, the New Partnership for Africa's Development (NEPAD) stated as one of its objectives: "to enhance Africa's growth, development and participation in the global economy" (NEPAD, 2001). Largely as a consequence of these developments, among others, some advances have been forged aimed at integrating Africa's diverse economies into the global mainstream economy, albeit through natural resources exploitation and export of primary product from the continent and increasing demand for mobile phones, with some modest achievements in attracting transnational corporations (Carmody, 2010: 34; Ndulu et al., 2007). For example, according to Pdraig Carmody

In 2007, Africa hosted seven of the world's top twenty fastest- growing economies . . . and there are now thirteen middle-income countries in sub-Saharan Africa. (Carmody, 2010: 34, citing Ndulu et al., 2007).

Sector-wise, the United Nations note that

Contraction of investment in the services sector in Africa was less pronounced than in other sectors. Sustained by expanded activity, the telecommunications industry became the largest recipient of FDI inflows. Recovering commodity prices and continued interest from emerging Asian economies are expected to feed a slow upturn in FDI flows to Africa in 2010. (UNCTAD, 2010: xix).

Consequently, many researchers share the view that even though Africa's share of FDI receipts have been relatively small, there are indications that the continent is increasingly becoming FDI destination, believed to be currently attracting about three

times the levels in the 1990s FDI (Broadman, 2007; Voltoirenet, 2007; Carmody, 2010: 40-41). For example, Carmody (2010) has stated that “the nature of globalization in Africa has evolved significantly, particularly, in the past decade, as a result of the rise of China and the global technological revolution” (p. 3). Current globalization in Africa is being led, predominantly, by Asia, particularly, India and China and predicated largely on natural resource exploitation (Carmody, 2010). The author has argued that China is playing a cardinal role in the globalization of Africa but is dismayed that mainstream research works have largely neglected to assert this fact. As a result he has suggested that

The rise of China in Africa, through the intensification of economic and ideational flows and migration, should be seen as an evolution of globalization on the continent rather than separate from it. (Carmody, 2010: 3).

To put this in perspective, Pdraig Carmody notes

Chinese trade with Africa grew an astonishing 45.1 percent in 2008 alone to US\$107 billion (Center for Chinese Studies, 2009). China is now the continent’s second-largest trading partner, after the United States; and its single largest source of imports. (Carmody, 2010: 3).

As far as researchers such Carmody are concerned, therefore: “Globalization is certainly not bypassing Africa anymore, if it ever did” (Carmody, 2010: 4-5), Chinese domination notwithstanding.

Another important development is that it is generally held that globalization on the African continent has moved beyond resource exploitation to encompass trade, investment and migration (Carmody, 2010: 4-5). More importantly, it has been noted that “Indeed, the World Bank claimed that the region’s higher economic performance is not transitory but is rather a structural break from the past” (World Bank, 2006a, cited in

Carmody, 2010: 34]). To the extent that Africa continues to globalize, FDI inflows is likely to continue.

Like FDI, remittances, particularly from developed to developing countries, have been on the increase following increased international migration (International Organization for Migration-IOM, 2011) and economic reforms which allow for free flow of financial resources across countries. The World Bank has estimated that migrant worker remittances were US\$182 billion in 2004, representing an increase of 5.7% and 34.5% over the figures recorded for 2003 and 2001, respectively (Maimbo & Ratha, 2005; World Bank, 2004). Even given the current global economic downturn, remittance flows have shown a better resilience compared to private capital flows such as FDI and portfolio investments. Thus, Mohapatra and colleagues have asserted that

The decline in remittances during the global financial crisis was modest compared to a 40 percent decline in foreign direct investment (FDI) between 2008 and 2009 and an 80 percent decline in private debt and portfolio equity flows from their peak in 2007. (Mohapatra et al., 2011: 1).

More importantly, it has been noted that “recorded remittance flows to developing countries are estimated to have fully recovered to the pre-crisis level of \$ 325 billion in 2010” (Mohapatra et al., 2011: 1) and the authors further assert that:

Remittance flows to developing countries are expected to increase by 6.2 percent in 2011 and 8.1 percent in 2012, to reach \$346 billion in 2011 and \$374 billion in 201 2 respectively. (Mohapatra et al., 2011: 1).

These developments point to the ever increasing importance of remittances to developing countries. However, remittance funds, like other forms of global funds flow, are unevenly distributed. Thus, even though remittances have increased significantly throughout developing countries as whole, regional variations do exist. Singh and colleagues note that

A number of African countries are among the largest recipients of remittances relative to their GDP, and for some of them remittances represent a major source of foreign exchange (Singh et al., 2009: 3).

For example, it has been noted that Sub-Saharan Africa received estimated US\$19 billion in remittances in 2007 accounted for only about two-and-half percent of GDP for the sub-region, which represented about five percent of total remittances to developing countries in general, far behind the amounts received in the Middle East and South Asia as regions (Singh et al. 2009: 3). Additionally, “Of the 25 largest recipients of remittances in 2007 in terms of GDP, six were in Africa (Cape Verde, Comoros, Lesotho, Senegal, Sierra Leone, and Togo)” (Singh et al., 2009: 4). Moreover, for some countries in Africa, remittances constitute a substantial source of foreign exchange earnings as has been noted by Singh and colleagues:

As a source of foreign exchange, in Benin, Cape Verde, Comoros, Eritrea, Gambia, Lesotho, and Uganda, remittances in 2006 represented more than 25 percent of each country’s export earnings (Singh et al., 2009: 4).

Increasingly, it seems, remittances flow to developing countries is assuming an important dimension as a vital source of external finance for many of these countries (Mohapatra et al., 2011). Beyond development financing, such remittance funds continue to be critical in terms of providing economic sustenance for numerous families as well as savings towards the acquisition of real property such as houses and lands in migrant home countries (Addison, 2004). To the extent that globalization reinforces international migration and given the ageing economically active population in rich countries; and so far as economic liberalization ensures almost seamless spatial flow of global funds, the future of oversea workers’ remittances flow (from developed economies to less developed ones) is likely to continue into the future (Chami et al., 2008).

Ghana is a beneficiary of the remittances and FDI 'waves'. A conservative estimate of oversea remittances by the Bank of Ghana put Ghana's remittance receipts at US\$ 1 billion in 2003 (Addison, 2004), representing about 13 percent of Ghana's GDP (Mazzucato et al., 2008: 104; Addison, 2004). Remittances to Ghana amounted to over \$4.5 billion in 2005, making it the largest foreign exchange earner (Sophism, 2006). Of particular importance is that remittances as a percentage of GDP rose from 3.2 percent in 1990 to 13.3 percent in 2003. Also, as a percentage of export, remittances rose from 22.5 percent to 40 percent within the same period (Sophism, 2006). Some researchers have asserted that local aggregate incomes formed only 64% of household spending in 1996 in Ghana, with the rest being derived from external sources such as remittances and "external" jobs (Grant, 2007), indicating that a significant portion of local consumption is related to foreign-derived incomes. Similarly, FDI inflows to Ghana have increased significantly in volume (Ghana Investment Promotion Center - GIPC, 2009; Grant, 2001). Concentrating on current figures, in 2008 Ghana received a total of GH¢ 3.17 billion in FDI funds (about US\$ 3.5 billion), representing more than 160% increase over the total FDI received in 2007 (GIPC, 2009). Additionally, the GIPC reports that Ghana received GH¢ 527.63 million (US\$ 351.75 million) in FDI funds, which represent 92.95% of the total estimated value and a rise of about 118% over what was received in the same quarter of 2010 -US\$161.34 million (GIPC, 2011). Unfortunately for Ghana, even though increased inflows of remittances and FDI should be a welcoming development for the better, the restricted geographical concentration of the bulk of these funds in the Greater Accra region and

the Accra metropolis, in particular, may not bode well for the environment (Moeller-Jensen et al., 2005; Grant & Yankson, 2003).

Accra: A 'Globalizing' Primate City

The contention that Africa is being bypassed by globalization, to a large extent, does not seem to be tenable, given the discussion above. If African economies are connected to the global economy, are cities on the continent equally connected? Generally, urban research have mostly focused on cities described as "World cities" such as London, New York, Tokyo, among others, in regard to globalization (Grant 2007; 2009; Sassen, 2006; Merwe, 2004). Merwe has particularly lamented the lacuna of information about African cities as world cities researchers have paid little or no attention to these cities in general (Merwe, 2004). This situation is changing, however. Current research efforts have aimed at situating the African urban systems in the global urban system since these cities can no longer be ignored considering their important role as the "springboard" for insertion of their national economies into the global economy. Thus, researchers with such orientation have argued that, increasingly, African urban spaces are being shaped by global forces (Grant, 2009; 2007; Robinson, 2002). Focusing on the external economic forces, for many countries, FDI-related activities have been concentrated in large, usually, primate cities, which more often than not, are also the designated capital cities of these countries (Grant, 2009). It has been documented that the majority of FDI-related projects established in Ghana have consistently been over-concentrated in the capital city, Accra (GIPC, 2011; Grant, 2009; Yeboah, 2003). For example, in the first quarter of 2011 (January - March), the GIPC reports that six out of the ten regions in Ghana benefited directly from FDI related projects. Of these, the Greater Accra Region received the majority share, amounting to

about 78% (GIPC, 2011). It is important to note that almost all of such FDI-related projects in the Greater Accra Region would normally be located in and around the city of Accra (Grant, 2009; 2007; Grant & Yankson, 2003; Yeboah, 2003). In a similar vein, Richard Grant has asserted that there is anecdotal evidence that much of Ghana's remittance receipts have been invested in some form of real estate property in the city of Accra (Grant, 2009). In effect, the over-bearing of the city of Accra as the main economic hub for the Ghanaian economy has helped positioned it in a considerable advantage in terms of receipts of these external funds, compared to other cities and towns in Ghana. Historical factors may be cited for this situation. In particular, Accra has enjoyed increasing attention since its inception as the colonial seat of government in the 1870s, benefiting from construction of relatively superior quality of infrastructure. Additionally, the boom in the cocoa industry in Ghana even in the pre-independence era has been noted to have had positive impacts on the city which served as the main port for exporting the commodity (Grant & Yankson, 2003). Indications are economic globalization is helping reinforce Accra's primacy in Ghana's urban system.

It has been asserted that "globalization trends lead to resources allocation consequences and these in turn result in urban impacts" (Richardson & Bae, 2010: 2). This dissertation research, along with Professor Richard Grant and many others, share the view that this is akin to what has happened in Accra since the implementation of the Structural Adjustment Program (SAP) in Ghana in the 1980s, especially the rapid loss of peri-urban natural areas which has become greatly intensified in the era of economic globalization (Grant, 2009; Grant & Yankson, 2003). This necessitates the consideration of global economic forces (FDI and remittances) in mainstream urban

land use theorizing and urban expansion modeling in primate cities in developing countries such as Accra in Ghana, to better understand drivers of urban land use change in the era of globalization. However, to a large extent this has not yet materialized. Three main issues come to the fore, following a review of the existing literature: (a) inadequate representation of forces of economic globalization in mainstream or the classical urban land use theory, (b) lack of systematic articulation of spatial financial flows-FDI and remittances-as integral components of economic globalization in urban land use theorizing; and (c) externally-induced peri-urban environmental degradation in 'globalizing' cities in developing countries has received little attention in the global urban environmental change literature, especially, concerning sub-Saharan African cities.

In very general terms, these issues constitute the problem which is the focus of this study. The timeliness and imperative of this research are underscored by the NRC (2010) report regarding the need to understand the human induced aspects of the changing earth by stating that

Although previous research has documented shifts in climate, soil erosion, habitat loss, and water degradation, the human role in these changes is often inadequately understood, hindering abilities to predict the magnitude and timing of future change. (NRC, 2010: 3).

Moreover, regarding geographical input to globalization studies, Coe and Yeung (2001) have called on geographers, thus:

It is imperative for future researchers to continue to evaluate the uneven geographical outcomes of globalization processes in order to arrive at better-informed development policies. (p. 14).

The exploration of the contemporary physical expansion of Accra and associated loss of peri-urban natural areas as globally-induced spatial change at the local scale being

advanced in this dissertation will, hopefully, add some insights in this important emerging area of geographical research.

Statement of the Problem and Objectives

The rapid spatial expansion of Accra has been breathtaking by all accounts (Angel et al., 2011; 2005; Grant, 2009; Moller-Jensen et al., 2005; Grant & Yankson, 2003).

For example, Shlomo Angel and colleagues note that

Between 1985 and 2000, the population of Accra, the capital of Ghana, increased from 1.8 to 2.7 million, a 50 percent increase. Its urban land cover increased from 13,000 to 33,000 hectares, a 153 percent increase: Urban land cover in Accra grew more than twice as fast as its population. (Angel et al., 2011: 5).

This is not unique to Accra, however. There have been instances in which population dynamics in a given geographic area appear to have little to do with the spatial expansion of the geographical region. For example, Burchell and colleagues have noted that

From 1982 to 1997, the U.S population grew by 17 percent while urbanized land grew by 47 percent. Between 1970 and 1990, the Chicago metropolitan area grew by 46 percent while its population grew by 4 percent. The Cleveland urban area expanded by 33 percent in that same period while its regional population declined by 11 percent. (Burchell et al., 2005: 38).

Obviously, at least to an extent, expansion of urban built up area may not have much to do with the city's population growth per se. It is therefore a welcoming development when researchers are able to isolate important drivers according to some criteria such as development levels to tease out the differential impacts of the "traditional" explanatory variables (population and GDP or GNP per capita growth). For example, Seto et al. (2011) have concluded that population increase was responsible for much of urban land expansion in developing countries, whereas in developed countries GDP per

capita growth rate was the most important variable. However, the apparent high significance of population as urban land use change driver in developing countries may be masking some other not so obvious underlying economic factors. For example, inflows of FDI into an urban economy may be a very significant source of employment for people, affording them the needed purchasing power in order to be able to express “effective” demand for housing and land. In such a situation, the advent of globalization and attendant FDI inflows may be contributing to increasing pressure on demand for housing and land. Indeed, even though Seto et al. (2011) did not include FDI in their analysis they rightly pointed it out that FDI could be responsible for some proportion of urban land expansion. From the foregoing, therefore, it is obvious that urban land expansion research efforts that will incorporate FDI will help increase our understanding.

Similarly, remittances inflow to Ghana has been on the increase and anecdotal evidence suggest that Accra’s real estate /construction sector absorbs about 20% of these funds (Tipple et al., 1998). Consequently, increasing remittances inflow into Accra’s economy may be implicated in the rapid spatial expansion of the city. Needless to say, therefore, the combined forces of FDI and remittances could constitute a formidable force of urban spatial expansion, especially if they are over-concentrated in a single primate city or urban area such as Accra. But, are these forces adequately represented in the standard economic theory of urban land use/land value?

Objective 1: Theorizing urban land use, land value under globalization: Most urban expansion models lack a coherent theoretical structure to explain the underlying economic drivers of urban land use / land cover change. Such models are usually

simulated and include most Cellular Automata (CA) and Agent Based Models (ABM); Attempts to link urban expansion modeling to a coherent urban land use /land value theory have invoked the postulates of the neoclassical economic theory of urban spatial structure (Angel et al., 2011; 2005; McGrath, 2005; Brueckner & Fansler, 1983). These approaches have most often emphasized local characteristics such as population growth, transportation costs and income (GDP per capita). However, global linkage of economies have resulted in the exposure of the urban economies and their biophysical environment to vagaries of global economic forces and these forces have the tendencies of influencing local land use decisions in favor of conversion of agricultural lands to urban uses. Given the fact that traditional factors emphasized by the neoclassical economic land use theory lag behind urban land conversion, it is important to explore beyond the local characteristics. However, for the most part the neoclassical economic theory of urban land use/land value still focuses on local factors pertaining to the city; and cities of all sorts are grouped together and attempts are made to account for the variations in their land cover by invoking traditional factors such as population growth, Gross National Product (GNP) per capita and transportation costs (Angel et al., 2010: 9). Even though these factors have been important for a long a time, their relative significance in a 'globalized' world appear somewhat questionable. Consequently, urban land use / land value theory relying on these factors as the most important predictors to attempt to account for land conversion in 'globalizing' cities such as Accra tells only a part of the story, thereby failing to provide a fuller understanding of the dynamics of the contemporary land expansion, especially as pertaining to primate cities in developing countries. To better understand contemporary urban expansion,

especially, in apparently “primate’ cities in developing economies such as Accra in Ghana, it is imperative that the standard economic theory of urban land use be refined to incorporate the influences of external economic factors flowing from economic globalization. In view of this the first and overarching objective of this study is: to attempt to ‘globalize’ the neoclassical economic urban land use/land value theory postulated by Alonso (1964) to reflect realities of the current era of economic globalization whereby global financial resources flow almost seamlessly into urban spaces, impacting urban physical growth.

In order to properly pursue this objective, however, it is important that FDI and remittances are systematically conceptualized as drivers of urban land conversion, thereby helping to identify the pathways through which FDI and remittances would impact contemporary urban spatial expansion.

Objective 2: Linking external economic forces to urban land conversion: That economic globalization has brought in its wake almost seamless flow of financial resources across locations is no longer a bone of contention in globalization discourses. In particular, as elaborated on above, FDI and remittances continue to flow into urban spaces in developing countries. For a deeper understanding of ‘globalized’ urban expansion, therefore, it is necessary that the global economic impulses are traced into the urban spaces by unraveling the pathways through which FDI and remittances impact urban land conversion. In this regard, a number of excellent research efforts have been devoted to describing the linkages between the physical expansion of Accra as influenced by forces of globalization. (Grant, 2009; 2007; Yeboah, 2003; 2001). Indeed, Yeboah (2003) has argued that “the expansion of Accra and the specific ways

in which it has happened reflect the interaction of global and local forces” (p.74). Thus, there is a growing body of works that have sought to analyze the globalization-spatial expansion nexus in Accra, via the interplay of global and local forces. Undoubtedly, these studies have provided rich, detailed information and analytical insights about how globalization and economic liberalization policies have combined to help shape the contemporary expansion of Accra (Grant, 2009 and Yeboah, 2003). However, these attributions have not systematically conceptualized the linkages between FDI and remittances on the one hand, and Accra’s contemporary spatial expansion. Laying out systematic conceptual frameworks that identify the specific pathways through which FDI and remittances impact urban land conversion will enhance understanding as well as facilitate their formal incorporation into the standard classical economic theory of urban land use (Alonso, 1964), which could be developed further to help account for externally induced urban land expansion. In view of this, the second of objective of this dissertation is: to develop two conceptual frameworks specifically aimed at unraveling the pathways through which FDI and remittances impact land conversion in cities where they are over concentrated, focusing on Accra.

It appears that the overconcentration of FDI and remittances in an urban setting transmits their impulses into the landscape, which in the absence of effective land use controls and urban planning could result in loss of peri-urban natural areas. This necessitates quantification in order to understand the extent to which this constitutes a problem. Widely used spatially explicit urban expansion modeling and estimation approaches such as Cellular Automata (CA) and Agent Based Models (ABM) largely fail to incorporate global economic influences, hence may not be appropriate for quantifying

externally induced urban spatial expansion. An appropriate and suitable model is called for.

Objective 3: Quantifying externally-induced built up area expansion over time: Land use / land cover changes, especially land conversion, form an important aspect of environmentally significant consumption since these have direct and indirect impacts on the biophysical environment (NRC 1999). Consequently, it has been argued that economic globalization, urbanization and environmental change are three fundamental, intertwined worldwide processes impacting almost all livelihoods on planet earth (Leichenko and O'Brien, 2008; IHDP, 2005; Dickens, 2003; UN, 2005). Even though the process of urbanization and attendant loss of urban vegetation cannot be said to be occurring only in recent times, the advent of economic globalization appears to be intensifying the process. The global linkages of urban economies and the exposure of urban environments and ecosystems to external forces of economic globalization make it imperative that we better understand contemporary peri-urban environmental degradation, especially in the developing world, in the proper contexts of overriding external influences following economic globalization. More importantly, perhaps, the external economic dimensions of contemporary peri-urban environmental change should be properly contextualized; rate of land expansion with respect to global economic forces should be identified and quantified in 'primate' cities. However, to a very large extent, urban growth models have focused on local factors using probability models and remotely sensed land cover change data to predict urban land use /land cover change, to the neglect of underlying global forces as potential drivers of urban land cover change. In effect, therefore, specific linkage of globalization forces and loss

of urban vegetation cover through land conversion has been considered less adequately in quantitative terms. As a result, our understanding is inadequate. Also, environmental managers, in their attempt to curb loss of peri-urban ecological resources may be targeting the wrong variables. This situation needs to be addressed given that globalization and urbanization are what we are going to live with into the future if current projections hold (Angel et al., 2011; 2005; UN, 2005; 2003). The third objective in this study, therefore, is: to lay the foundations for a simple analytical model of urban spatial expansion (the IUSEEM), which, when properly calibrated, could be used to compute the rates of loss of peri-urban natural areas in Accra as induced by economic forces of globalization; emphasizing the increasing importance of FDI as a potent driver of contemporary urban land expansion in primate cities such as Accra. The main questions formulated in pursuant of the foregoing objectives are given below.

Research Questions and Hypotheses

The following questions are designed, firstly, to identify the pathways through which remittances and FDI affect the urban expansion process. Secondly, to investigate the specific statistical relationships between remittances and FDI on the one hand and urban built up area on the other hand. Thirdly, to interrogate how the classical Alonso theoretical framework could be refined to accommodate remittances and FDI as emerging potential urban land conversion drivers. Finally, to inquire into how an appropriate method can be developed to quantify incremental changes in the urban extent over time as induced by external (global) economic influences in the form of FDI inflows. The questions are followed by related specific hypotheses.

Questions

RQ1: *What are the specific pathways through which FDI impact urban spatial expansion?* Due to relatively less attention paid to researching the FDI-urban spatial expansion relationship, the specific pathways through which FDI impacts the urban built up area have not been identified for systematic conceptualization in order to aid theory building. Answering this question will provide more insight on the specifics of the FDI-urban spatial expansion relationship which will help facilitate urban land use theory building in the face of increasing economic globalization. [Answer attempted in Chapter 2]

RQ2: *What are the specific pathways through which remittances impact urban spatial expansion?* Following the relative lack of consideration, the specific pathways through which remittances impact urban spatial expansion are not properly understood. To properly understand the remittances – urban spatial expansion relationship it is imperative that the specific pathways of transmission of remittances impulses in the urban landscape are properly identified and systematically conceptualized, hence the relevance of this question. [Answer attempted in Chapter 3]

RQ3a: *What is the nature of the correlation, if any, between FDI and remittances on the one hand, and urban built- up areas, on the other hand?* FDI and remittances constitute the spatial financial flows as conceived in this dissertation. FDI's impact on lands in destination countries have been examined mostly from the perspective of extractive industries such as mining, plantation agriculture and the likes, with less attention paid to FDI impact on urban lands. However, increasing global FDI flows, with the tendency of overconcentration in urban agglomeration enclaves in developing countries, would warrant that more attention be paid to this FDI-urban built up area

relationship in view of economic globalization. Similarly, even though researchers are increasingly paying attention to remittances and their impact in origin countries of migrants, the potential impact of remittances on urban land demand has received little attention. In other words, this question seeks to understand the specific nature of the FDI-urban spatial expansion relationship as well as that of remittances and urban spatial expansion. [Answers attempted in Chapter 4]

RQ3b: *In what ways can the classical Alonso urban land use theory be refined to accommodate remittances and FDI as drivers of urban land expansion?* This question seeks to examine how to ‘embed’ the increasingly important globalization driven phenomena of remittances and FDI in order to provide a rigorous and theoretically grounded explanation for contemporary urban spatial expansion in light of economic globalization. The rationale here is that the classical Alonso urban land use land value theory is considered by urban economists as the most useful theory of urban land use and land value. However, the advent of globalization seems to have raised new questions as to how realistic the theory reflects current realities of economic globalization whereby the urban land market may be “shocked” by stimuli generated in far-distant places. This underscores the need for the re-evaluation of the Alonso theoretical framework with the view to ‘refining’ it to accommodate the potential urban land value change drivers like FDI and remittances. [Answer attempted in Chapter 4]

RQ4a: *What is the nature of the relationship between FDI flow volume and rate of expansion of the urban extent over time?*

RQ4b: *How best can FDI induced increase in the urban extent be quantified?* As noted above, models and methods directly concerned with urban spatial expansion fail

to incorporate “top-to-bottom” influences such as FDI flowing from global sources, hence the need for this question.

Hypotheses

H1: FDI and remittances are expected to be positively correlated with urban built – up area; increasing inflows of both would correspond to expanding urban extent, and statistically significant at the 95% confidence level. [Statistical tests in Chapter 4].

H2: The Thunen-Alonso theoretical framework can usefully be extended to reflect the influences of FDI and remittances on urban land use values by framing these external economic variables in the context of urban land demand and urban land values change. [Theoretical arguments put to ‘test’ in Chapter 4 and Chapter 5].

H3: FDI induced urban spatial expansion exhibits non-linear and exponential growth characteristics; increasing FDI volumes correspond to rapid increase in the rate of expansion of the urban extent . [Tested in Chapter 5, using the IUSEEM].

H4: The IUSEEM is most appropriate for quantifying FDI induced urban spatial expansion. [Tested in Chapter 5, using the IUSEEM].

It is important to note that since the 4 main chapters of the dissertation have been designed as independent but related essays, the objectives, questions and hypotheses above may be broken into sub-units in the appropriate essay if necessary.

The General Conceptual Framework and Theoretical Structure

General Conceptual Framework

It is generally acknowledged that economic globalization is impacting the world’s economies, integrating them together, thereby making these economies interdependent on each other (Dickens, 2003), as well as exposing the biophysical environment (Leichenko & O’Brien, 2008). Almost invariably, therefore, local environmental changes

can often be traced to global forces such as FDI (Grant, 2009); for example, whereby foreign capital is used to exploit local natural resources such as oil (Carmody, 2010). To some extent, therefore, this study shares in the assertion that

One of the ways in which the world has changed profoundly in the last two centuries is that sustainability of the biosphere increasingly is threatened by human activities. Globalization contributes to the threat of environmental destabilization by tying distant places closer together, by diffusing new technologies faster to distant lands, and by encouraging changes that may not fit harmoniously into local cultures or may produce unanticipated effects. (Johnson et al., 2010: 46).

It must be noted, however, that this author is not opposed to globalization per se. It is the tendency of advocates to attempt to decouple the phenomenon from nature that is troubling. More importantly, therefore, this author believes, with numerous others, that

Humans cannot be separated from nature for analytical purposes as easily as one might think. Humankind lives in and is an integral part of the natural world; our species is both nurtured by nature and an influential driving force in altering the natural environment. (Johnson et al., 2010: 46).

This turn of thinking necessitates the reconceptualization of the nature of the human-environment relationship (Constanza et al., 1997; Daly, 1991, for example). In resonance with these views, the general conceptual approach to this study is that of a hierarchical systems perspective in which humans are considered integral, but small part of nature (Costanza et al., 1997; Rees, 1992; Daly, 1991; Georgescu-Roegen, 1971). Essentially, with the intensification of economic globalization, the urban biophysical system or environment is exposed to the full vagaries of global economic forces. Thus, local land use/land cover change becomes directly or indirectly linked to global economic dynamics. This is because one important pathway through which global economic forces manifest in the urban landscape is through real estate development and other land consuming activities such as infrastructure and road

construction (Leichenko & O'Brien, 2008; 2005; Keivani & Mattingly, 2007; Parnell et al., 2007; Seto, 2005). For example, Leichenko and Solecki (2005) have argued that globalization of consumption (housing in this case) has led to the exportation of the American style of single family housing units with large open spaces to the developing countries of the world. The authors concluded that changing global consumption culture is shaping the urban spaces of developing countries elsewhere with the attendant accelerated peripheral land conversion as growing incomes enabled the adoption of American-styled housing.

Since urban land conversion usually forms an important part of environmentally significant human consumption activities, the process affects the biophysical environment (NRC, 1999). Figure 1-1 shows the linkage between economies (global and urban) to their natural support systems – the physical environment (global finite and regional ecosystems). With regard to the broader global finite ecosystem in relation to the global economy Daly (1991), Rees (1999; 1997; 1992), Sanderson et al. (2002) and Rees and Wackernagel (1994), among others, have elaborated the linkages and consequences of unconstrained economic growth on global ecosystems. Sanderson et al. (2002), in particular, have asserted that the burden economic growth puts on ecosystems is resulting in global disappearance of wilderness through increasing human footprint globally. Land conversion impact is borne directly by the regional physical environment, unlike other footprints that can be “exported”. Thus, the inverse relationship between economic growth and land conversion becomes obvious. It must be noted, however, that these research efforts have largely taken the broadest view based on global scale dynamics. However, the same principles could be applied on the

regional and local scales as well for the integration of the urban economy and environment into the larger global economy. Figure 1-1 depicts the four world systems impacted by globalization and macroeconomic reforms. Globalization pushes global economic growth, resulting in capital accumulation which subsequently flows into the urban economy, much of which would be translated into built structures. However, global and regional ecosystems are fixed. Consequently, economic globalization drives urban spatial expansion at the expense of the regional ecosystem in which a city is located. This is analogous to what Jansson and colleagues have described as “Empty World” and “Full World” (Jansson et al., 1994: 24-25). By this conceptualization, this dissertation research advances the argument that spatial financial flows on a global scale, in the form of FDI and remittances can and do affect urbanization - contemporary urban land expansion - in urban spaces far and near, especially when such funds are disproportionately concentrated in a single, primate city such as Accra in Ghana

Theoretical Structure

The systemic conceptualization and theorizing of land use in the context of globalization will enable the explicit incorporation of global economic dynamics into urban land use theoretical framing as well as modeling of contemporary urban spatial expansion; and simultaneously give solid foundation for a better understanding of the role of global economic forces in the urban environmental change process, especially, in rapidly expanding cities in developing countries.

Mainstream urban land use theories are largely rooted in Alonso’s (1964) and Muth’s (1969), with Von Thunen’s (1826, 1926) agricultural land use theory providing a useful starting point (Cadwallader, 1985: 24-50). Current formulations (Angel et al. 2011; 2005, for example) have sought to reflect external economic dimensions but

inadequately, since they failed to consider the combined impact of FDI and remittances inflows, even though these forms of global funds flow have assumed important dimensions under globalization. For cities of sub-Saharan Africa that exhibit some form of 'primacy' the external funds are geographically constrained, often over-concentrated in these large cities, thereby fueling rapid expansion through increased demand for housing, infrastructure and related activities that consume lands (Grant & Yankson, 2003). At the minimum, it can be argued that in addition to recognized local drivers of urban expansion, it is important to consider factors such as the urban hierarchical structure and the relative position of the particular city under study [lumping cities like Cincinnati (USA) and Accra (Ghana) may not be appropriate, given the 'primacy' status of Accra in Ghana's urban system], which puts it in a strategic position to receive the bulk of FDI and / or remittances. Again, the extent of the integration of particular economies into the broader global economy should have some influence on the development of its urban system. This is because prices for real estate in the 'primate' city is more likely to be compared with prices in other similar-sized cities (or cities of similar status) in other countries as opposed to comparing prices in the 'primate' cities with prices in cities in the same country (Sassen, 2006). For example, international demand for real estate would compare prices in Accra to those in Lagos rather than comparing prices in Accra to prices in Kumasi (Ghana's second largest city).

Remitters' reasons for sending money are classified into altruistic and family contract motives as well as self-interest motives in which remitters invest in real assets and businesses (Chami et al., 2008; Addison, 2004). Remittances increase as senders

maximize their utility with respect to self-interest as they seek to acquire real assets in their origin countries.

The combined effect of these funds inflow manifest in the urban landscape through real estate boom and other construction activities, usually in the primate / large cities (Yeboah, 2003; Grant & Yankson, 2003; Tipple et al., 1998; Diko & Tipple, 1992); making it imperative that these external variables be integrated into standard urban land use theories. Hence, this study seeks to theorize the globalization-urban spatial expansion relationship building on current extensions of Alonso's (1964) theory, with particular reference to Angel et al. (2011; 2005), McGrath (2005), Fansler (1987) and Brueckner & Fansler (1983).

After contextualizing FDI and remittances in the standard economic theory of urban land use, the study further explores how the induced global financial flows are implicated in the rapid loss of peri-urban natural areas. The global and urban economies are embedded in 'finite' ecosystems, both global and regional (Sanderson et al., 2002; Rees, 1999; 1997; 1992; Costanza et al., 1997; Rees & Wackernagel, 1994; Daly, 1991). Urban expansion, largely driven by economic processes, proceeds in tandem with global economic growth (Wackernagel & Rees, 1995; Daly, 1991; Georgescu-Roegen, 1971); putting stress on ecosystems (Wackernagel et al., 2006; Burchell et al., 2005; IHDP, 2005; UN, 2003; Goldblum & Wong, 2000; NRC, 1999). Consequently, urban land transformation constitutes an important environmentally significant consumption process, partly driven by flows of external funds into cities. Thus it is important that urban growth models properly incorporate these external drivers. Harvey (1969) notes that the Allometric law could be used to mathematically link a growth

process over time to spatial change with the potential to enhancing geographic theory (p.466), citing Nordbeck's works in this area. Basically, the Allometric Law states that the rate of relative growth of an organ is a constant fraction of the rate of relative growth of the total organism (Savageu, 1979; Nordbeck, 1965). Coffey (1981) adds that

Allometry refers to the study of size and its consequences, and relates the differences in proportions of one component of a system to changes in either the absolute magnitude of the system or a second component of the system. (p. 185).

As an embedded system, therefore, spatial expansion of a city constitutes a 'growth', negatively impacting regional ecosystems. To help better understand the underlying global economic drivers of contemporary urban expansion this study attempts to link the "refined" Alonso theoretical framework to the allometric law, formulating an allometric based exponential function which is integrated with regression analysis to develop the IUSEEM. Thus, an important focus of this dissertation research an attempt to link standard economic theory to urban spatial expansion modeling which is mostly lacking in many current spatially explicit urban model expansion models but would be most suitable for studying contemporary urban physical expansion in the chosen study area.

Study Area, Data and Methods: An Overview

Study Area

Ghana

Ghana is a West African country with a population of about 23 million people, according to year 2008 estimate (CIA, 2009); and occupying a land area of about 238,533 sq. km. The physical size of Ghana is estimated to be equivalent to the size of United Kingdom or a little less than the state of Oregon in the United States. The country is bounded by Togo and Cote d'Ivoire to the east and west, respectively. The

northern boundary is shared with Burkina Faso, with the south of the country bordered by the Gulf of Guinea (in the Atlantic Ocean). Ghana's southern coastline and northern boundary coincide, approximately, with latitudes 4° 30' N and 11° N, respectively. The eastern boundary coincides with longitude 1° 12' E, with the western boundary coinciding with longitude 3° 15' W. English is the official language of Ghana, a colonial legacy inherited from Great Britain, but country is home to more than 50 ethnic and linguistic groupings. Incidentally, the Greenwich Meridian (Longitude 0°) which passes through London also goes through Tema, a prominent industrial hub in Ghana, which is gradually assuming a twin-city status with Accra. Ghana's immediate neighbors (Togo, Cote d'Ivoire and Burkina Faso) are French-Speaking countries, following colonization by France. Ghana's climate is generally of the warm, tropical type with drier conditions along the southeastern coastal areas. The southwestern coast is comparatively hot and humid with the northern part of the country being generally hot and dry. Mean annual rainfall ranges between 1,100 mm (approx. 43 in) in the north to about 2,150 mm (approx. 83 in) to the south. The southwestern part of Ghana is wettest with annual mean rainfall of about 2,100 mm. The Accra Plains, in the Greater Accra Region, within which the city of Accra is located, has mean annual rainfall ranging between 750mm – 1100mm, considered among the drier areas in Ghana, besides the northern part of the country. The mean annual temperature for Ghana ranges between 26-29 degrees Celsius. As would be expected, the vegetation types, in general, follow the rainfall and temperature patterns. Thus, wooded grasslands are found mostly to the north and south-east drier parts of the country, with forests occupying roughly the south-central and the southwestern parts of the country.

With a successful democratic dispensation for over a decade now, Ghana's economy is generally recognized by its development partners such as the IMF and World Bank as one of the few success stories of the economic liberalization 'patients' of these agencies. As of 2011, according to the CIA (2012), the composition of Ghana's GDP was as follows: agriculture (29.9 percent), industry (18.6 percent) and services (51.4 percent). Even though the services sector surpasses the agricultural sector in terms of composition (which used to contribute the bulk of GDP), Ghana's economy is still heavily dependent on agriculture which employs about 56% of the estimated labor force of 10.56 million people, with the industry and the services sectors employing 15 percent and 29 percent, respectively, (CIA, 2012). Major agricultural products exported from Ghana include cocoa, timber, oil palm, coffee, cotton, shea nuts. Gold has been a major source of foreign exchange for Ghana for a long time. It is important to note that commercial quantities of crude oil has been found in Ghana and drilling is currently (2012) underway which may change the composition of Ghana's exports and mainstay of the economy, which currently depends largely on primary products exports with cocoa being the chief export commodity. The country's GDP in 2010 was estimated at US\$31.08 billion (at official exchange rate), with a real growth rate of 7.7% annually, according to the CIA (2011); and estimated to grow at the rate of 13.5% for 2011, ranked 3rd fastest growing economy in the world (CIA, 2012). The estimated GDP per capita in 2010 was US\$2,500 (Purchasing Power Parity), ranked 180th in the world, one of the lowest (CIA, 2011), even though "speculations" of fastest growing economy abound. The low ranking of the GDP per capita may be partly due to inflation, estimated at 10.7% (at consumer prices) in 2010. For instance, Nigeria, a neighboring

country, had the same estimated GDP per capita of US\$2,500 in 2010 but was ranked 175th on the same scale (CIA, 2011). It must be noted, however, that Ghana's current GDP per capita is estimated to be US\$3100, moving up to the 170th position in terms of world ranking (CIA, 2012) which represents a modest improvement in economic performance over the 2010 performance level. For international trade, available data show that Ghana's total imports amounted to US\$8.046 billion in 2009, increasing to US\$10.95 billion in 2010. Exports amounted to US\$5.84 billion in 2009, increasing to US\$ 7.892 billion in 2010 (CIA, 2012). Clearly, Ghana still imports more than it exports, effectively earning the country a "dependency" status. The annual budget is even more revealing. The estimated revenues for 2010 were US\$5.381 billion while expenditures totaled US\$7.757 billion, creating a deficit of -7.6% of GDP. The population below poverty line (usually defined as people living on less than US\$1 per day in the Ghanaian context) is estimated at 28.5% (CIA, 2012). Positive highlights of the Ghanaian economy, compared to its neighbors, include unemployment rate estimated 11% which is lower than Cote D'Ivoire (13%), Mali (14.6%) but higher than Nigeria (5.8%) (Baabereyir, 2009, citing CIA, 2008). Attempts are being made to transform the country's agricultural sector, with the signing of the Millennium Challenge Corporation Compact in 2006. Furthermore, estimated oil reserves discovered in Ghana is about 700 million barrels, which is expected to impact positively on Ghana's economic prospects.

Ghana's economy has moved through colonization, nationalism; and modernity, thanks, largely to the implementation of the Structural Adjustment Program - SAP (Killick, 2010; Aryeetey-Attoh et al., 2010; Grant, 2009). Consequently, the linking of the

Ghanaian economy to the global economic order has been intensified especially after the implementation of the SAP in the 1980s and the 1990s (Killick, 2010; Grant, 2009; Grant & Yankson, 2003; Yeboah, 2003), facilitating rising volumes of FDI inflows into Ghana, with high concentration in Accra's urban space.

Even though urbanization level in Ghana is generally low, recent indications are that the situation is rapidly changing, with increasing numbers of people now living in settlements classified as "urban" (5000 or more people). According to the Ghana Statistical Service (GSS) data, the percentage of Ghana's urban population increased from 23 in 1960 to 43.9 in 2000 (GSS, 2002). Further, the number of urban settlements increased from 98 to 364 during the same period (Table 1-1). Even though population numbers have been rising in some urban centers in Ghana, most urban settlements are usually classified as "small" compared to global numbers. For example, in 2000, Accra, the largest urban center in Ghana had a population of a little more than 2 million (Table 1-2), with Kumasi, the second largest recording just a little over 1 million people (GSS, 2002, cited in Baabereyir, 2009). The statistics given above show that even though low, the level of urbanization in Ghana is on the increase. Several factors have been put forward to explain the increasing urbanization levels, with the key ones being the rural-urban migration and natural population increase (GSS, 2002; Songsore, 2003, cited in Baabereyir, 2009). Related to the rural urban migration phenomenon is the fact that the post-independence industrialization drive pursued by Kwame Nkrumah, Ghana's first president, favored large cities, particularly Accra, enhancing economic opportunities in these cities which in turn served as "magnets" to attract more rural-urban migration, and at the same time neglected rural areas helped push people into large cities. Urban-

ization level in Ghana has also been impacted by reclassification of settlements usually after census, whereby hitherto rural settlements are 'upgraded' to urban status.

One important observation about the urbanization discourse among urban researchers in Ghana is the fact that more often than not, urbanization has been described in terms of the demographics, with little attention paid to the spatio-temporal dynamics until recently. Consequently, explanations of urban expansion have usually attributed the phenomenon to demographic factors of rural-urban migration and natural population increase (for example, Songsore, 2003, cited in Baabereyir, 2009). Even though these factors would explain the "swelling" urban population, they may not adequately explain a rapid spatial expansion, characterized by "quality residential sprawl", according to Yeboah (2003; 2000) as is currently happening in Accra. Indeed, one may wonder: what proportion of rural urban migrants has the requisite purchasing power to afford these quality homes that are eating up the peri-urban lands? As a consequence of the relative lack of the systematic analysis of the spatio-temporal aspects of urbanization in general in Ghana, the externally induced urban environmental degradation which is 'creeping' on Accra in the advent of economic globalization may escape detection and may not be mentioned as one of the urban challenges facing Ghana.

One major urbanization challenge in Ghana often cited in the literature is rapid population increase, (growth rates estimated at about 4.1percent for urban areas and 2.6 percent nationally). It is argued that the rapid growth in population puts pressure on infrastructure and other amenities in urban centers. More specifically, traffic congestion, inadequate and poor housing, overcrowded hospitals and schools, rising unemployment

levels, unsanitary conditions and the likes (Baabereyir, 2009). What is important for the purposes of the arguments advanced in this dissertation is that urban environmental degradation resulting from urban land conversion would almost certainly not make the list of environmental problems in Ghana. Essentially, therefore, with the exception of a few researchers like (Angel et al., 2011; 2005; Moller-Jensen et al., 2005; Grant & Yankson, 2003), most urban expansion analyses have continued to attribute the rapid physical expansion of Accra, for example to demographic factors, including rural-urban migration. This can no longer be accepted without question, in view of the realities of economic globalization whereby urban land demand may be pushed by forces originating afar. For example, demand for real estate in Accra may be boosted by 'outsiders' and residents who have been "purchasing power enabled" by gaining employment in FDI related jobs. Moreover, remittances, which is now reputed to be a major foreign exchange earner for Ghana (CIA, 2012), has been estimated to constitute about 20% of real estate demand in Accra (Tipple et al., 1998). In short, these developments warrant a closer examination of the demographic-based explanation of urban expansion, especially in Accra and similar cities in Ghana and Sub-Saharan Africa, generally.

Accra

The beginning of Accra's transformation from a cluster of small fishing villages, occupied predominantly by the Ga people, to an urban settlement, is traced back to the arrival of the European colonialists – the Dutch, Danes and the English - in the 15th century (Adu-Boahen, 1975, cited in Baabereyir, 2009). The advent of the Europeans saw the establishment of three main trading posts, namely, Christiansburg Castle (Danes), Usher Town (Dutch) and James Town (English). After the acquisition of all

these trading posts by the English, they transferred their main 'hub' of activities from Cape Coast to Accra, which was later to become the capital of the colonized Gold Coast from where the country was administered. Accra's status as the capital of Gold Coast was to remain even after the attainment of independence from colonial rule in 1957. Thus, the relatively well developed infrastructure, including roads, government offices and accommodation, schools, health centers, among others, in the city received a major boost from Kwame Nkrumah's administration (Baabereyir, 2009). Today, the city of Accra contains the bulk of Ghana's industries, offices of NGOs and financial institutions as well as government ministries, seat of Ghana's parliament and foreign missions, among other things. The concentration of infrastructural development in Accra did not change under subsequent administration, hence helping accentuate Accra's status as the most diversified urban economy in Ghana, attracting people from all walks of life including rural-urban migrants. Consequently, the city has continuously been expanding to incorporate surrounding villages in what has been described as 'urban villages' whereby former surrounding rural settlements have become 'nested' in the city of Accra (Songsore, 2003, cited in Baabereyir, 2009). According to the Ghana Statistical service (2002), about 25 percent of Ghana's urban population was contained in Accra in 2000, with the city contributing about 20 percent to the GDP of Ghana and offering employment to 10 percent of Ghana's labor force (World Bank, 2007; cited in Baabereyir, 2009). From humble beginnings, therefore, Accra has been positioned as the main economic hub of Ghana and also the 'gateway' to the global community through air linkage (for example, Kotoka International Airport, Ghana's only international airport built in the 1960s is located in Accra). Therefore, by the time of the

implementation of SAP in the 1980s, Accra's primacy in the urban system of Ghana was well established but the SAP is widely held to have helped Accra maintain the status quo. Currently, the urban area of Accra is usually defined to include the Accra Metropolitan Area, the Tema Municipal area and the Ga District (Grant & Yankson, 2003), with a population of 2.7 million in 2000, estimated to be 3.2 million in 2005 and projected to increase to 4 million in 2010 (GSS, 2002).

In general, Ghana has had to deal with its fair share of environmental challenges ranging from severe and recurrent droughts in the northern savannah areas. The north is further plagued by intensive cultivation and animal grazing as well as rampant and widespread seasonal bushfires which exacerbated the already precarious environmental conditions. These issues have combined to create serious environmental degradation in the northern part of Ghana. The southern, mostly forested areas, are grappling with different set of environmental problems, including unregulated timber exploitation, pollution from mining, as well as soil infertility resulting largely from traditional farming practices (Baabereyir, 2009). Whereas these environmental issues are known and well documented in Ghana, the emerging urban environmental degradation involving the loss of peri-urban natural areas, which is the focus of this dissertation research, has not been systematically explored.

Almost invariably, therefore, the phenomenal urban growth such as has been experienced by Accra would be faced with environmental problems as well as health issues relating to poor environmental and unsanitary conditions, which according to Songso (2008) also hold true, to some extent, for urban areas in Ghana in general.

Not surprisingly, Professor Songsore cites some of the most pressing environmental problems as

Inadequate access to potable water, sanitation facilities, and solid waste disposal as well as smoky kitchens from the use of biomass fuels and insect infestation among others. (Songsore, 2008: 8).

He further asserts that

These hazards directly threaten the health of citizens arising from the life and death immediacy of malaria, respiratory illness, diarrhea, and other infectious and parasitic diseases. (Songsore, 2008: 8).

Undoubtedly, these environmental problems in Accra 'stare one in the face' and therefore deserve the attention of urban researchers, spatial ramifications associated with the rapid expansion of Accra such as sprawled urban development, in the absence of effective land use controls and efficient physical planning, is emerging as a formidable environmental challenge with the potential to undermining urban environmental sustainability (Grant & Yankson, 2003). It is the view of many researchers that Accra is fast "sprawling" post SAP and intensification of economic globalization (Aryeetey-Attoh, 2010, Grant, 2009; Moller-Jensen et al., 2005; Grant & Yankson, 2003). In particular, the potential undermining of ecosystems services resulting from removal of vegetation cover could also be considered an "environmental hazard" in the medium to long term through loss of ecological resources and consequently environmental degradation. Even though the 'traditional' land use change drivers of population and income growth may be blamed, it seems that this is being driven, at least in part, by external economic forces of globalization such as FDI and remittances whose advent has been greatly facilitated by the SAP. In this regard, the following three statements are worth quoting to buttress the main argument of this dissertation research:

Accra has the most diversified economy of any area in the country. The city's economy experienced the most rapid and sustained expansion after the introduction of structural adjustment policies (SAPs) in 1983, which has resulted in a sprawl along all frontiers (Grant & Yankson, 2003, citing AMA, 1999; Amuzu & Leitmann, 1994: 5).

One of the most visible impacts of the liberalization program is the dramatic rise in the number of new foreign companies that have established operations in Accra, which is currently headquarters for 655 foreign companies (Grant, 2001: 1005, cited in Grant & Yankson, 2003: 69).

The liberalization of the financial sector has enabled foreign currency transactions, and much of this money originates from Ghanaians working abroad and can be used for investment in Accra housing (Grant & Yankson, 2003: 69).

The statements above, at least to some extent, seek to link the rapid physical expansion of Accra in recent times to forces of economic globalization which trigger spatial financial flows (FDI and remittances) of which Accra is generally believed to be the major beneficiary in the Ghanaian context. Consequently, the need to explore the apparently emerging phenomenon of externally induced spatial expansion in Accra and possible negative repercussions on Accra's peri-urban ecological resources cannot be overemphasized, giving further impetus to the imperative for this dissertation research.

Data and Methods

The four essays comprising the main focus of this dissertation are designed as independent but interrelated publishable essays which are largely "self-contained". As a result, the data and methods relating to particular essays are fully described and detailed where appropriate. For brevity, therefore, it is suggested that readers refer to these data and description of methods in Chapter 3 and Chapter 4. Consequently, only very brief overviews are given here.

Statistical dataset covering annual FDI flow amounts and annual remittances flow amounts have been obtained from United Nations (2011; 2012) online databases. Also,

processed remotely sensed urban land cover change data for Accra based on published sources have been obtained from “the Atlas of Urban Expansion” (Angel et al., 2011; 2010) and Moller-Jensen et al. (2005). The methods employed in this research are quantitative in nature. The theoretical propositions derived from the refined Alonso theoretical framework are tested using regression modeling and analysis. Specifically, FDI and remittances are included in log-transformed cross-sectional multiple regression models (Chapter 4). The log transformation made the data suitable for the application of the Ordinary Least Squares (OLS) regression estimation method. Another desirable characteristic of the log transformation is that the co-efficients can be interpreted as elasticity (percentages), thus eliminating the problem of unit of measurement. The study takes advantage of this to sum up the estimated co-efficients in the (IUSEEM) formally developed in Chapter 5. IUSEEM represents an attempt or approach to contemporary urban expansion modeling, potentially suitable for a rapidly expanding primate city in a developing country context; as induced by economic forces, with particular reference to FDI. The model integrates regression into an allometric based exponential function, which is simple, analytically tractable, dynamic, non-linear and spatially explicit in nature. (Full description of this estimation method or model – the IUSEEM, is presented in Chapter 5 of the dissertation).

Significance of this Dissertation

Firstly, this research is designed to contribute to theory building in contemporary urban and economic geographical research in the context of economic globalization by examining the significance of the external economic dimensions in the spatial expansion process. Thus, a cogent argument has been advanced for the need to ‘globalize’ the classical economic theory of urban land use to incorporate FDI and remittances as

“new” and emerging external economic drivers of contemporary urban spatial expansion, especially in primate cities in developing country setting. This has the potential to making immense contributions to theory construction in geographical research in general and urban geography in particular, from an interdisciplinary perspective; utilizing concepts, ideas and theories from geography and economics.

Secondly, a methodological contribution is also envisaged as the study adopts a new approach to develop an Allometric based urban growth model which can be used to monitor urban environmental degradation as induced by economic forces, mostly originating from global sources such as FDI. This model could be potentially replicated in primate cities elsewhere with similar characteristics as Accra. Some of the main ‘charges’ leveled against traditional urban analytical models by advocates of more modern methods (Batty, 2005) include being static and linear. However, the modern spatially explicit, dynamic, non-linear simulation models such as Cellular Automata (CA) generally lack the support of standard economic theory; can be computationally-intensive and methodologically complex, sometimes placing them beyond the means of many researchers, especially those in developing countries. Desirable characteristics of the IUSEEM formulated in this study include simplicity, dynamism, non-linearity and spatially explicit. In this regard the model will be potentially useful to many modelers, especially those interested in the contemporary urban spatial expansion in primate cities in developing countries as induced by economic forces (FDI in particular).

Thirdly, Geographical research, especially the tradition that focuses on understanding human-environment interactions could be usefully employed to help understand the human dimensions of global environmental change.

The human dimensions of global environmental change are assuming significant proportions as world population grows and human consumption expands as well as continued acceleration of urbanization (IHDGEC, 2005; NRC, 1999). Thus, this approach to urban geographical research, in addition to attempting to make urban land use theory more realistic in view of growing global interconnectedness and increasing spatial interactions, has the potential to contribute meaningfully to efforts aimed at mitigating current urban environmental problems, especially in large cities of developing countries. The study seeks to highlight the magnitude of peri-urban land consumption that could be attributed to the external forces of economic globalization, particularly, FDI. Assessing the globally-induced aspect of the vegetation cover depletion will contribute to our understanding of the human dimensions of the current environmental change in the peri-urban areas which are leading to environmental degradation.

Further, this study seeks to integrate concepts and ideas across the disciplines of urban geography, economic geography and urban economics as well as drawing on concepts from biological science. Such an approach is likely to be effective since no single discipline can adequately explain the complex issues of globalization and urbanization and their combined impact on the urban biophysical environment. In addition to broadening the scopes of the respective disciplines through integration of concepts and ideas, a better understanding would be gained in the area of linking temporal process to spatial form, thereby facilitating thinking across geographical scales. Primate cities in developing countries such as Accra in Ghana are grappling with the environmental consequences of globalization and urbanization (Grant, 2009; Moller-Jensen et al., 2005; Grant & Yankson, 2003). For example, Moller-Jensen et al.

(2005) have asserted that effective environmental policy and urban planning are urgently needed in Accra. It is not too difficult to see, therefore, that the continued intensification of global linkages of cities and economies makes it imperative that urban policy makers and managers be cognizant of the impact of external forces on their object of interest –the city and its environment- if the challenges posed by these forces are to be adequately taken care of and in order to stem the tide. The broader perspective of this research, therefore, is the anticipation that urban planners and urban environmental managers and conservationists will find insights from this research useful in their decision making, giving due consideration to the influences of external economic forces of globalization. At the minimum this will help ensure that the external dimension is recognized and anticipated.

Moreover, this dissertation research is designed to produce 4 publishable peer reviewed journal articles. These planned journal publications, when realized, will be of great benefit to the advancement of knowledge in general and geographical research in particular in addition to enhancing my prospects as a budding geographer in academia – teaching and research.

Finally, just as any worthwhile piece of scholarly work is invaluable to the academic community, it is the fervent hope of this writer that this dissertation research would contribute to energizing urban and economic geographical theorizing with the potential to opening up new avenues for intellectual pursuits in geographical research aimed at increasing the understanding of contemporary economic globalization and spatial financial flows as well as their ecological consequences in urban areas of developing countries.

Overview of Chapters and Organization of the Dissertation

This dissertation is composed of 6 chapters, 4 of which are designed as independent but interrelated publishable articles (Chapters 2, 3, 4, and 5), anticipated to be published in peer-reviewed journals. Chapter 1 provides an overview of the dissertation, and a general statement of the research questions, objectives and hypotheses; as related to the topic of assessing the impact of Foreign Direct Investment and remittances, as driven by globalization and economic liberalization, on urban peripheral change and the expansion of the urban fringe (study region: Accra, Ghana). Chapter 2 offers a conceptual and theoretical analysis on the specific pathways through which FDI impact urban spatial expansion; basically, expansion of the employment base as associated with FDI-related jobs, the multiplier effect, induced employment for the population and migrants who gain entry to FDI related jobs in stimulated sectors, and demand by expatriate workers and FDI firms. These pathways increase the demand for housing and land, especially for those workers in the skilled portions of the labor force (middle and upper-income segments; those who have the greatest purchasing power) – typically a segment of the economy who prefer locations in the peripheral areas of the city, which leads to urban sprawl. Chapter 3 examines the relationships between remittances and urban expansion, as enhanced by globalization and economic liberalization policy; with an overview of the determinants and consequences of remittances as they relate to such variables as economic growth rates and urban land consumption. Chapter 4 reviews and recasts Alonso's and Von-Thunen's theories of land value/use to examine the theoretical links between intensification of globalization and liberalization policies and its impact on urban spatial structure using a mathematical framework; focusing on the disproportional impact FDI and remittances have on primate

cities such as Accra. Empirical evidence is presented to support the model for a selected time period (via a Regression analysis). Chapter 5 makes the case that FDI can be directly implicated in the physical expansion of Accra and the associated loss of peri-urban land and related ecological resources. The argument is that FDI - driven change is responsible for rapid urban change, based on a review and synthesis of the literature and the formulation of an Integrated Urban Spatial Expansion Estimation Method to estimate the impact of FDI-induced expansion. A series of results and data are presented to analyze the expansion of Accra over the period spanning from the mid-1990s to 2001-2011. Chapter 6 provides a summary and overview of the dissertation, its implications and limitations, and directions for future research.

Note: The reader is reminded that ideas, arguments and statistical figures may be repeated across the dissertation chapters. The reason is that the four main chapters (Chapters 2, 3, 4 and 5) have been designed to be independent, publishable journal articles. This necessitated the inclusion of all relevant facts, arguments and statistical figures in the relevant chapters to render each one coherent and understandable on its own, resulting in the repetitions across the chapters since they all address the one topic of the dissertation. It is hoped that readers interested in specific a sub-topic of this dissertation can read the relevant chapter and gain useful insights without necessarily having to read the whole document.

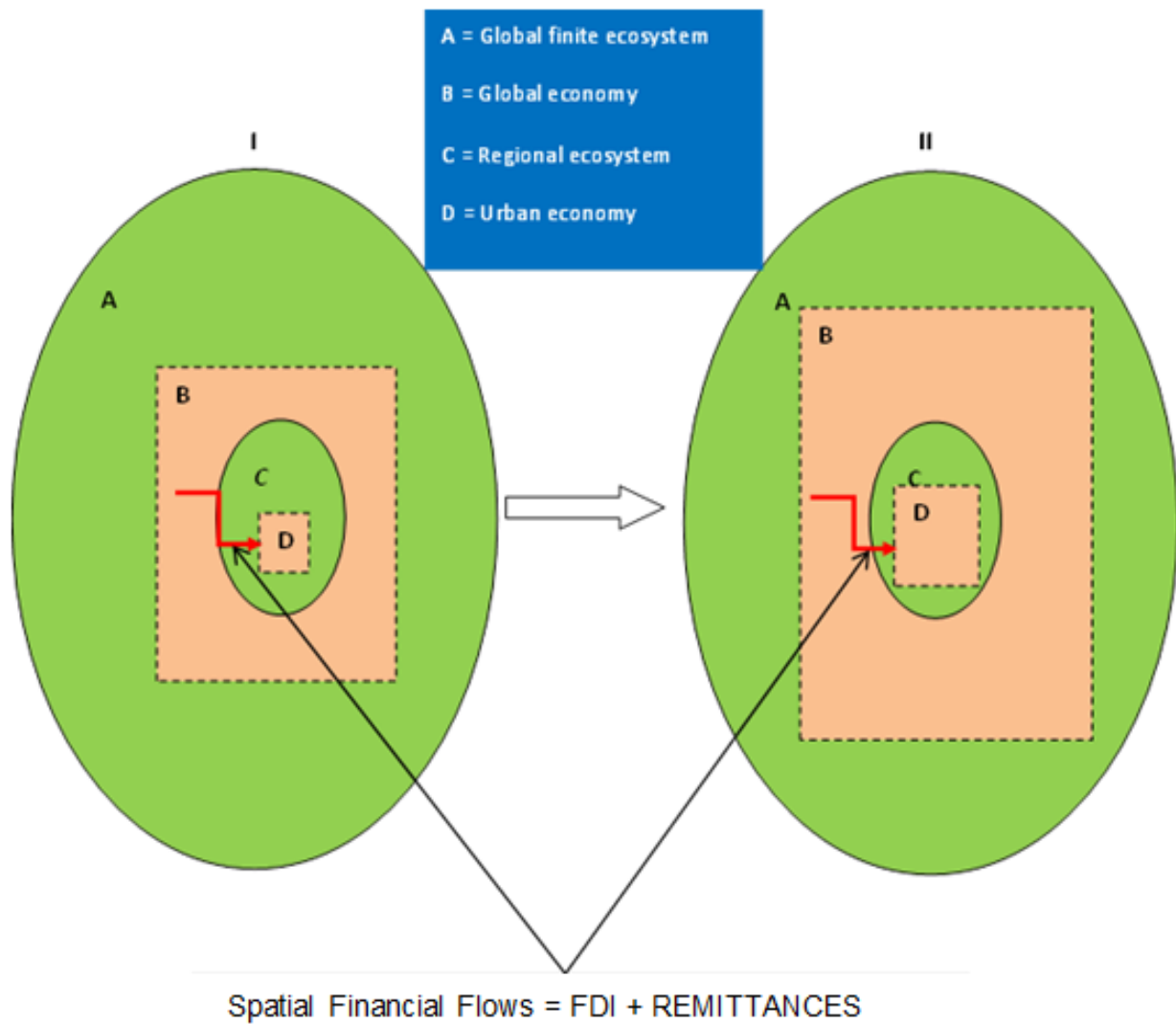


Figure 1-1. Transmission of spatial financial flows into urban spaces and consequences on ecosystems. Source: Author's construct.

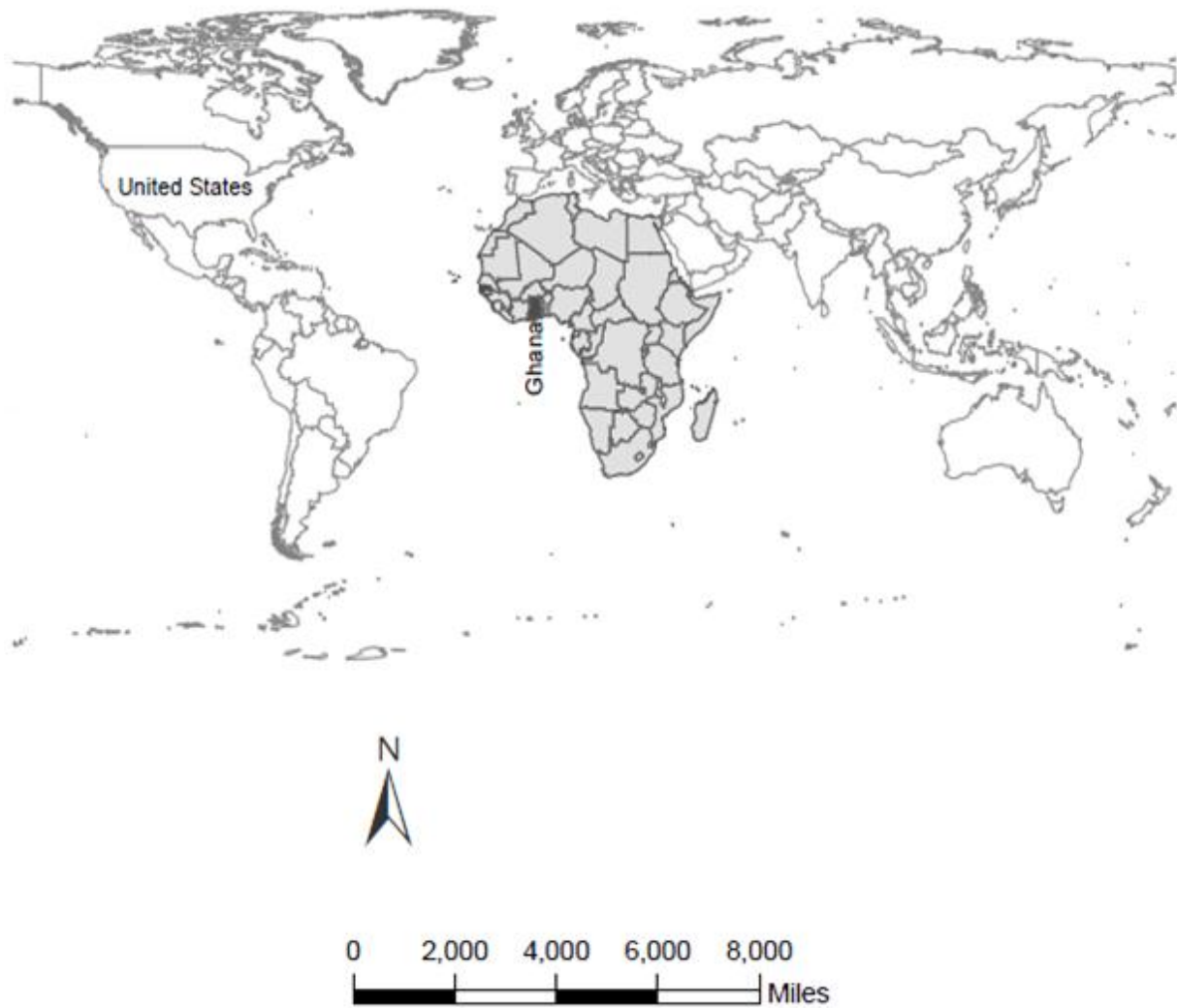


Figure 1-2. Study Area - Location of Ghana. Author's construct based on data obtained from the Environmental Systems Research Institute (ESRI).

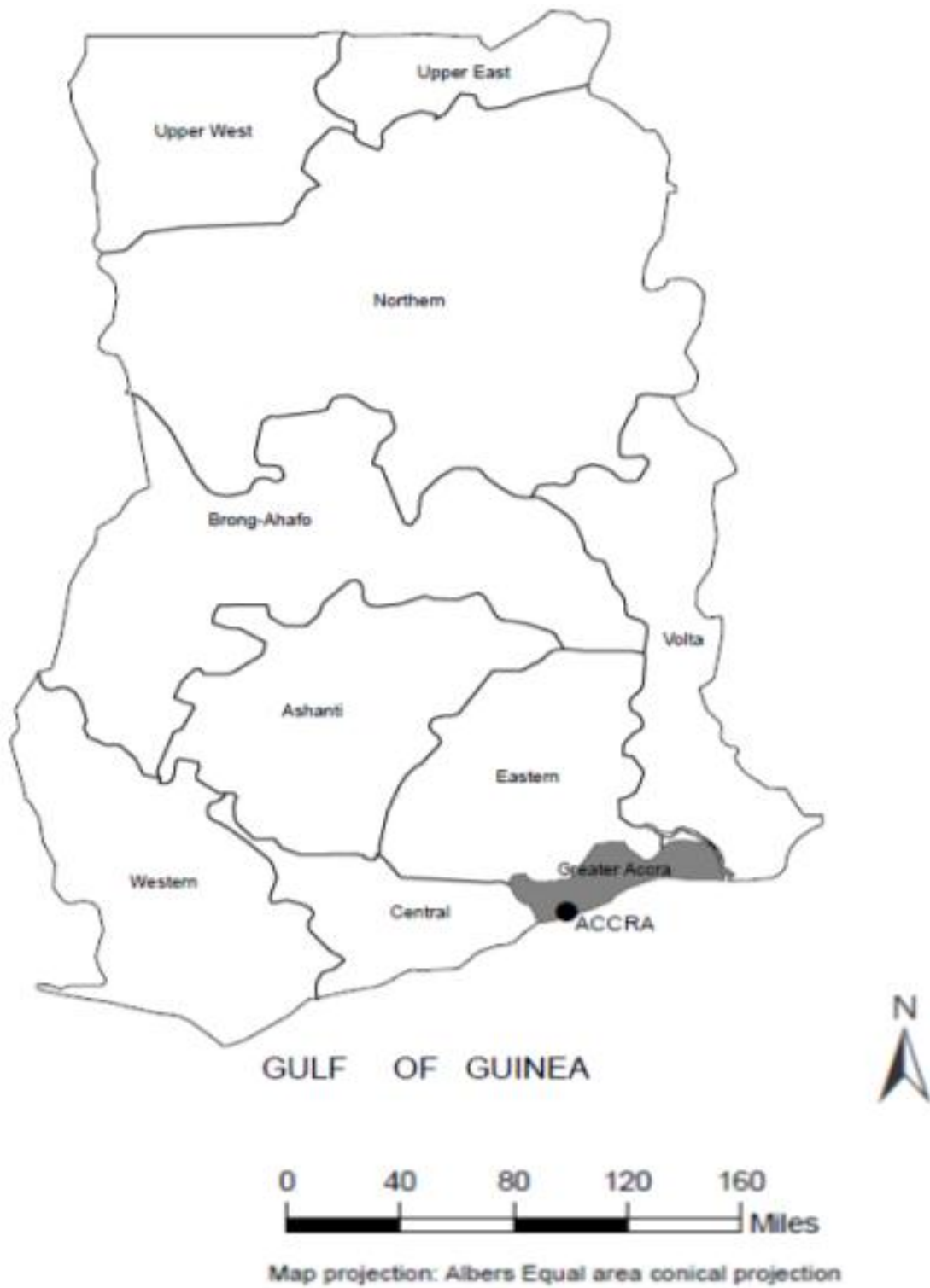


Figure 1-3. Study Area - Location of Accra. Author's construct based on data obtained from the Environmental Systems Research Institute (ESRI).

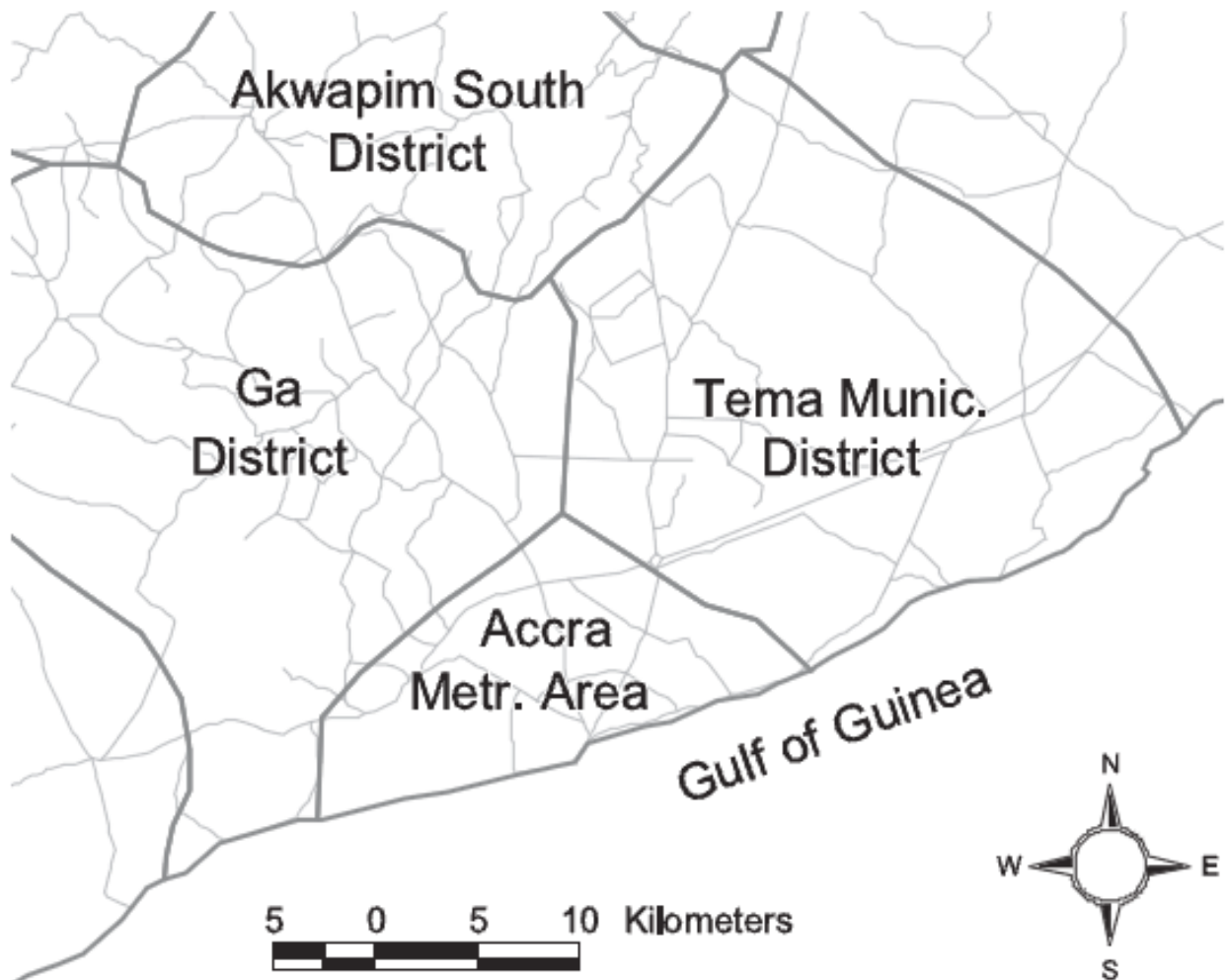


Figure 1-4. Study Area-The Greater Accra Metropolitan Area (GAMA). Source: Adapted from Moller-Jensen et al. (2005).

Table1-1. Growth in Ghana's urban population: 1960-2000.

| Year | Total population | Percentage urban | No. of urban settlements |
|------|------------------|------------------|--------------------------|
| 1960 | 6744234 | 23.0 | 98 |
| 1970 | 8555211 | 28.9 | 135 |
| 1984 | 12296081 | 31.3 | 203 |
| 2000 | 18912079 | 43.9 | 364 |

Source: Author's construct based on Ghana Statistical Service (2002). 2000 Population and Housing Census.

Table 1-2. Population growth in the ten largest cities in Ghana 1970-2000.

| City | Total Population | | |
|------------------|------------------|---------|---------|
| | 1970 | 1984 | 2000 |
| Accra Metropolis | 634809 | 1005834 | 2045125 |
| Accra Central | 624091 | 969195 | 1658937 |
| Kumasi | 346336 | 496628 | 1170270 |
| Sekondi-Takoradi | 143977 | 188203 | 289593 |
| Tamale | 83653 | 135952 | 202317 |
| Ashaiman | 22549 | 50918 | 150312 |
| Tema | 60767 | 100052 | 141479 |
| Obuasi | 31005 | 60617 | 115564 |
| Koforidua | 46235 | 58731 | 87315 |
| Cape Coast | 56601 | 65763 | 82291 |
| Wa | 13740 | 36067 | 66654 |

Source: Author's construct based on Ghana Statistical Service (2002). 2000 population and housing report. Special report on urban localities.

CHAPTER 2 FDI AND URBAN SPATIAL EXPANSION: TOWARDS A SYSTEMATIC CONCEPTUAL FRAMEWORK

Background

Chapter 2 is guided by the question: What are the specific pathways through which FDI impact urban spatial expansion? Investigating this is important because the link between FDI and contemporary urban spatial expansion is still less understood; largely lacking a well-established theoretical framework which take account of current realities of economic globalization. Developing a formal theory to help address this situation would benefit from a well-constructed conceptual framework which will help clarify the linkages for formal articulation into a theory. In this regard, Egan (2002), has asserted that most of the literature point to the fact that conceptual writing is a necessary component of theory writing; hence the necessity for this chapter which seeks to unravel the linkages between FDI and urban spatial expansion through the construction of a coherent and systematic conceptual framework.

Economic liberalization has coupled with economic globalization to reinforce global capital flows across geographic space without hindrances as barriers are removed to enhance economic integration (Dickens, 2003). There are various types of global financial flows – those meant for investments and loans for which returns are expected but there are also those for which returns are not expected including remittances and aid. In this chapter the focus is on the capital category. Two main forms of capital flows are distinguished in the literature –investment and lending (Hanink, 1994). Investment comes in two main forms –portfolio and direct investment. According to Hanink (1994) “Direct investment is unlike portfolio investment because it entails control of the activities financed; it is unlike lending because it entails ownership” (p.113)

Thus, an important component of the global capital flow FDI in which foreigners bring their financial resources into a country with the aim of establishing business operations, going into partnerships with local entrepreneurs or some combinations of both. Such operations are sometimes generally termed as Multi-National Enterprises (MNEs) or Trans-National Corporations (TNCs) by some researchers (Hanink, 1994). Increasing FDI flows have become a key indicator of economic globalization. Whereas world output has approximately doubled since 1970, FDI has quadrupled during the same period (Dicken, 1997). And according to the World Investment Report, FDI increased from US\$400 billion in 2000 to a record US\$1, 833 billion in 2007 (UNCTAD, 2007; Bank of Ghana, 2009). Undoubtedly, currently, the global economy has taken devastating hit, with the UN asserting that “the current FDI recovery is taking place in the wake of a drastic decline in FDI flows worldwide in 2009” (UNCTAD, 2010: xvii). The organization notes that “After a 16 per cent decline in 2008, global FDI inflows fell a further 37 per cent to US\$1,114 billion” (UNCTAD, 2010: xvii). This has led to what has been described as “cautious optimism” by the UNCTAD, stating that global inflows are expected to pick up to over \$1.2 trillion in 2010, rise further to \$1.3–1.5 trillion in 2011, and head towards \$1.6–2 trillion in 2012. Thus, in very general terms, the current global economic downturn notwithstanding, the global economy as a whole is predicted to experience a rebound soon (UNCTAD, 2010: xxiii). This expected global economic recovery will almost invariably be associated with increasing levels of FDI flows, even though “these FDI prospects are fraught with risks and uncertainties, including the fragility of the global economic recovery” (UNCTAD, 2010: xvii). It has been noted further that “despite its impact on FDI flows, the global crisis has not halted the growing

internationalization of production” (UNCTAD, 2010: xviii). The important point here is that multinationals will continue to look for viable economic opportunities in different geographic locations. In this regard it is heartening (at least to those interested in international business) to know that:

The reduction in sales and in the value-added of foreign affiliates of transnational corporations (TNCs) in 2008 and 2009 was more limited than the contraction of the world economy. (UNCTAD, 2010: xviii).

More specifically, the UNCTAD (2010) has asserted that foreign affiliates of multinationals are contributing significantly to the GDP of countries around the world, stating that “foreign affiliates’ share in global gross domestic product (GDP) reached an historic high of 11 per cent. TNCs’ foreign employment increased slightly in 2009, to 80 million workers.” (p. xviii). For most developing and transitional economies in particular, the increase in multinational operations in their economies is a blessing as they bring much needed capital in the form of FDI, which unlike loans, they do not have to worry about repayments. According to the UNCTAD (2010):

These economies now host the majority of foreign affiliates’ labor force. In addition, they accounted for 28 per cent of the 82,000 TNCs worldwide in 2008, two percentage points higher than in 2006. This compares to a share of less than 10 per cent in 1992, and reflects their growing importance as home countries as well. (UNCTAD, 2010: xviii).

Therefore, it would be rational to expect that economic globalization and associated FDI flows across geographical space, particularly the flow into developing economies will continue to increase. These almost seamless flows of capital across geographical space have spatial ramifications in the urban landscapes in FDI destination countries (Harvey, 1985) which are often overlooked in the theorization and analysis. Harvey (1985) has considered this link of global capital and urban development, from the perspective of the capitalist mode of production, asserting that urban expansion has

been the result of excess accumulation of capital, which is then invested in real assets in the urban economy, to put it simply. Even though the purpose for this chapter is to link global capital to urban land conversion, this author does not see it necessary to use the approach by Harvey (political economy - Marxism) because cities have been in existence for as long as human civilization, long before there was a formal articulation of Capitalist mode of production (capitalism). For instance, before colonization of Ghana from the 1800s and before the introduction of Western system of governance, the Ashanti people of Ghana had a functioning city-Kumasi, which had become well established and had nothing to do with Western capitalism, as far as one tell. Yes, money does have the potential to cause urban growth, but this does not necessarily mean that those who build structures in the city are capitalists. Consequently, this chapter focuses on unraveling the pathways of transmission of FDI impulses into the urban land expansion process, without interpreting it as being the result of capitalism or otherwise.

The FDI determination theoretical literature is well developed with a long history, even predating the current era of economic globalization. This aspect of the FDI theoretical literature can be loosely described as focusing mainly on the question of: what motivate entrepreneurs to set up operations in foreign countries as opposed to producing in their domestic economies and exporting elsewhere? As would be expected, this literature offers virtually nothing in the way of explanation of the potential impact of FDI on urban lands in destination economies or countries. Thus, theoretical frameworks bothering on FDI impact on destination economies should provide the platform for understanding FDI impacts such as economic growth, poverty alleviation,

household welfare, as well as impacts on specific localities. Even though commendable research have been done in this direction, in general terms, little has been done by way of helping lay the theoretical foundations for the comprehensive understanding of the specific pathways through which external economic impulses such as FDI inflow influence the urban extent. Among other things, the geographical concentration of ‘development funds’ even though welcoming to an economy as a whole, the situation accentuates the “primacy” of the urban area with the potential to draw in migrants from other areas, which could potentially put undue pressure on demand for housing and land which would in turn necessitate the need to construct new infrastructure such as roads. It is imperative that a better understanding is gained in this emerging area of externally induced urban change by developing a formal theoretical framework which will enable urban researchers (within geography and beyond) to account for realities of economic globalization as it affects distant geographical spaces, albeit urban spaces in primate cities in developing countries.

The cardinal objective of this chapter, therefore, is to build a conceptual framework for linking FDI and urban spatial expansion under globalization, which would provide the platform for the formal theoretical articulation of FDI as an urban land conversion driver in an era of intensifying globalization. Specifically, the chapter seeks to identify the pathways through which FDI would influence contemporary urban land conversion, especially where FDI is over-concentrated in large / primate cities in developing countries and lays, in a systematic manner, the conceptual framework for understanding the globalization – urban expansion relationship. According to Rudestam and Newton (2007):

A conceptual framework, which is simply a less-developed form of a theory, consists of statements that link abstract concepts (e.g. motivation, role) to empirical data. (p. 6).

For Lynham (2002) conceptualization serves as the first step in developing a theory.

Following along these lines, therefore, unraveling the linkages between FDI inflows into urban spaces and urban spatial expansion will help pave the way for the explicit incorporation of FDI as a plausible explanatory variable in urban land use theorizing as well as urban expansion modeling. Therefore, the importance of this exercise cannot be overemphasized. In broader context of this dissertation, this chapter is one of the two chapters that are designed to provide the conceptual frameworks for developing a formal 'refinement' of the classical urban land use, land value theory (Alonso, 1964).

Globalization, Africa and FDI Flows in Context

Traditionally, developed or industrialized countries are known to receive the largest chunk of global FDI flows, namely, North America, North West Europe and Japan. Consequently, in 1970 - 1980, large parts of Asia, Africa and Latin America had little or no FDI inflows (Hoogvelt, 1997; Hanink, 1994). Ankie Hoogvelt (1997), in particular, has described the global economy then as "imploding capitalism" reasoning that capital flows and trade almost invariably were concentrated in the rich / industrialized countries and some parts of Asia. However, the situation is rapidly changing. For a large measure, developed countries still account for sizeable share of global FDI flows but UNCTAD note that "developed countries did not return to FDI growth in 2010" (UNCTAD, 2011: 4). Thus, UNCTAD's latest estimates show that FDI flows to this group of economies fell some 7 percent to US\$ 527 billion, despite the robust recovery in some countries" such as USA which saw its FDI inflow surged by more than 40% over 2009 levels, representing an increase of US\$ 56 billion, and has

been described as the single biggest increase in FDI among the major economic regions” (UNCTAD, 2011: 4). For developing countries, overall, increases in FDI inflows have been modest but nonetheless significant. What is even more revealing is the gradual increase in receipts of FDI in developing and transition economies and its resilience even in the face of global economic crisis. Thus, notes the UNCTAD, despite worldwide economic downturn, the UN reports that the global FDI inflows to developing and transition economies rose to 43 percent in 2008, after six years of continued growth (UNCTAD, 2009). This was however to decline by 27 percent, to US\$ 548 billion in 2009 (UNCTAD, 2010: xviii-xix). Even so (UNCTAD2010: xviii-xix) claims that this group of countries fared better than developed countries, as a group, in terms of resiliency, which suffered a decline of 44 percent. Moreover, according to UNCTAD

Put in perspective, for developing and transition economies, their share in global FDI inflows kept rising: for the first time ever, developing and transition economies are now absorbing half of global FDI inflows (UNCTAD, 2010: xviii-xix).

It appears, therefore, that contemporary FDI flows are becoming more geographically diversified with increasing inflows to countries traditionally described as the ‘Global South’ –mostly developing and transitional economies. Are FDI inflows to developing and transition economies merely ephemeral or enduring? The United Nations seems to support the latter view, stating that

There are some major changes in global FDI patterns that preceded the global crisis and that will most likely gain momentum in the short and medium term. Firstly, the relative weight of developing and transition economies as both destinations and sources of global FDI is expected to keep increasing. These economies, which absorbed almost half of FDI inflows in 2009, are leading the FDI recovery. (UNCTAD, 2010: xvii).

How does Africa fare in terms of economic globalization and receipts of FDI?

Africa has had a long history of interactions / interconnections with places far and beyond, ostensibly predating the current era of global economic integration (Cooper 2001) - from slave trade, colonization to economic exploitation- as argued by Bond (2006). In contemporary development discourses in relation to globalization, two main views on Africa prevail (Bond, 2006). The first view asserts that Africa has been bypassed by economic globalization; with the second one alluding to the fact that Africa has suffered from globalization (Bond, 2006; Carmody 2010:1). It must be noted that until recently independent countries in Africa were suspicious of their former colonial masters, fearing that the global “North” would seek to recolonize them under the disguise of economic reforms. Thus, after gaining independence, following the end of the Second World War, most countries in sub-Saharan Africa suspected that foreign investments, foreign ownership of production were neocolonial strategies that have been instituted in order to recolonize the region (Killick 2010, Broadman, 2007; Voltoirenet, 2006, Carmody, 2010:41-42). This prompted many leaders of the newly independent countries to nationalize companies with foreign ownership; in some cases privately owned companies by citizens were not spared. For example, Tony Killick (2010) has noted that the first independent government of Ghana followed this path to a large extent (Killick, 2010). To a very large extent, this hostile attitude towards foreign business interests in their domestic economies and the general aversion for private entrepreneurship effectively restricted FDI inflows (Killick, 2010). Currently, however, the general consensus emerging among developed countries and developing ones alike is that FDI is desirable, if not essential for both economic growth and poverty reduction (Broadman, 2007; Voltoirenet, 2007, Carmody, 2010:41-42 and NEPAD 2001). Indeed,

at its inception in 2001, the New Partnership for Africa's Development (NEPAD) stated its objective as "to enhance Africa's growth, development and participation in the global economy" (NEPAD, 2001). Largely as a consequence of these developments, some advances have been forged aimed at integrating Africa's diverse economies into the global mainstream economy, albeit through natural resources exploitation and export of primary product from the continent and increasing demand for mobile phones, with some modest achievements in attracting transnational corporations (Carmody, 2010: 34; Ndulu et al. 2007). For example, "In 2007, Africa hosted seven of the world's top twenty fastest- growing economies . . . and there are now thirteen middle-income countries in sub-Saharan Africa" (Ndulu et al., 2007 cited in Carmody, 2010: 34).

Sector-wise, the United Nations noted that

Contraction of investment in the services sector in Africa was less pronounced than in other sectors. Sustained by expanded activity, the telecommunications industry became the largest recipient of FDI inflows. Recovering commodity prices and continued interest from emerging Asian economies are expected to feed a slow upturn in FDI flows to Africa in 2010 (UNCTAD, 2010: xix).

In terms of economic growth in general, Africa narrowly missed the projected 7 percent annual growth rate which has been predicted to ensure accelerated growth and enhance sustained poverty reduction by 2015 (Carmody, 2010: 40-41; UNDP, 2005; NEPAD, 2001). Africa in general is not faring too badly. In the case of Sub-Saharan Africa, it is estimated that

Overall growth was 6.9 percent for sub-Saharan Africa according to the IMF (2008), just shy of the 7 percent that some international plans argued was necessary for sustainable poverty reduction. (NEPAD, 2001; cited in Carmody, 2010: 34).

To some degree, globalization in Africa so far has been mostly extractive focused on outward flows of wealth and resources such as oil and agricultural products like cocoa.

However, Carmody (2010) has noted that “the nature of globalization in Africa has evolved significantly, particularly, in the past decade, as a result of the rise of china and the global technological revolution” (p. 3). Thus, current globalization in Africa is being led, predominantly, by Asia, particularly, India and China and predicated largely on natural resources exploitation (Carmody, 2010; Klar, 2008). In particular, Padraig Carmody has argued that China is playing a cardinal role in the globalization of Africa, even though mainstream research works have largely neglected to assert this fact. As a result he has suggested that

The rise of China in Africa, through the intensification of economic and ideational flows and migration, should be seen as an evolution of globalization on the continent rather than separate from it. (Carmody, 2010: 3).

Chinese trade with Africa estimated to have grown by about 45.1 percent in 2008, worth about US\$ 107 billion (Center for Chinese Studies, 2009). Indeed, China is widely believed to be the single most influential trading partner now; with Africa trailing only USA in terms of imports from China (Carmody, 2010: 3). In sum, current developments on the African continent in relation to globalization seem encouraging, leading Carmody to conclude that “globalization is certainly not bypassing Africa anymore, if it ever did” (Carmody, 2010: 4-5). For example, while some once theorized that Africa was a “black hole of informational capitalism”, it has been argued that the global technological revolution has swept over the continent, through the wide-scale adoption of mobile phones (Carmody, 2010: 4-5). Some researchers have suggested that China’s rise to top spot of mobile phone producing countries and its consequences on price has contributed to making mobile phones accessible to more Africans (Carmody, 2010):

Thus, the rise of China and the spread of the information technology revolution to Africa are not empirically distinct events, but interconnected

axes of the wider process of globalization generated, mediated, and promoted through state, corporal and other social structures. (p. 3).

Indeed, the World Bank claimed that ‘the region’s higher economic performance is not transitory but is rather a structural break from the past (2006a, 2 cited in Carmody 2010: 34]). Professor Carmody continues that

Nonetheless, the economist Intelligence Unit (predicted that seven of the top ten fastest growing economies in 2009 would be in sub-Saharan Africa (Malawi, Angola, Ethiopia, Congo-Brazzaville, Djibouti, Tanzania, and Gambia (Carmody, 2010: 6).

This is a welcoming development for the continent as whole and individual countries such as Ghana. It can be argued, therefore, that the economic success of Africa is related to mainstream economic globalization, considering the flow of global capital into African economies, particularly in the form of FDI. FDI inflows into the continent have had something to do with the rapid transformation of most economies that implemented liberalization policies in the 1980s and the 1990s. In this regard, many researchers are of the view that “While still miniscule in relative terms, Africa’s share of global FDI has risen to 1.8 percent, attracting absolute amounts roughly three times what they were per year in the 1990s” (Carmody, 2010:40-41; Broadman, 2007, Voltoirenet, 2007). For example, regarding Accra in Ghana, Grant (2009) has asserted that

The establishment of new foreign companies accelerated to unprecedented levels in the liberalization period: over 90 percent of all companies currently active have been established since 1983. (pp. 27-28).

In terms of jobs for Ghanaians it is estimated that FDI projects has created over 73,000 jobs as of 2004 (Mmieh & Owusu-Frimpong, 2004: 591). Moreover, foreign firms have been noted to have accounted for about 75 percent of increase in export earnings (UNCTAD, 2002:16). It seems, therefore, that even though the bulk of the FDI flows have taken place predominantly among developed countries such as among UK, USA,

Japan and Germany (Dickens, 2003; Beenhakker, 2001; Hanink, 1994) such funds have become an important source of development financing in developing countries in view of the associated job creation and other economic benefits to the destination countries in the developing world (GIPC, 2009; Glick, 1998; Mallampally & Sauvant, 1994). Among developing countries, therefore, there is intense competition for such private funds flowing from external sources, chiefly from developed and newly industrialized countries (Grant, 2009; Grant & Yankson, 2003; Grant, 2001; Mallampally & Sauvant, 1999; 1994) as this quote exemplifies:

With liberal policy frameworks becoming commonplace and losing some of their traditional power to attract FDI, governments are paying more attention to measures that actively facilitate it. Still, the economic determinants remain key. What is likely to be more critical in the future is the distinctive combination of locational advantages and, especially, created assets that a country or region can offer potential investors. (Mallampally & Sauvant, 1999: 37)

For example, following the doctrine of the economic liberalization brought on by the SAP, Ghana established a unit called the Ghana Investment Promotion Center (GIPC) to help create conducive investment climate to attract FDI into the country (Grant, 2009; 2001; GIPC, 2009). It is estimated that Ghana has benefitted from over US\$ 2.8 billion of foreign investments, largely due to the activities of the GIPC and 'peaceful' administration of political processes in the country. It would be interesting to review the theoretical underpinnings of FDI flow - What drives FDI? This will aid the interrogation about the linkage, if any, between FDI flow determination theories and urban spatial expansion. In other words: are there any theoretical signals to the effect that FDI could feed into housing and land demand in developing host economies?

A Review of the FDI Theoretical Literature

FDI can be divided into three main components, namely, extraction, manufacturing and services (Moran, 2011). This FDI theoretical literature review has been categorized into two main groups – FDI flow determination theories and theories on the impact of FDI on destination countries/economies. This latter category will provide the platform for the new conceptual framework which is the subject of this chapter - identifying the link between FDI and urban land conversion in “primate” cities of developing countries.

Perfect Competition and FDI

Early theorization of FDI derived mainly from the Heckscher-Ohlin background where perfect competition underlies the postulates. In these approaches, FDI has been modeled as capital flows from one location to another based on the concept of *relative capital abundance*. The basic tenet of the reasoning was that there is spatial inequality in the distribution of capital among countries - some countries having more capital than others. In essence, therefore, this result in differential returns on capital, implying higher returns on capital in “capital-scarce” countries and lower returns on capital in “capital-abundant” countries. Consequently, capital would move from capital abundant countries (rich or developed countries) to capital scarce countries (poor or less developed countries), thereby exhibiting the notion of comparative advantage of some sort. Mundell (1957) attempted a formalization of the perfect competition approach to FDI theorizing. He explained the effects of factor movements in a two-sector, two countries and two factors (2×2×2) framework, principally deriving from the Heckscher-Ohlin model. Holding constant the possibility of factor equalization constant, Mundell postulated that product and factor prices would remain constant following capital inflows (Mundell, 1957; Lattore, 2008). A further deduction was that capital inflows and imports

were substitutes in that increasing capital inflows would tend to reduce the imports of the recipient country, resulting in what has been characterized by the catch-phrase: “trade in factors is a substitute for trade in goods”. (Lattore, 2008: 3). However, these outcomes did not sit well with some researchers, particularly, the “one-way” flow of FDI; and the notion that factor prices are not responsive to capital inflows was particularly disconcerting (Caves, 1971; 2007; Brown et al., 2003; MacDougall, 1960). The general argument here was that empirical evidence pointed to “two-way” movements of capital. This observation, to some extent rendered Mundell’s approach incapable of explaining the empirical evidence, needing a modification or reformulation. MacDougall (1960) took up this challenge, postulating a one-sector economy receiving capital inflows. However, unlike Mundell, MacDougall allowed for the responsiveness of labor productivity and local capital-to-capital inflows, whereby rent on local capital gets reduced whereas labor productivity increased (MacDougall, 1960; Lattore, 2008), thus allowing for two-way flows of capital or FDI. It must be noted that both theoretical contributions (Mundell and MacDougall) still alluded to the fact that capital would move from capital abundant (rich, developed) countries to capital-scarce (poor-developing) countries. However, the empirical evidence once again pointed to the contrary as it was observed that the so called capital rich countries were simultaneously originators and recipients of capital. Indeed, it has been noted that the bulk of FDI flows originates in (and is directed to) developed economies, which should be capital abundant (Barba Navaretti & Venables, 2004; Markusen, 2002), alluding to the existence of market imperfections for FDI flows.

Market Imperfections and FDI

According to Kindleberger (1969), everyone agrees on one point, in a world characterized by perfect competition, FDI would no longer exist. Thus, it was realized that the assumption of perfect competition was no longer tenable as it became increasingly obvious that individual firms may have monopolistic control over their innovations and inventions, at least, in the short to medium term (Kindleberger, 1969). Since FDI normally entails “extensions” of parent companies via subsidiaries in different countries, this could cause a break from the capital movements framework (Kindleberger, 1969). It is also important to note that early theoretical frameworks did not distinguish between portfolio and FDI per se.

Stephen Hymer (1976) demonstrated that the view of FDI as capital movement which followed higher rates of return was contrary to what empirical data presented. Drawing on his original doctoral dissertation, Hymer argued that due to market imperfections, the type of assets possessed by multi-national enterprises cannot be transferred easily. He went on to identify two main types of market imperfections associated with MNEs as (1) MNEs’ advantages with respect to firms with no foreign operations –claiming that this violated the assumptions of perfect competition); and (2) resulting from costs of transactions (Lattore, 2008; Denisia, 2010). In a nutshell, Hymer argued that if a firm decides to set up a subsidiary abroad against all odds; the firm must have some advantages relative to firms operating domestically in the foreign country. For example, the indigenous firm has knowledge of indigenous market, consumer tastes, the legal and institutional framework of business and local business customs (Denisia, 2010; Lattore, 2008; Kindleberger, 1969), which on the surface of it, should put the MNEs subsidiary purporting to operate in the domestic economy at a

disadvantage. Hymer explained that control of foreign enterprises was important to appropriate fully the returns on advantages the firm possessed (Denisia, 2010). Thus, FDI becomes an alternative choice for minimizing the cost of uncertainty. Furthermore, in order to survive the imperfect market, direct ownership (affiliates) is the viable strategy to be adopted. Essentially, therefore, Hymer concentrates on firm-specific advantages (FSA) which can be exploited in foreign countries by MNEs (Lattore, 2008). These advantages may include ownership of a brand name, innovations, unique marketing know-how, patents, management skills and perhaps secure sources of finance as well as economies of scale derived from plant size, etc. (Lattore, 2008). Therefore, industries where vertical integration takes place will be characterized by high seller concentration, which creates barriers to entry (Lattore, 2008). It is also important to note that Stephen Hymer (1976; 1960) was the first scholar to have distinguished FDI from other foreign capital movement such as portfolio investments (Denisia, 2010; Moran, 2010; Lattore, 2008). A number of theorists have followed Hymer's path-breaking efforts to advance his line of argument. For example, Cave (1971) has adopted Hymer's idea to explain industry characteristics of investment and structural features of the markets in multinational corporation system. According to Cave, a firm can enter a foreign market through horizontal or vertical integration. Horizontal integration describes a situation whereby MNEs produce the same kinds of products in foreign markets as being produced in the home country of the multinational corporation. Cave argued that product differentiation would underlie horizontal FDI integration which is enabled by the possession of assets/advantages not available to local firms in the host country. On the other hand, vertical FDI integration is engendered by the MNEs

attempts to avoid uncertainties over supplies, and prices. The involvement of MNEs in this type of integration, therefore, assures that supplies are carried out by affiliates. Consequently, Cave has argued that the most important skill is the ability to differentiate a product.

The Product Life-Cycle and Beyond

Raymond Vernon (1966) worked along similar lines of thinking as Hymer but elected to describe the expansion of multinational enterprises (or FDI flows) as distinctive stages. His theory is widely known as the Product Life-Cycle theory –PLC (Vernon, 1966; Lattore, 2008) and entails three main stages. Vernon argued that most production processes went through these stages or product life-cycle. The first stage is characterized mainly as innovation phase whereby firms produce for the local market (US in this case). The key importance of this stage is that it enables the firm to satisfy local demand with sufficient profits to allow for it to engage in research and development, thereby enhancing product quality. In this stage, therefore, research, development and the production processes are efficiently coordinated (Lattore, 2008). The second stage focuses on market-seeking outside the home country (mainly Western Europe, at the time of the formulation of this theory). In the stage, the product begins to be exported (to Western Europe). In a third stage, some competitors arise in Europe. If conditions are favorable, the firm will establish foreign subsidiaries there to face the increased competition and it may also establish subsidiaries in less developed countries to have access to cheaper labor costs to enhance its competitiveness. Vernon (1979) himself recognized that the circumstances had changed rapidly since his theory was developed and that this had considerably weakened its predictive power. However, the product-cycle theory provided a framework under which a number of

authors dealt with crucial questions about FDI. Hirsch (1976), for example, worked on the circumstances which influence a firm's decision on whether using exports or FDI to serve the foreign market. His model takes into account the costs of managing production abroad as well as the asset specificity of the capital owned by MNEs in a simple but complete framework (Denisia, 2010; Lattore, 2008). The cardinal importance of the product life cycle theory was the novel attempt to give relevant explanation specifically relating to the expansion of US enterprises in foreign markets, especially after the Second World War. Consequently, Lattore (2008) notes that the theory "explains FDI as a reaction to the threat of losing markets as a product matures, and as a search of cheaper factor costs to face competition" (p. 8). Again, this theory is concerned mainly with FDI flows among capital-rich countries or capital abundant countries, not comprehensive enough to account for other types of FDI flows, especially those flowing from developed to developing countries.

In response to this deficiency, John Dunning (1977) attempted to synthesize the existing FDI theories to formulate a more comprehensive theory (Denisia, 2010; Lattore, 2008) resulting in what has been described as the *Eclectic Theory* of foreign direct investment (Denisia, 2010; Lattore, 2008; Dunning, 1977). His theory is based on the "OLI" paradigm ("Ownership-specific" advantages, "Locational" advantages and "Internalization" advantages). Drawing on existing theories, the eclectic theory attempts to incorporate the three main strategies through which firms try to get involved in the global economy or operate in foreign markets, namely, -exports, FDI and contracts (i.e. licensing, technical assistance, management and franchising)- (Denisia, 2010; Lattore, 2008). Essentially, the Eclectic Theory posits that firms that would seek to engage in

FDI must have some advantages which include ownership, location and internalization, simply abbreviated as OLI (Lattore, 2008: 57). Ownership advantages refer to intangible assets, which are, at least for a while, exclusive possessions of the company and may be transferred within transnational companies at low costs, leading either to higher incomes or reduced costs (Dunning, 1977). Dunning (1973; 1980; 1988) theorized that there are three main types of specific advantages that can be recognized - Monopoly advantages in the form of privileged access to markets through ownership of natural limited resources, patents, trademarks; technology, knowledge broadly defined so as to contain all forms of innovation activities; economies of large size such as economies of learning, economies of scale and scope, greater access to financial capital and so on (Denisia, 2010: 57). Locational advantages are mainly derived from endowments such as natural resources and cheap labor. Location advantages of different countries are the key factors to determining who will become host countries for the activities of the transnational corporations. The specific advantages of each country can be divided into three categories (Denisia, 2010) –economic, political and social:

(a) The economic benefits consist of quantitative and qualitative factors of production, costs of transport, telecommunications, market size, among others;

(b) Political advantages: common and specific government policies that affect FDI flows;

(c) Social advantages: includes distance between the home and host countries, cultural diversity, attitude towards strangers, among other things.

Supposing the first two conditions (OL) are met, it must be profitable for the company to use these advantages, in collaboration with at least some factors outside

the country of origin (Dunning, 1988; 1980; 1973). This third characteristic of the eclectic paradigm offers a framework for assessing different ways in which the company will exploit its powers from the sale of goods and services to various agreements that might be signed between the companies. As cross-border market benefits is higher the more the firm will want to engage in foreign production rather than offering this right under license, franchise. Eclectic paradigm shows that OLI parameters are different from company to company and depend on context and reflect the economic, political, social characteristics of the host country. These advantages are assumed to increase the wealth creating capacity of a firm and hence the value of its asset. FDI will occur only if the ownership-specific advantages can be profitably “internalized”. This means that a firm will get more advantages to use its outputs by itself rather than to sell or lease them to foreign firms. The basic tenets can summarized as follows: Enterprises which have the greatest opportunities for internalizing activities will be the most competitive in foreign markets. If only ownership-specific advantages are possessed, a firm will consider FDI, exporting, and licensing as equal. In case those ownership specific advantages can be “internalized”, the firm will prefer FDI and exporting to licensing. Lastly, if the ownership-specific advantages can be profitably internalized across national boundaries because of the location-specific factors of a foreign location, then the firm will definitely prefer foreign direct investment to both exporting and licensing. Essentially, therefore, Eclectic theory states that all forms of all countries’ productions can be explained by these three conditions. The possession of ownership advantage is a necessary prerequisite of foreign involvement. According to the internalization advantages, the enterprises will exploit ownership advantage by way of

export of FDI rather than by contractual resource exchanges, whereas the FDI preferred to exports will be chosen where location advantages favor a foreign rather than a domestic production. Several variants of the OLI paradigm have been formulated. For example, the *Multinational Enterprise Theory* is developed from the eclectic theory by Markusen (1991). Markusen argued that the most basic question that any theory of the multinational must answer is why multinationals exist (Denisia, 2010). Why are markets not served by exports from foreign firms or by production by locally owned firms? Markusen invoked the concept of knowledge-based, firm-specific assets (FSAs), arguing that these are proprietary assets of the firm embodied in such things as the human capital of the employees, patents or the reputation of the firm. There are two reasons why these knowledge-based assets are more likely to generate FDI. First, knowledge-based assets can be transferred easily back and forth across space at low cost. Second, knowledge often has public goods characteristic in that it can be supplied to additional production facilities at very low cost. The knowledge-based assets have important implications for the efficiency of the firm and in turn for market structure. FSAs are important in the theory of the multinational. It implies that a major component of trade between parent firms and subsidiaries is management, engineering, and other services. This theory can apply to both export and import-competing industries, and indeed non-traded industries as well. The Multinational Enterprise Theory explains what types of firms and industries are likely to be dominated by Multinationals. This theory has three major motives which are as follows; (1) market oriented FDI; (2) raw material based FDI; (3) cost reducing FDI. Market-oriented FDI is naturally oriented toward countries with large home markets, often in response to rapid market growth

and/or the threat of tariff imposition. Much of this type of investment takes place in the advanced industrialized countries or in the large rapidly growing less developed countries, and some in the newly industrializing countries (Denisia, 2010; Lattore, 2008). Raw material based investment has traditionally been the source of much satisfaction between host and home countries. Linked very closely with colonial patterns, the historical factors which have led to extraction technology reposing in advanced countries and the raw materials in colonized, less developed countries have increased tension. The expropriation and indigenization have led to massive restructuring of operations and the search for new forms of institutional arrangements (Denisia, 2010; Lattore, 2008). Cost reduction is one motive through which FDI can be generated (Denisia, 2010; Lattore, 2008). In any industry, labor factor is a major element of cost and one which can be reduced by the act of relocation (Denisia, 2010; Lattore, 2008). The search for cheap labor has led to multinationals reorganizing their operations so that the labor intensive stages can be relocated (Markusen, 1991; Vernon, 1966). Markusen concluded that multinationals arise in industries which have certain technological and informational characteristics, but that trade orientation of multinationals in a particular country is determined by more traditional principles of comparative advantage and trade barriers.

The foregoing review, which is an attempt to trace the beginning of theorization of FDI, shows that among the FDI determination theories, the OLI, the PLC and the Multinational Theory hold sway and that there is no single agreement as to which is better. Together, they constitute the FDI determination theoretical framework. However, unlike remittances determination theories that hint on asset accumulation in migrant

home country, which relate to urban land demand, these theories do not offer insights regarding how FDI feed into urban land demand as a result of over-concentration of FDI in geographical space in destination countries. What might be more relevant to the objective in this chapter would be the theoretical literature that examines the impact of FDI in destination countries from where one could “insert” FDI impact on urban land conversion/expansion. Unfortunately, such theoretical framework does not exist in the FDI theoretical literature. What is available have focused mainly on empirical research. However, the need for such a theory that links FDI to urban expansion cannot be overemphasized, given the realities of economic globalization currently. Even though developed countries receive the bulk of FDI, it is generally acknowledged that FDI is crucial for developing countries in their bid to better the lot of their people. Thus, Mallampally and Sauvart (1999) have noted that

While FDI represents investment in production facilities, its significance for developing countries is much greater. Not only can FDI add to investible resources and capital formation, but, perhaps more important, it is also a means of transferring production technology, skills, innovative capacity, and organizational and managerial practices between locations, as well as of accessing international marketing and networks. (Mallampally & Sauvart, 1999: 35-36).

Economic growth naturally entails the use of resources and in developing countries, mostly characterized by extractive and manufacturing FDI, the use of natural resources is usually paramount in attracting the FDI in the first place.

In this regard, Borensztein and colleagues note:

The literature on the FDI–growth relationship is vast for both developed and developing countries. The basis for most of the empirical work focuses on neoclassical and endogenous growth models. It is often claimed that FDI is an important source of capital, that it complements domestic investment, creates new jobs opportunities and is in most cases related to the enhancement of technology transfer, which of course boosts economic growth. While the positive FDI–growth linkage is not unambiguously

accepted, macroeconomic studies nevertheless support a positive role for FDI especially in particular environments. Existing literature identifies three main channels through which FDI can bring about economic growth. The first is through the release it affords from the binding constraint on domestic savings. In this case, foreign direct investment augments domestic savings in the process of capital accumulation. Second, FDI is the main conduit through which technology transfer takes place. The transfer of technology and technological spillovers lead to an increase in factor productivity and efficiency in the utilization of resources, which leads to growth. Third, FDI leads to increases in exports as a result of increased capacity and competitiveness in domestic production. Empirical analysis of the positive relationship is often said to depend on another factor, called “absorptive capacity”, which includes the level of human capital development, type of trade regimes and the degree of openness. (Borensztein et al., 1995; 1998, cited in Ajayi, 2006: 2).

Considerations for resource usage should include the need for land resources for crops/agriculture as well as land for settlement expansion where globalization fuels urbanization, for example. Lambin and Meyfroidt (2011) have asserted that

Addressing global land availability is made more complex by the processes of economic globalization. In particular, cropland expansion and forest conversion are accelerated by global-scale spatial dynamics caused by the displacement, rebound, cascade, and remittances effects. (Lambin & Meyfroidt, 2011: 3466).

Thus, economic globalization has the tendency to reduce natural land availability, if FDI should influence urban land demand (impacting urban settlement sizes). It is obvious that urban land expansion has not been considered here. However, in their own conceptualization (Lambin & Meyfroidt, 2011: 3465), natural land availability is represented as:

$$\text{Land for nature} = \text{Total land area} - (\text{Agricultural area} + \text{Settlements})$$

2-1

This would imply that change in settlements affect total land area and consequently change in land for nature. However, urban land expansion has not been linked to FDI resulting from intensifying economic globalization in a manner such as advanced in this

dissertation. However, Seto et al. (2011) have alluded to the plausibility of FDI-induced urban land expansion, but identified GDP per capita growth rate as the major contributor to urban land expansion in developed countries, and population increase as most relevant driver of urban land expansion in developing countries. Essentially, what analysts have failed to consider with regard to population's impact on urban land expansion is the "purchasing power" enabling aspect that is brought on through FDI jobs creation and related activities. In effect, there is the need to know exactly how population increase fuels urban land demand. In cities where new settlements are characterized by tenements at the periphery one can safely assume that people do not need to be relatively rich to be able to acquire and develop the land for residential purposes. Hence, in this situation, even new rural-urban migrants will contribute significantly to the physical expansion of the city through demand for land. However, if the contemporary expansion of the city shows peri-urban "accretion", characterized mostly by "quality" residential houses such as has been noted by Yeboah (2003) for Accra, it is not entirely tenable to attribute the expansion to absolute population numbers per se, since in most cases ordinary local residents, normally do not have the purchasing power to acquire such homes. Konadu-Agyemang (2001) provides a fuller discussion of the housing issues in Accra. It is against this backdrop that Chapter 2 asserts that FDI provides the necessary purchasing power through employment. Essentially, Chapter 2 argues that population increase must be backed by purchasing power to enable people express "effective" demand for housing and land, in order to affect the urban extent, other things being equal. Even though it is difficult to untangle the demand for land generated by FDI via employment for rigorous analysis, it is worth

trying. Untangling the pathways linking FDI and urban land expansion could potentially lead to a more complete understanding. This is imperative since our understanding in this area of research is incomplete, given the recent assertion by Seto et al. (2011) to the effect that

Although demographic and economic factors capture a fair amount of urban land expansion in China and India, much of the observed expansion in other regions cannot be accounted for by the explanatory variables of the model. (Seto et al., 2011: 1)

referring to their work on the meta-analysis of urban land expansion studies. The authors further note that

The idiosyncratic nature of the world's urban areas suggests a long list of additional factors that may interact with the fundamentals of population and economic growth in determining urban expansion. . . First, the role of international capital, be it foreign direct investment, overseas development assistance, or other types of financial instrument, is key in driving development and especially urban expansion in developing country cities and is excluded from the analysis. (Seto et al., 2011: 7).

This is precisely why this dissertation in general, and this Chapter 2, in particular is timely and potentially useful exercise, especially developing well-thought out conceptual framework for subsequent theoretical development.

FDI and Urban Spatial Expansion: A Conceptual Framework

The uneven geographical distribution of FDI, with its tendency to “flock” into urban agglomerations could have important spatial ramifications, including the expansion of the urban extent. Commenting on Accra's spatial change under globalization, Grant (2009) notes that “the liberalization era in Ghana has gone hand-in-hand with rapid rates of urbanization and expansions of the built-up area” (p. 27). Even though no causal inference has been advanced, it is not too difficult to see that opening up of the Ghanaian economy to external “impulses” could have played some role in this process.

The impact of foreign direct investment on urban land conversion can be conceptualized at 3 levels which feed into land demand and subsequently land conversion, other things being equal: via unemployed people already living in the city who get employment from FDI-related jobs; people who are drawn from other parts of the country, and even from outside the country, into the city and get employed in FDI related jobs, and land requirements of foreign investors-for expatriate housing and also to establish operations and other related activities, constituting direct demand for land by foreign investors. These are outlined below.

FDI Impact on Land Conversion via Income and Population

At any point in time it is conceivable to reason that there is a surplus labor in the city, especially for cities which have assumed the 'primacy' status in the urban hierarchy of their country, given their attractiveness to potential migrants who perceive relatively better economic / living conditions in the "flagship" city. With the advent of FDI and jobs made available, new income earners enter the urban economy, which would have the "purchasing power" to demand, at least, housing which will in turn have a positive impact on land demand. The implication here is that even though the general income levels in the country for individuals as measured by GDP per capita may remain unchanged, the city's aggregate income (quantum), total income of inhabitants of the city increases as a result of gaining employment in FDI related operations.

Population migration from rural areas to urban centers is not a recent phenomenon by any stretch. In particular, colonial legacy and governmental urban biases have helped create overconcentration of infrastructure and other amenities in urban centers of most developing countries creating 'primacy' (Aryeetey-Attoh, 2010); and contributing to the current situation whereby such cities receive disproportionately

large portions of FDI funds. Once FDI starts flowing into a country and it is concentrated in the 'primate' city this will trigger migration from other parts of the country-both from other towns and cities as well as rural areas-into the city receiving disproportionate share of FDI. It must be noted that this FDI induced type of migration is distinct from rural-urban migration in the literature in the sense that these people are likely to be relatively highly skilled, may be changing jobs into a high wage-paying FDI jobs; as opposed to the 'mass' exodus associated with most rural-urban migration. It is crucial to emphasize that the latter group of migrant would find it difficult to exert any appreciable pressure on demand for land that would cause new land conversion, given the income status and lack of skills to command significant purchasing power. At best, such migration will only fuel demand for housing at the lower end of the income stratum which flies in the face of the high-cost residential buildings in the periphery which has generally characterized Accra's contemporary spatial expansion.

Expatriates' need for housing must be satisfied through infill, gentrification or 'greenfield'. If demand is satisfied through the latter channel, it will fuel demand for new land and consequently land conversion and land expansion.

FDI Impact on Land Conversion: Direct Land Demand

Even though classical economic theory recognizes "land" as one of the input factors of production, mainstream economics has not directly considered FDI impact on urban land expansion. In this study, land is literally interpreted to mean the physical space on which some infrastructure could be constructed to facilitate the operation of the firm. For example, *Direct* FDI demand for land entails the requirement to establish warehouses, offices, plants, housing for expatriates, among other things. Figure 2.1 illustrates the pathways through which FDI transmits impulses into the biophysical

environment. Essentially, incidence of FDI in the urban economy results in job creation and arrival of expatriates. Job creation offers employment for both unemployed city residents and potential migrants from other places, sometimes including from neighboring countries. Thus, more people gain the purchasing power. On the other hand expatriates demand housing. Expatriates, together with the newly employed in FDI-related jobs will increase the demand for housing. Part of this demand may be met through gentrification and occupation of existing homes. However, if the bulk of this demand is made up by middle-to upper income earners, their demand will consist of quality, spacious, usually new homes. This will fuel demand for new lands, usually. Added to this demand is the demand for land by FDI firms for their operations such as warehousing. Part of this land demand may be met through infilling and use of existing structures. But almost invariably, a significant part of this land demand may be met through the conversion of new land / natural areas, given the lower prices of land in the urban periphery for the most part (Hanink, 1997). The broken lines and boxes in Figure 2-1 imply that “densification” through gentrification - use of existing homes, infilling and use of existing structures - absorb some of the demand pressure on housing and land. However, in most “primate” cities in developing countries, this “absorbed pressure” is not likely to be significant enough to accommodate substantial part of the land demand generated by FDI. Thus, the argument is advanced to the effect that the bulk of this FDI-induced demand will be translated into the conversion of new lands / natural areas, especially in the absence of effective land use management policy and ecologically conscious planning practices. *Assumptions:* It is assumed that this city exhibits “primacy” characteristics in the urban hierarchy of the country, with overconcentration of

infrastructure, population, economic agglomerations, among other things.

Consequently, it is not far-fetched to suggest that the bulk of FDI will flow into this “primate” city. Another important assumption is that agricultural land market, usually assumed in standard urban economic modeling, is virtually non-existent (Chapter 4), hence demand for urban land overrides all other consideration, constrained only by customary land tenure practices, in the case of Accra and other urban centers in Sub-Saharan Africa. In a nutshell, land will be made available once there is effective demand for it. Implications of the conceptualization are that:

(a) Even though city population may increase in absolute numbers, this may not necessarily result in the type of demand for land that will result in new land conversion. In effect, this population must have the “purchasing power” in order to translate into “effective” demand for housing and / or land. Invariably, however, population increase will correlate positively with urban land expansion, thereby “masking” the purchasing power contribution afforded by the inflow of FDI as an external economic stimulus. It is important that this is untangled in order to properly understand the role of FDI in contemporary land /spatial expansion, especially in “primate” cities of developing countries. The statistical evidence of positive association does not give the complete picture therefore our understanding is less complete.

(b) In primate cities: Policy interventions that target urban population control / management in lieu of urban expansion should be augmented with effective FDI management policy otherwise the triggers described above will likely undermine their efforts. A comprehensive FDI management is in order, to ensure a more geographically diversified FDI distribution into smaller urban centers. Of course such an approach will

come at the expense of benefits of economic agglomeration, perhaps. This makes it even more imperative that a more concerted effort be geared towards a more complete understanding in this area of research. For example, at what level does agglomeration result in negative consequences? What levels of FDI can be accommodated by the “primate” city without the potential negative impacts associated with FDI overconcentration? What proportion of land demand can be attributed to FDI activities? What percentage of the primate city’s population has been induced by FDI related jobs? What percentage of the primate city’s population, previously unemployed, have gained employment in FDI related jobs? These are questions that will help illuminate further the complexity of economy-environment relations in general and in the urban setting in particular.

Summary

It is widely held that conceptualization enhances the process of theory construction. Chapter 2 has attempted to provide a conceptual framework which can be used to aid the theoretical framing of FDI-induced urban spatial expansion, especially in primate cities in developing countries settings. The chapter identifies and describes the pathways through which FDI flows into an urban space may influence the expansion of the urban extent: i.e. via employment of previously unemployed city residents who gain employment in FDI-related jobs; via employment of induced population / migrants who gain employment in FDI related jobs; via direct demand by expatriate workers and demand by FDI firms for operations. Together, these pathways contribute to increasing demand for housing and land and if this demand is not satisfied by existing housing stock or construction of high-rise, high density structures on existing lands or the use of existing lands and structures, new natural areas must be converted to urban uses.

Another dimension of the externally (FDI) induced demand for housing and land is that it is likely that middle - and upper class housing will dominate the market because FDI related jobs usually employ skilled, educated workers who more than likely will not earn low wages. These people have been afforded a relatively high “purchasing power” and can express “effective” demand for “quality” housing and land, which in the case of Accra, get constructed in the peri-urban areas. Preliminary indications are that it does appear that FDI overconcentration in a large/primate city could feed into the expansion of the urban extent, even though there is no FDI related theory that seeks to link this increasingly important spatial financial flow to contemporary urban spatial expansion.

It is argued in this dissertation that FDI and remittances both have the potential to impact the urban land conversion process. Given the foregoing conceptual analysis which gives more insight into the FDI – land conversion relationship, it can be argued that similar insights would be needed for a better understanding of the remittances-urban land conversion relationship. This is the focus of Chapter 3.

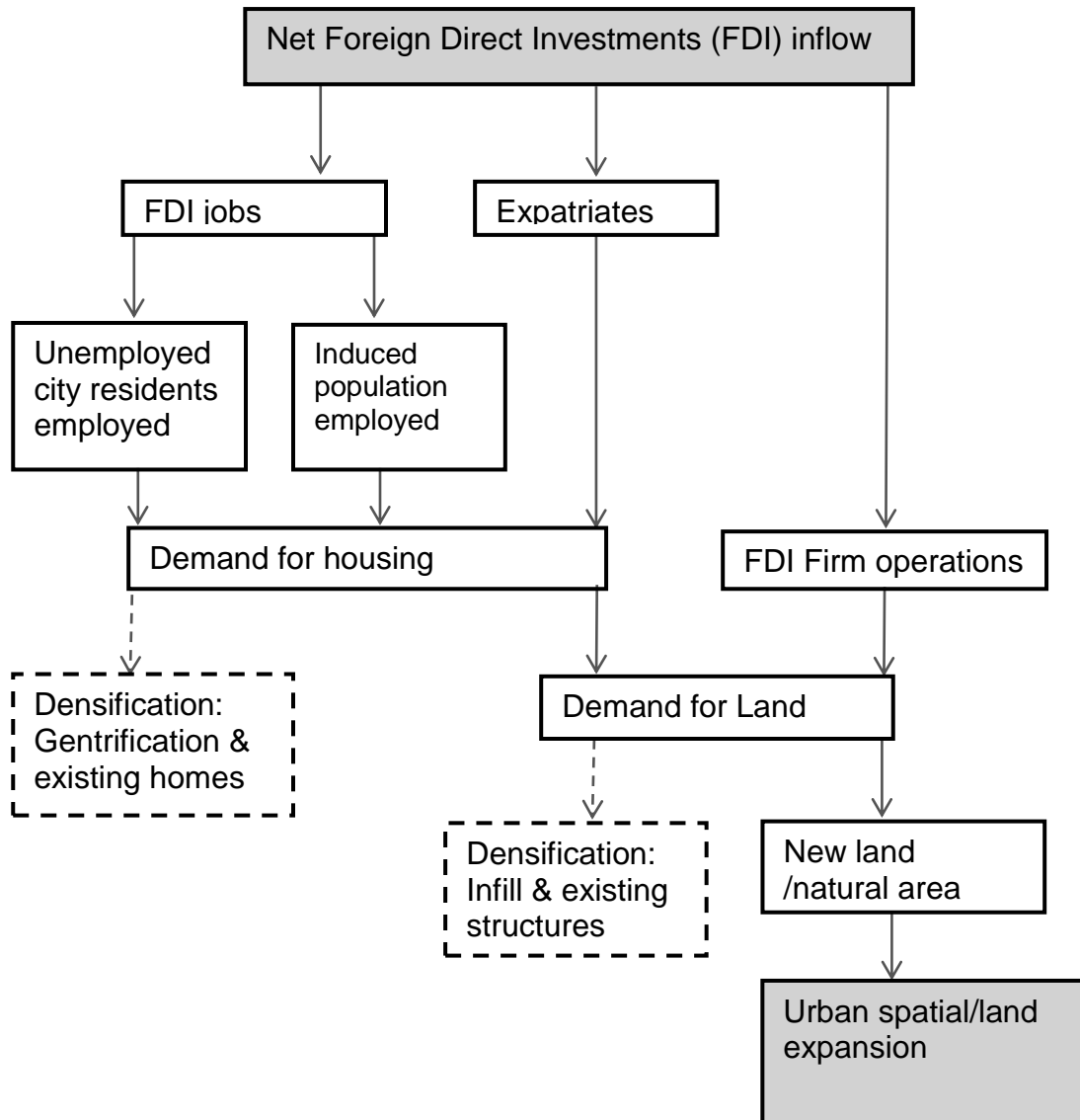


Figure 2-1. Pathways linking FDI to urban spatial expansion. Source: Author's construct

CHAPTER 3 CONCEPTUALIZING THE LINK BETWEEN REMITTANCES AND URBAN SPATIAL EXPANSION

Background

Chapter 3 seeks to explore and conceptualize the relationship between remittances and the urban spatial expansion process. Specifically, the analysis is guided by the question: What are the specific pathways through which remittances impact urban spatial expansion? The main argument advanced is that remittances inflow, if significantly concentrated in a single city, impact urban land expansion positively (more remittances would reflect in more land conversion). This process is especially accentuated with the advent of economic globalization and its attendant improved communications; fuelling unprecedented levels of human migration which generate rounds of remittances flows (IOM, 2010). Addison (2004) defines remittances as “that portion of migrant’s earnings sent from migration destination to the place of origin” (p.5). Money transfers by migrants from their domiciled countries to their countries of origin, especially from wealthy countries to developing ones, continue to increase in rate and volume every year (Ratha et al., 2009; Pablo et al., 2009; Maimbo & Ratha, 2005; Faini, 1994). For example, Maimbo & Ratha (2005) note that

Officially recorded remittance flows to developing countries exceeded US\$125 billion in 2004 making them the largest source of development finance after foreign direct investment. (p. 2).

Beyond development financing, such funds continue to be critical in terms of providing economic sustenance for numerous families (Mallampally & Souvant, 2008; Addison, 2004). The rate and size of remittances flow are closely tied to economic globalization (Maimbo and Ratha, 2004) and liberalization policies implemented in most developing countries such as Ghana which facilitate easy inflows of funds across locations (GIPC,

2011; Grant & Yankson, 2003). It is widely held that remittances are of immense and increasing importance to developing countries (Maimbo & Ratha, 2005; Addison, 2004; Ratha, 2003). Dillip Ratha notes that in 2001 remittances flow to developing countries totaled US\$72.3 billion, which was second only to flow of FDI Ratha (2003). Moreover, remittance has been found to be a more stable flow than other forms of funds such as portfolio and even FDI (Ratha, 2003). Thus, for many developing countries, remittances from citizens abroad have assumed important dimensions as inflows of private capital and official aid decrease steadily (Ratha, 2003). In effect, therefore, remittance has been recognized as one of the reliable financial flows with increasing importance as a form of development financing for developing countries (Acosta et al., 2009; Ratha et al., 2009; Maimbo & Ratha, 2005; Faini, 1994). Moreover, Maimbo & Ratha (2005) note that beyond development financing, such remittance funds continue to be critical in terms of providing economic sustenance for numerous families. An important emerging aspect of remittances flow is remitters quest for investments in small businesses and acquisition of real property such as houses and lands (World Bank, 2010; Amuedo-Dorantes & Pozo, 2006; Addison, 2004). According to the World Bank (2010) data Ghana received about US\$17.210 million in 1995 in remittance funds which increased to about US\$ 99.185 in 2005, representing about 476 percent increase within the ten-year period. It seems that these positive attributes of remittances have contributed to “masking” its other, possibly negative impacts on natural areas in primate cities of their origin countries. Such potential impacts on urban land demand and consequent land conversion to urban uses, especially if the funds are concentrated in primate cities of developing countries, is closely associated with migrants asset accumulation motive

articulated in the literature (Amuedo-Dorantes & Pozo, 2006), but less articulated directly. Thus, even though Amuedo-Dorantes and Pozo (2006) have emphasized the increasing importance of the motive of migrants to acquire real assets in their origin countries, including housing construction in cities, a formal theory of remittance-induced urban land expansion is yet to materialize. However, it appears as migration is projected to increase going forward and remittances levels continue to rise in quantum and importance in developing countries, the emerging phenomenon of remittance-induced urban land expansion is likely to assume high importance. To the extent that globalization reinforces international migration and given the ageing economically active population in rich countries; and so far as economic liberalization ensures almost seamless spatial flow of global funds, the future of oversea workers' remittances flow- from developed economies to less developed ones- is likely to continue into the future (Chami et al., 2008). In order to effectively manage urban land use in lieu of urban sustainability, given that globalization has come to stay, it is imperative that understanding about globalization related urban spatial changes be improved especially remittances-induced urban spatial expansion which appears to be characterizing primate cities in developing countries. Developing a formal theory to explain the relationship between remittances and contemporary urban spatial expansion in primate cities of developing countries will aid our understanding of how external economic forces-in the form of remittances-contributes in shaping the contemporary primate city in a typical developing country setting. A systematic conceptualization will benefit such a theoretical development process (Egan, 2002).

The goal in Chapter 3, therefore, is to start this theoretical journey by providing a conceptual framework, systematically formulated and designed to unravel the pathways through which remittances impact urban spaces they happen to be concentrated. The importance of conceptual frameworks for theorizing has been underscored by Rudestam and Newton (2007), when they stated that: “Theories and conceptual frameworks are developed to account or describe abstract phenomena that occur under similar conditions” (p.6). They further assert that:

Generally speaking, a research dissertation is expected to contribute to the scholarly literature in a field and not merely solve an applied problem. Thus, identifying a conceptual framework for a research study typically involves immersing oneself in the research and theoretical literature of the field. (Rudestam & Newton, 2007: 6).

In a nutshell, it is plausible to conceptualize, to the effect that remittances will generate rounds of economic activities through direct employment as well as demand for construction and other materials. Combined, these activities will exert pressure on housing and land demand resulting in land conversion, especially with the intensification of economic globalization.

Globalization and Remittances: An Overview

Economic globalization forces and economic liberalization policies have combined to reinforce unprecedented spatial flows of economic resources almost seamlessly across locations (Dickens, 2003; Hanink 1994). One of such economic flows is workers’ remittances. This private, unrequited flow of funds has assumed important dimensions for developing countries, in particular, as other financial flows decline in relative terms (Addison, 2004). Remittances and migration are two phenomena which have been immensely impacted by increasing interconnectedness of economies and deepening

spatial inequality in global economic prospects (Dickens, 2003; Abler et al., 1971).

Thus, Abler and colleagues have pointed out that

Economic change is never ubiquitous in kind or intensity. Migrations are the ways people smooth out the peaks of per capita opportunity which differs from place to place (Abler et al., 1971: 197-198).

In effect, migration and perceived enhancement of economic well-being of migrants at some 'place' appear to be intertwined. The International Organization for Migration asserts that

Migration is considered one of the defining global issues of the early twenty-first century, as more and more people are on the move today than at any other point in human history. (IOM, 2010).

Not surprisingly, therefore, the unprecedented international migration has brought in its wake increasing flows of workers' remittances by migrants to their countries of origin (IOM, 2010). Thus, remittance flows are closely tied to international migration, which has been enhanced by globalization as well as economic liberalization policies, especially in developing countries (MOI, 2010; Maimbo & Ratha, 2005). Moreover, remittance has been found to be a more stable flow than other forms of funds such as portfolio and even FDI (Addison, 2004; Ratha, 2003). As noted previously, beyond development financing, such remittance funds continue to be critical in terms of providing economic sustenance for numerous families as well as savings towards the acquisition of real property such as houses and lands in migrant home countries (Amuedo-Dorantes & Pozo, 2006; Addison, 2004). Consequent to this has been the growing interest in this phenomenon among researchers (Addison, 2004), largely following the seminal work by Lucas and Stark (1985).

Research on remittances can be grouped broadly into (i) determinants of remittances and (ii) impacts /consequences of remittances in recipient economies. In

the latter group, efforts have emphasized remittance impacts on variables such as economic growth (Chami et al., 2008), poverty reduction (Mazzucato et al., 2008; Stark, 1985); and real exchange rates appreciation in receiving economies (Acosta et al., 2009; Faini, 1994), among others. Since these have been extensively discussed in the literature already but do not explicitly/directly treat the impact of remittances on urban land expansion, this work focuses mainly on building the conceptual framework based largely on the asset accumulation motive (Amuedo-Dorantes & Pozo, 2006); derived from the remittances determination theoretical literature.

Remittances Theoretical literature

Mainstream Theories

The mainstream remittances determination theoretical literature, for the most part, has concentrated on the motives behind remittances (Lucas & Stark, 1985). These theories generally recognize the following underlying motives of migrants – altruistic, implicit family contracts – loan repayments and insurance; and self-interests (Addison, 2004; Stark, 1991; Stark & Lucas, 1988). It has been noted, however, that majority of the remittances flow theories have bordered mainly on the altruistic and self-interest motives (Chami et al., 2008). The theories built on altruistic motive posit that migrants feel a moral obligation to help cater for their families they left in their home countries; as a result no ‘quid pro quo’ notion is involved (Addison, 2004; Stark, 1991; Lucas & Stark, 1988; 1985). Theories based on the altruistic motive dominated research efforts on remittances in earlier times (Addison, 2004). For example, Lucas and Stark (1985) have stated that

Certainly, the most obvious motive for remitting is pure altruism—the care of a migrant for those left behind. Indeed, this appears to be the single notion underlying much of the remittance literature. (p. 902).

This line of reasoning led Lucas and Stark (1985) to formulate a utility function of altruistically motivated remittances flow which included the consumption of the migrant's family members left at home. Stark and Lucas (1988) have argued further that altruism, apart from having merit on its own, aids self-interest motivations of migrants through a re-enforcement mechanism whereby recipients of remittances reciprocate by taking care of migrants' investments or supervising migrants' real assets such as housing and land (Chami et al., 2008).

Current theoretical frameworks give increasing consideration to the self-interest motives (Chami et al., 2008). With regard to self-interest motivated remittances flow theories (Chami et al., 2008), the main assertion is that remitters send money purely for self-interests such as investing in business or long-term projects (Lucas & Stark, 1985; Addison, 2004). For example, Lucas and Stark (1985) have noted that remittances are used to take care of the migrant's interests, be it business or some piece of real asset. In this regard families are used as agents who then are compensated by the migrants in monetary form as the recipients take care of migrants' interests (Lucas & Stark, 1985). In a similar vein, Hoddinott (1994) explains that migrants' families reward the migrants for high levels of remittances by ensuring that their shares of inheritance of family lands are increased. In effect, therefore, remittances serve as an indirect investment in real assets for the benefit of the migrant. This is corroborated by Amuedo-Dorantes and Pozo (2006) in their study of the behavior of Mexican migrants in the USA, but articulation of the asset accumulation motive in this case was more direct as opposed to the indirect approaches discussed earlier in the literature (Hoddinott, 1994; Lucas and Stark, 1985) prior to Amueodo-Dorantes and Pozo (2006).

From the foregoing, the general state of the theoretical literature on remittances, therefore, is that research efforts appear to fall under one of the categories above, with mutual exclusivity – an “either-or-situation”. This has been pointed out by Chami et al. (2008) thus: “But one point that the recent literature does not sufficiently acknowledge is that altruistic and exchange motivations can coexist” (p.23). Thus, Chami et al. (2008) have argued that both motives could co-exist, stating that

Indeed, a critical reading of the literature on the theory of remittance determination finds ample support for the idea that multiple motivations and intended uses for remittances can coexist. (p. 23).

This, in effect, would imply that a remitter could ask the recipients that part of the money be used by the family for their own needs and part be invested in some business or be used to purchase real assets for him/her (the migrant), in the origin country. It has generally been acknowledged that altruistic motive reinforces self-interest (or exchange) motive and these are not necessarily exclusive (Chami et al., 2008; Stark & Lucas, 1988). Thus, increasingly, current research efforts have been geared towards models that allow for the co-existence of both altruistic and self-interest motives. Following along these lines, Chami et al. (2008) specifies a remitter’s utility function as:

$$UE(cE, a, UH)$$

3-1

Where; cE = emigrant’s consumption, ‘ a ’ = action the recipient takes, and UH is the recipient’s utility (Chami et al., 2008: 24). In short, according to this utility function, a remitter’s utility (motivation to remit) is determined by his/her consumption, expected behavior (applying remittance funds as would be directed by the migrant) and the utility of the recipients. The model is described as “a generalized exchange view of the motivation to remit which has profound implications for empirical tests of remittance

determination” (Chami et al., 2008: 24). What is relevant to this dissertation research is the fact that it could be deduced from the review so far that migrants’ own consumption is recognized, implying that remittances are not necessarily only altruistic but increasingly becoming a mode of wealth accumulation in origin countries; be it in small businesses, housing construction or some combinations of these. These encouraging developments in the remittances determination theoretical literature provide the premise for the conceptual framework presented in this part of the dissertation research.

Figure 3-1 depicts a diagrammatic outline of the current state of remittances determination theoretical literature and where the conceptual framework advocated in this chapter fits into the overall theoretical framework. The striped box denotes that remittances impact, as treated in the mainstream remittances literature is not the main focus in Chapter 3 and in this dissertation in general. Thus, the conceptual framework presented here is based on the determination theoretical literature for the following reasons. Firstly, as noted above the remittance impact aspects have been discussed extensively elsewhere. Secondly, the research on remittances impact does not directly link remittances to land demand and consequent spatial expansion in cities. Finally, it should be noted that approaching the conceptualization of remittance-induced urban land expansion from the perspective of “asset accumulation” seems more coherent and easy to understand the link between remittances and demand for land in that acquisition of real assets such as housing construction directly impact land demand. Even if business establishment is the motive, it is not too difficult to see that this will employ people who would become “purchasing power enabled” to be able to express “effective” demand for housing and land.

The Asset Accumulation Motive of Remitters

Some authors have argued that the remittance determination research has focused mainly on the sender's behavior, largely neglecting the potential mitigation factors in the recipient economies such as "changing state policies and economic conditions in the home country" (Blue, 2004: 64). Thus, Blue (2004), has argued that "the changing economic conditions in the home country act as an important determinant for sending remittances". (p. 63). Building on the behavioral theoretical models advanced in Lucas and Stark (1985), Blue (2004) incorporates structural characteristics thereby shifting the focus of analysis onto the mitigating economic factors in the origin country of migrants. This paves the way for the inclusion of diverse factors such as state policies, gender, economic crisis, family ties, among other things (Blue, 2004). Along these lines Chami et al. (2008) identified nominal exchange rate, income gap (proxied by GDP per capita differential between remittance source and destination countries) and investment opportunities (indicated by interest rate differential between remittance source and destination countries) as important determinants/drivers of remittances flow (Not the main focus of this work, though). More important for this dissertation research, however, are the other works that have emphasized the notion of insurance under the self-interest motive (Amuedo-Dorantes & Pozo, 2006; Lucas & Stark, 1985). Amuedo-Dorantes and Pozo (2006) describe two forms of insurance, namely, family-provided insurance and self-insurance (Figure 3-1); arguing that remittances sent from USA to Mexico showed that remitters were partly motivated by asset accumulation as a form of self-insurance (Figure 3-1) whereby remitted moneys are used to purchase physical assets such as houses and plots of land. These authors attribute the self-insurance motive to risks in host countries of remitters whereby high

economic risks in the host country motivated increased remittances to the home country to purchase physical assets (Amuedo-Dorantes & Pozo, 2006). Whereas this attribution holds true to a large extent, it is also conceivable to reason that migrants do not necessarily have to experience or anticipate risks in their host countries in order to start acquiring real assets in their origin countries. For example, migrants who intend to return to their home country would likely want to remit for wealth accumulation for their own welfare. Consequently, in conceptualizing the relationship between remittances and urban land conversion in migrant origin countries, this study does not assume that migrants send money to their origin countries due to risks in their host countries per se.

Conceptualizing Remittances-Urban Spatial Expansion Relationship

Remittance is conceptualized as 'quasi' capital which may be used to fund business establishments or operations which could in turn fuel land demand. Additionally, a portion of remittances is used for building houses in origin countries of migrants (Amuedo-Dorantes & Pozo, 2006). In this latter sense, it is plausible to reason that remittances will generate rounds of economic activities through direct employment. For example, those previously unemployed or changed jobs for higher wages in construction related jobs become able to effectively demand housing and land. Combined, these activities will exert pressure on land demand resulting in conversion of new lands if the increasing demand for housing and land are not met through some form of densification (infilling, use of existing homes and structures and / or gentrification, in general). The specific aspects of the remittances –urban spatial expansion linkages are described below.

Figure 3-2 outlines the pathways through which remittances potentially impact the urban spatial / land expansion process. According to the wealth or asset accumulation

motive of remitters, part of remittances would be used to acquire real property in the origin country, including housing (Amuedo-Dorantes & Pozo, 2006). Conceptually, this results in *Land Demand 1* in Figure 3-2. Thus, Land Demand 1 is essentially for construction of homes which would in turn create jobs in the construction sector of the urban economy. It is also conceivable that part of the remittances would be invested in some businesses (Chami et al., 2008), adding jobs to the urban economy. Previously unemployed city residents and induced migrants will find work related to remittances, other things being equal. Having gained employment from remittances - related economic activities, these people become purchasing-power enabled, and are able to effectively demand housing and land. Part of the housing demand could be met through densification by way of gentrification into high-rise buildings, and use of existing homes. However, there is likely to be surplus demand which would fuel into *Land Demand 2*. Part of Land Demand 2 may be fulfilled by infilling but likely surplus demand would require construction of new homes on new lands, which in the absence of effective land use management, would often result in conversion of natural areas into urban uses usually in the peri-urban areas. Part of Land Demand 2 is also generated by remittances related businesses that require new lands. Back to Land Demand 1, part of the demand will be satisfied by infilling but more often than not there will be surplus demand for land for housing construction that will require new lands, which usually occur on /natural areas in the peri-urban areas of the primate cities in developing countries. It must be noted that there is a distinction between land demand for housing construction that fuel land demand through job creation which in turn enable people to gain purchasing power to demand “better” housing. (It should be noted that some of

these previously unemployed people may be living with friends and family members prior to becoming gainfully employed). Also, it is assumed that migrants would want to own homes in the “primate” city even if they own or plan on building one in their home town, as pertains to some degree, in Accra. One reason for this is the possibility of renting out such buildings as the city’s economy booms. Another reason may be the intention to eventually return home and entertain the hopes of finding employment in the “primate” city. (Of course, this is the hub of economic activities in the country). Also, it could be a source of pride for one to own a home in the capital city of the country. Finally, it should be noted that the broken lines and boxes in Figure 3-2 denote “no-impact” on urban land expansion. Or more specifically, they are processes that, if in operation, would work to mitigate the rate of new land conversion or the rate of loss of natural areas in the peri-urban area to urban uses.

To sum up, the main pathways through which remittances would impact urban spatial expansion are: (1) via direct demand for land for housing construction in the large/primate city; (2) via jobs boom in the building and construction sector. A related activity to migrant direct demand for land for house construction is the likely boost to the building and construction which offers employment to previously unemployed city residents as well as new migrants who “flock” into the city; and (3) via migrant investment in small businesses. Part of remittances may be used to fund small scale businesses which offer employment to people who can now express effective demand for housing and land. The combination of the 3 pathways would potentially fuel the demand for housing and land.

Summary

The advent of economic globalization has brought in its wake increased financial flows across geographic space, including remittances. Remittances have been particularly touted as one stable source of fund flow, usually not affected severely by economic downturns. However, its potential impact on urban biophysical environment through the fuelling of land demand is often masked. Chapter 3 has attempted to unravel the relationship between remittances and contemporary urban expansion, most probably in primate cities in developing countries. The chapter has presented a conceptual framework which clarifies the pathways through which remittances could potentially impact the urban land expansion process, if such funds are unevenly distributed across urban areas in a given country. The main pathways are: (i) migrants' demand for land for house construction; (ii) demand for housing by people employed in construction and related jobs relating to remittances ; and (iii) demand for housing by people employed in small businesses established with remittance funds. Thus, it seems that there are some linkages between remittance flows on the one hand, and urban land expansion process on the other, especially as pertains in many primate cities in developing countries. The increased demand for housing and land must be met through densification-gentrification into tall/apartment styled buildings, or use of existing vacant lands and buildings. Otherwise, new lands must be converted from agricultural and natural areas, usually in the peri-urban areas, given the general absence of effective land use planning. So far, based on the literature on Accra in Ghana, it appears that the urban planning process has failed to take advantage of gentrification, infilling and activities that may lead to densification. Consequently, it can be argued that increased remittance inflows to Ghana and considerable concentration in Accra may be

contributing to the rapid physical expansion of the city. As a result, holding other things constant, remittances overconcentration in 'primate' cities may be contributing to contemporary land expansion in these cities of the developing world.

The main contribution of Chapter 3, therefore, is the provision of the a systematic conceptual framework which has sought to unravel the links between remittances and contemporary urban spatial expansion, alluding to the notion of remittances induced urban spatial expansion, in both direct and indirect ways. Going forward, Chapter 3 (this chapter), together with chapter 2 have laid the conceptual foundations for theorizing externally-induced urban expansion, premised on the classical urban land use theory, formally espoused by Alonso (1964). Thus, having unraveled the pathways and systematically conceptualized the relationships between FDI and remittances on the one hand and urban land expansion on the other hand, the stage is set for the formal articulation of these emerging contemporary urban land conversion drivers into a relevant economic theory. In chapter 4, therefore, both FDI and remittances will be 'embedded' in the classical economic theory of urban land use, land value (Alonso, 1964); drawing extensively on current extensions which have derived the urban extent as a function of socioeconomic factors operating in the city (Angel et al., 2011; 2005; McGrath, 2005; Brueckner & Fansler, 1983).

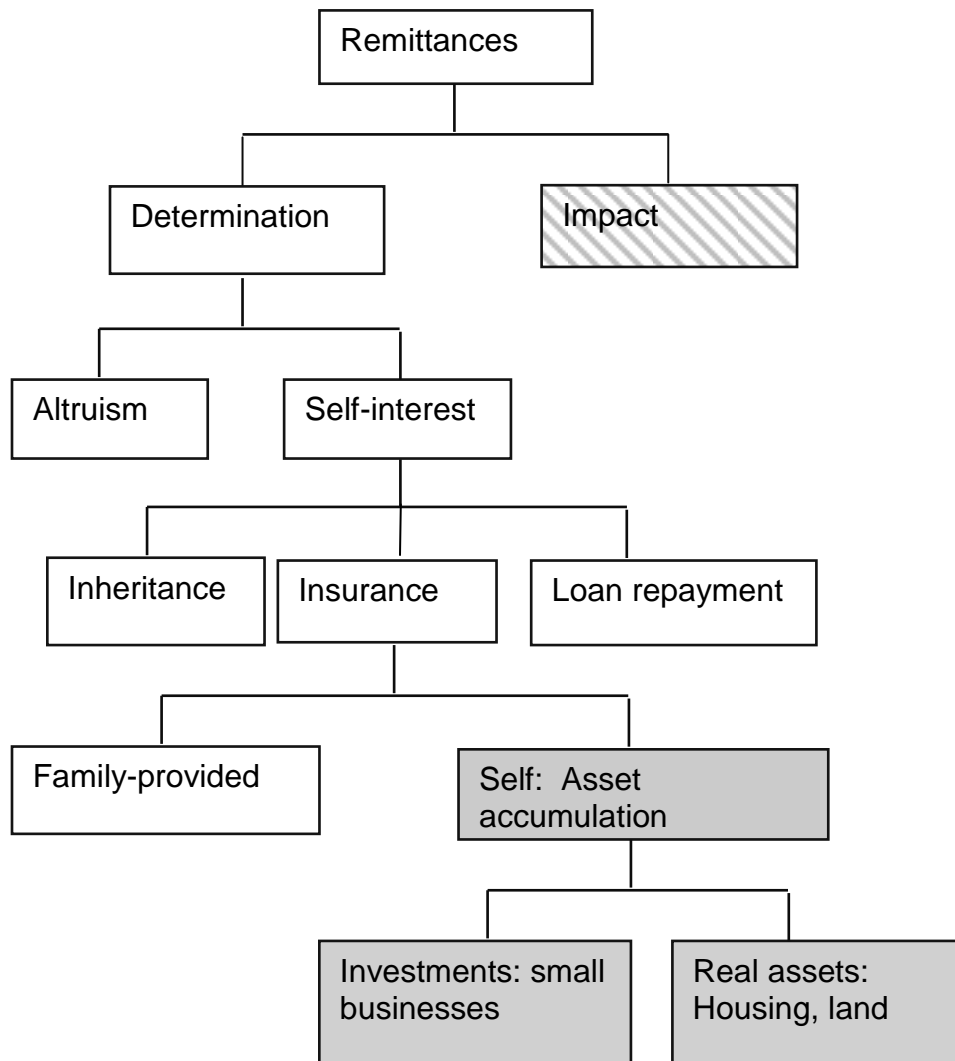


Figure 3-1. Outline of mainstream remittance determination theories. Source: Author's construct.

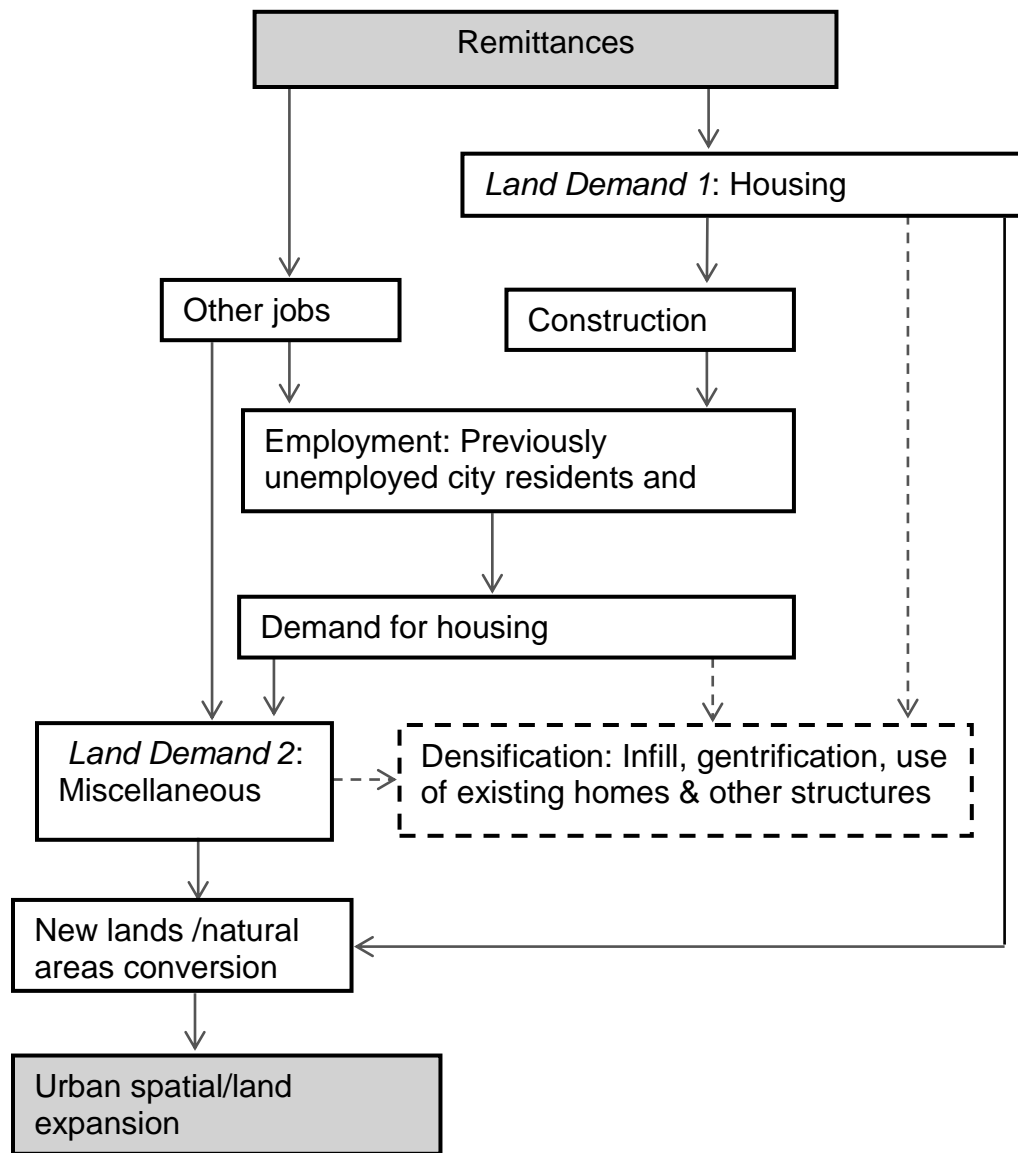


Figure 3-2. Pathways linking remittances to urban spatial expansion. Source: Author's construct.

CHAPTER 4 GLOBALIZATION AND ALONSO'S THEORY: OVERLOOKED FACTORS?

Background

The main objective in Chapter 4 is to attempt to extend the Alonso (1964) theoretical framework to facilitate the geographical analysis of contemporary urban spatial expansion as driven by FDI and remittances flows into urban spaces. The economic theory of urban spatial structure, formally formulated by Alonso (1964) has not been sufficiently refined to incorporate contemporary external economic forces. Thus, influences of the forces of economic globalization have not been systematically examined under this generally accepted standard economic theory of urban land use and land value. It is imperative, therefore, that this important economic theory of urban land use be refined to reflect current realities of economic globalization, to make it particularly suitable for explaining contemporary urban spatial expansion in developing country settings, where almost invariably such external funds become attracted by existing urban agglomerations in large or primate cities.

The twin forces of economic globalization and liberalization in developing countries have helped made their urban economies more open to global economic influences, exposing the urban biophysical environment to the vagaries of global economic forces as well. Thus, it is not too difficult to see that urban spatial change could be linked to forces external to the urban area and even outside the country (Chapter 2; Chapter 3). Global urban built up areas are growing at a very rapid pace such that even in some cities, the growth in the built area have outstripped the growth in population (Angel et al., 2011; 2005). For example, Angel and colleagues note that Accra, the capital of Ghana saw expansion in its built area from 13,000 hectares in 1985 to 33,000 hectares

in 2000, representing over 150 percent. During the same period, According to the authors, the population of the city increased from 1.8million to 2.7 million, representing about 50 percent increase (Angel et al. 2011). In contemporary urban spatial expansion analyses, such a dramatic increase in the urban extent normally is attributed to population increase for cities in developing countries and to GDP/GNP per capita growth for developed countries (Seto et al., 2011). Thus, the traditional suspects have, almost invariably, been population increase and growth rate of GDP per capita (Angel et al., 2011; 2005; Seto et al., 2011; McMillen & McDonald, 2010; McGrath, 2005; Brueckner & Fansler, 1983; Muth, 1969; Alonso, 1964). Even though consistent with the classical Alonso urban land use theory, the advent of economic globalization and attendant potent external economic forces, requires that new questions are raised with regard to the extent to which these “traditional” drivers are able to give adequate explanation for contemporary urban land expansion. This is of particular importance to land expansion in primate cities of developing countries, where more often than not, many primate city residents may not have the requisite purchasing power to effectively demand housing and/or land. For instance, in Accra many researchers agree that respectable, “quality” housing being put in the peri-urban areas is usually above the means of the ordinary Ghanaian living and earning incomes in the local economy (Moller-Jensen et al., 2005; Grant & Yankson, 2003; Yeboah, 2003; Konadu-Agyemang, 2001). Indeed, overall economic growth in some of the developing countries has lagged rapid urbanization and urban spatial expansion. It seems, therefore, that the rapid physical expansion of primate cities like Accra, characterized by “quality” residential sprawl (Yeboah, 2003), might have some connections with external

economic stimuli associated with intensification of economic globalization, fostered and enhanced by economic liberalization policies pursued in the 1980s (Grant & Yankson, 2003). Thus, it would be interesting to know whether the explanations based on these variables are adequate, given the current era of economic globalization whereby location and land use decisions could be driven by underlying global economic forces beyond the borders of a particular city or country. For example, demand for urban land and housing could be driven by increases in FDI and to some degree, remittances inflow into a country as migrants seek to own real assets in their home countries. Therefore, it is not gainsaying the fact that primate cities in developing countries are being “bombarded” by external economic forces of globalization as increasing spatial interconnectedness and close integration of economies have generated almost seamless flow of economic resources such as FDI and remittances across countries. Almost invariably for developing countries, these funds are often concentrated in “primate” cities such as Accra in Ghana, where disproportionate share of infrastructure and amenities are concentrated (Grant & Yankson, 2003). On average, it is estimated that between 75-85 percent of the FDI funds concentrate in the Greater Accra Region; with metropolitan Accra being the main center of economic activities (GIPC, 2001-2011). The disproportionate concentration of such funds in such a geographically restricted manner help fuel demand for land and housing, directly and indirectly; as firms locate in the urban space and can also induce people to move into the city as jobs are made available through FDI and remittances (Chapter 2; Chapter 4). Similar findings have been reported for other cities in developing countries (Seto, 2005). It appears, therefore, that some kind of externally induced expansion of large or a primate

city in developing countries is emerging with the advent of economic globalization. Some attributions have been made in this regard (Grant, 2009; 2001; Leichenko & O'Brien, 2008; 2000; Yeboah, 2003). For example, Richard Grant has noted that Accra has become an international city of some sort whose growth has been significantly impacted by global forces (Grant, 2009). To the dismay of Grant, however, it appears, most typical African cities, including Accra, are not conceptualized in the global context, arguing that Accra's growth dynamics must be placed in an international context:

Accra is very different city from the 'typical' African city conceptualized primarily in local and regional terms in the earlier nationalist era. This more internationally oriented city represents an incomprehensible city to government policy makers and others who fail to grasp the extent of the transformation, and who instead still situate Accra in national, national-regional, and local terms. (Grant, 2009: 3).

In essence, Accra has not been marginalized by globalization as other researchers have argued regarding African cities in general (Merwe, 2004). Thus, even though primate cities such as Accra are not by any means "global cities" by the criteria of researchers like Saskia Sassen (2006), most researchers would agree that they have not escaped the forces of economic globalization (Killick , 2010; Grant, 2009; Grant & Yankson, 2003; Yeboah, 2003). As a result, externally-induced urban growth may be emerging as a new phenomenon in the primate city of Accra in Ghana and might well be underway elsewhere in cities in other developing countries exhibiting similar characteristics. However, as noted by Grant (2009), this has not been appreciated generally.

All these developments support the notion that the classical land use theory cannot adequately account for current realities of economic globalization which impact urban land expansion. Questions have been raised about the suitability of the classical

land use model before (Batty, 2005) but usually these questions have bordered on the so called “unrealistic assumptions” of rational economic behavior and the static nature of the model (Aniya Masamu, 2010; Batty, 2005). The contention in Chapter 4, however, is in respect of the external economic influences which appear to be influencing contemporary urban land use and land expansion, particularly, in primate cities of developing countries. In particular, this study does not argue for the abandonment of the classical urban land use theory / model but seek to refine it to reflect current realities of economic globalization’s influences transmitted into the urban landscape which in turn impact the urban extent.

As noted from above, dissatisfaction with the classical economic theory of urban spatial structure (Alonso, 1964), however, is not new. In particular, the static nature and monocentric city assumptions do not sit well with many analysts, with some advocating the use of complexity theory as the most representative of the city growth dynamics (Aniya Masamu, 2010; Batty, 2005, for example). Laudable as these approaches have been in regard to helping increase our understanding of urban expansion modeling, explicit representation of space and time, they do not seem to represent external economic drivers of urban change adequately. Admittedly, there is a myriad of factors that affect urban growth, it is generally agreed that economic forces dominate (Pacione, 2009). Moreover, the complexity approaches when used to simulate urban expansion do not explicitly show how individual explanatory variables contribute to the expansion process. Furthermore, the transition rules seem to be based on some arbitrary decisions by the modeler, not necessarily based on any economic theoretical propositions as informed by socioeconomic processes. The implications of all these

would seem to suggest that completely abandoning the standard economic theory of urban spatial structure may not be the way to go with regard to enhancing our understanding of contemporary urban expansion dynamics. It is in this regard that this dissertation in general, and Chapter 4 in particular, advances the argument that to some extent Alonso's (1964) economic theory of urban spatial structure can still be reformulated to incorporate the influences of external economic forces on urban spaces, especially in developing countries which are characterized by urban "primacy", whose propositions can be tested by estimating regression equations (Angel et al., 2010; 2005). Coefficients of the estimated regressions can be input in a simple exponential model which can then be used to estimate the built up area of the city over time. Combined, these should be able to reasonably account for contemporary urban spatial expansion, especially in cities that receive disproportionately large amounts of the external funds inflow as pertains in primate cities of developing countries. Such an approach will be theoretically informed, dynamic, explicit representation of contributions of individual explanatory variables as well spatially explicit. This allometric based integrated urban spatial expansion model is formally articulated in Chapter 5 of this dissertation.

For now, Chapter 4 focuses on the first stage of "inserting" global economic forces into the classical economic theory of urban spatial structure, essentially building on current extensions of the model that derive the urban extent as a function of socioeconomic forces operating in the city (Angel et al., 2011; 2005; McGrath, 2005; Brueckner & Fansler, 1983). In this regard, the main questions motivating the analysis in Chapter 4 are: (1) what is the nature of the correlation, if any, between FDI and

remittances on the one hand, and urban built- up areas, on the other hand? And (2) in what ways can the classical Alonso urban land use theory be refined to accommodate remittances and FDI as urban land use value change drivers?

In seeking answers to the questions above, this study shares the view that most economic activities (be it globally or locally generated) can hardly be dissociated from the land or the biophysical system (Wackernagel, 2006; Sanderson et al., 2002; Constanza et al., 1997), even though Alonso might not have considered his work from this broader perspective.

Economic Theory and Urban Space: The Thunen-Alonso Theoretical Framework

Urban spatial change is essentially the physical manifestation of the aggregation of land use decisions made by individuals and authorities over time, as individuals and societies attach different values to lands depending on expected economic benefits. The classical explanation to spatial patterns and change, from the perspective of urban geographical research, has relied mainly on two important land use / land value theories/models which have been widely recognized among researchers (Cadwallader, 1996; 1985) – the agricultural land use theory, the classical one being Thunen's agricultural land use theory (Von Thunen, 1926; 1826) and urban land use theory with Alonso's (1964) bid-rent theory being the classical example. It is generally agreed that these two theories have informed much of the urban land use theorizing and modeling research efforts to the present and according to Cadwallader (1985; 1996), provide useful theoretical foundations for understanding urban land use and change dynamics. The key underlying assumption of rational economic behavior in which individuals are believed to maximize profits from their use of the land (von Thunen, 1926; 1826) or maximization of utility (Alonso, 1964; Muth, 1969) underlies these theories.

Von Thunen's Agricultural Land use Theory

Johann Heinrich von Thunen's (1826; 1926) classic land use theory provides a useful starting point for theorizing land use in general and urban land use in particular (Cadwallader, 1985: 24-50). The basic tenets of Thunen's agricultural land use theory is that transportation costs and accessibility exert overbearing influence on what type of use a piece of land will be put to, in order to obtain the maximum economic or location rent; hence putting the land to its best use. This theoretical framework resulted in concentric zone arrangement of agricultural land use around the market, centrally located in the agricultural plane. Basically,

The von Thunen model as it was first introduced and used in geography was largely descriptive. It was not until the quantitative revolution that researchers with the requisite mathematical and model-building background were able to examine the full range of geographic implications. This descriptive model was, in 1954, operationalized in the form of a mathematical model by E.S. Dunn, Jr. (1954). Dunn concurred with von Thunen's basic ideas when considering product type and location. He formalized the von Thunen model in a functional relationship expressed as: $R = E(p-a) - Efk$, Where R = rent per unit of land; E = yield per unit of land; p = market price per unit of commodity; a = production cost per unit of commodity; f = transport rate per unit of distance for each commodity; and k = distance from market. (Dunn, 1954, cited in Mabogunje, 1997)

Also, it has been noted that

Dunn's model, however, summarizes a one-product linear model in which a given lands use is capable of producing a net return up to that point where its marginal revenue and marginal costs are equal. He postulated receipts will be maximized at a site as close to the market as possible and will be minimized at that distance where marginal returns equal zero. (Mabogunje, 1997: 52).

The most important elements of this theorizing are the concepts of *economic /location rent, accessibility and maximization of profits* from the use of the land (Cadwallader, 1996; 1985), essentially implying that economic or location rent is a measure of the value of land in its best use.

One essential outcome of Von Thunen's land use theory, in spatial terms, is that land values declined with distance from a central location; in this case, the isolated market located centrally in the agricultural landscape (Figure 4-1), thereby representing a first serious pioneering effort aimed at theorizing land use and land values from a spatial perspective (Cadwallader, 1996; 1985).

Alonso's Theory and Extensions

The foregoing outline of the von Thunen theory/model, to a large extent, lays the foundation for analyzing distance-land value relationship in general. This motivated William Alonso (1964) to extend and formalize this theoretical framework in the urban context. Essentially, the complexities of urban landscapes do not make the explanation of their associated land use dynamics easily amenable to the simplified Thunen theoretical framework, implying there was the need to reformulate Thunen's theory in an urban setting. This was the basic rationale behind William Alonso's (1964) economic theory of urban spatial structure (Watkins, 2011; Reid, 2002; Mabogunje, 1997).

It is generally agreed that the standard urban spatial model is the mono-centric city model (McMillen & McDonald, 2011: 79; Alonso, 1964). Basically, Alonso (1964) theorized the existence of a center of economic activity in a city known as the Central Business District (CBD), equally accessible from all parts of the city. Three main urban uses are recognized – commercial, industrial and residential. He postulated a bidding process in the urban land market whereby the use to which a piece of land is put would be determined by its highest and best use - the land use or activity deemed to fetch highest economic return or value will command the highest price (McMillen & McDonald, 2010; Cadwallader, 1985; 1996; Alonso, 1964). Alonso further postulated that individuals seeking to use the land will behave rationally so as to maximize their

overall utility or satisfaction and in this case to *minimize transportation costs*. Again, *accessibility*, like Thunen's postulates, becomes a key determinant of land use arrangement in the Alonso theoretical framework. Consequently, concentric zones arrangement of land use patterns can be envisaged (Figure 4-2). Land use in more accessible areas such as close to the central business district (CBD) receives the highest bid for its use. Consequently, commercial land use (especially retail and professional offices) will be found close to the CBD (these "businesses" can afford higher rents), followed by industrial land use; with the outlying areas being occupied by residential land use with higher density first and lower density bordering the agricultural land/natural areas. Similar to Thunen's postulates and rightly so, the consequence, as per Alonso (1964), is the creation of *Bid-Rent Curves* (Figure 4-2). It is also important to note that Von Thunen's theory in a way alluded to the bid-rent curves concept in which land users offered or bid according to the economic value they would expect from a particular land use, given the price of the crop to be cultivated and distance from the market (Mabogunje, 1997; Cadwallader, 1996; 1985). Figure 4-2 depicts the bid rent curves and their associated spatial manifestation - concentric zones - derived from Alonso's theoretical postulates (Reid, 2002; Mabogunje, 1997). This simplified representation shows the close link between Thunen's agricultural land use theory/model and Alonso's theoretical framework, which is important for understanding the *distance/accessibility-land value/land use relationships*; thereby serving as a critical link between the economic theory of urban spatial structure and geographical analysis of urban land use. In this regard, it is imperative to emphasize that Alonso's theory relies strongly on the concepts of accessibility and transportation costs to analyze the

cost minimization behavior of individuals as they seek optimal locations for different urban economic activities. More succinctly, according to Mabogunje (1997):

The bid price function answers the question: As the individual considers residential locations at different locations in the city, i.e. at increasing distances from the city center, what price of land would allow her to buy sufficient amount of land (and other goods) to enjoy as much satisfaction as a given (starting) price (and amount of land) at the city center (Mabogunje, 1997: 50-52).

Based on current extensions, with particular reference to work of Shlomo Angel and colleagues (Angel et al., 2011; 2005), Alonso's theoretical framework and mathematical formulation is outlined as follows: House households denoted by (L) occupy land in concentric zones which surround the CBD. Households, who have similar preferences, have at least one member who travels a distance of (x) to the CBD to work in order to earn (y) income annually, paying (t) as annual cost per unit of travel to work, with the annual commuting cost totaling $t \cdot x$. It is further postulated that households budget their income such that quantity of housing (q) , total commuting cost $(t \cdot x)$ and composite good (c) , (assumed to be the same throughout the city), exhaust the incomes. Further, housing price (p) would vary with distance from the CBD. Household's preferences for both housing and composite good (c) can be represented by a utility function $v(c, q)$ which is quasi-concave (Angel et al., 2011; 2005). The equilibrium condition of city residents requires that all households are settled and that a household at any location attains a common utility level (u) , inside the city. If households are assumed to be rationale and will operate on the highest indifference curve, choosing a combination of affordable housing (given income constraint) and the composite good that will maximize their utility, the equilibrium can be represented as in (Angel et al., 2011; 2005):

$$\max_q v(y - t \cdot x - q \cdot p(x), q) = u$$

4-1

Partial differentiation of Equation 4-1: change in price and quantity with respect to distance from the CBD can be derived as in the Inequalities 4-2.

$$\frac{\partial p}{\partial x} < 0 \text{ and } \frac{\partial q}{\partial x} > 0$$

4.2

The Inequalities 4-2 posit that price of land (or cost of housing) declines as one moved outward from the CBD but quantity of housing increased as the price of land declines with distance from the CBD.

On the housing supply side, again based on Angel et al. (2011; 2005) producers combine capital (N) and land (l), operating with the production function $H(N, l)$ which is concave (i.e. housing production obeys the law of diminishing marginal returns of capital and land) and exhibits constant returns to scale. If producers compete in a perfect market, with free entry and exit, an equilibrium land rent function $r(x)$ and capital-land ratio $S(x)$ - floor-area ratio, or building density - can be derived. This equilibrium is dependent on distance from the CBD. Taking partial derivatives of land rent and the capital-land ratio with respect to distance from the CBD will yield the Inequalities 4-3 which imply that both land rent and capital land – ratio (otherwise denoted by building density) decrease as distance increased from the CBD (Angel et al., 2011; 2005).

$$\frac{\partial r(x)}{\partial x} < 0 \text{ and } \frac{\partial S(x)}{\partial x} < 0$$

4-3

A related issue is the city's population density. If population density at a distance (x) from the CBD is denoted by $D(x)$ and it is assumed that a household has only one member, population density declines as one moved from the CBD, away from the city center since houses would become larger (perhaps due to changing taste?) and building density also decrease as shown in Inequality 4-4, as per Angel et al. (2011: 42-46).

$$\frac{\partial D}{\partial x} < 0$$

4-4

Alonso's theory also postulates that housing producers will compete with farmers for the use of peri-urban land. Once housing producers outbid farmers, the peri-urban land will be converted from agricultural use to urban uses, most probably to residential use. (It must be noted that land on the peri-urban areas may not be necessarily in agricultural use per se; it could be natural area or lying fallow). A major question is: what happens in the absence of viable agricultural uses for peri-urban lands? It is not too difficult to envision an unbridled city expansion, driven mainly by demand for land for urban uses, such as Accra seems to be experiencing in recent times.

Representing the distance to the outer boundary of the city (radius) by \bar{x} and denoting agricultural rent in the peri-urban area by (r_a); and given that

$$\frac{\partial r(x)}{\partial x} < 0$$

4-5

it can be deduced that $r(x) > r_a$; within the city's boundary and that $r(x) < r_a$ outside the city boundary, yielding the equilibrium condition:

$$r(\bar{x}, y, t, u) = r_a.$$

4-6

Thus, a circle with radius \bar{x} (urban-rural interface) is created within which the city's population, denoted by (L), should be accommodated (or housed or settled) at equilibrium. If (θ) is an exogenous variable denoting the share of land available for building in a ring x distance away from the CBD, the equilibrium can be derived as (Angel et al., 2011):

$$\int_0^{\bar{x}} 2\pi \cdot \theta \cdot x \cdot D(x, t, y, u) dx = L$$

4-7

Thus, according to Shlomo Angel and colleagues:

The classical theory thus provides an endogenous solution for the extent of the area that a city occupies, $A = 2\pi\theta\bar{x}$, given its population L, the income of that population y , the cost of transport t , the share of buildable land θ , and the agricultural rent on the urban periphery r_a . (Angel et al., 2011: 40).

Resolving, the equilibrium Equation 4-7 results in several testable propositions as presented in Angel et al. (2011):

$$\frac{\partial \bar{x}}{\partial r_a} < 0, \quad \frac{\partial \bar{x}}{\partial t} < 0, \quad \frac{\partial \bar{x}}{\partial \theta} < 0, \quad \frac{\partial \bar{x}}{\partial L} > 0, \quad \frac{\partial \bar{x}}{\partial y} > 0, \text{ and}$$

$$\frac{\partial S}{\partial L} > 0 \text{ and } \frac{\partial D}{\partial L} > 0.$$

4-8

To sum up, according to the authors, increasing levels of agricultural rent, transport cost and share of buildable area will tend to decrease the radius of the city (reduce size of the built up area). However, increasing levels of the city's population and income of residents will lead to increasing radius (expanding built up area). Consequently, Angel and colleagues assert that

More generally, it follows that the total area of the city A , will decrease if the agricultural rent, " r_a " increases, if the transport cost t increases, and if the share of buildable land θ increases, and will increase if the city population (L) increases and the income y of that population increases. (Angel et al., 2011: 41).

This is a profound conclusion which is one of the underpinning pillars of this dissertation in that we can now formally derive the urban extent from the economic theory of urban spatial structure (Angel et al., 2011; 2005; McGrath, 2005; Brueckner & Fansler, 1983); and that *one can analyze the dynamics of the urban extent as a function of economic factors operating in the city*. Essentially, it implies the analysis in this dissertation can focus on the shifting boundary (extending radius) of the city and examine the responsiveness of the urban extent (built up area of the city) to changes in underlying economic forces; specifically for this dissertation research, as induced by external economic forces of globalization in the form of FDI and remittances flows.

Alonso's Theory under Globalization: Initial Propositions

Two important results of Alonso's classical theory of urban spatial structure which have been confirmed by numerous researchers are "population" and "income" as explanatory variables (Angel et al., 2011; Seto et al., 2011; McMillen & McDonald, 2010; McGrath, 2005; Brueckner & Fansler, 1983). In a meta-analysis of over 300 studies, Karen Seto and colleagues concluded that GDP per capita did influence urban land expansion in developed or advanced countries but for developing countries, population

increase was found to be the main driver of urban land expansion in contemporary times (Seto et al., 2011). In a nutshell, conventional urban spatial/land expansion studies continue to “arrest” the “traditional” variables (the usual suspects) for urban land expansion. However, the advent of economic globalization appears to have made it imperative that a closer look is taken at the apparent significance of these ‘traditional’ variables’ impact on the urban land expansion process, especially as pertains in large/primate cities of developing countries. Thus, in the era of increased interdependence of economies, unrestricted flow of funds and recognition of property rights by individuals, several issues need to be examined in respect of contemporary urban land expansion; especially with respect to primate cities in developing countries. So how does the city, in ‘equilibrium’, accommodate external economic shocks in the form of FDI and remittances inflows, for example?

This dissertation research introduces the concept of “FDI-Remittances purchasing power enabled population” (PPEP), which is described in this work simply as *the proportion of people resident in a city who were previously unemployed but find jobs resulting from FDI and remittances related economic activities as well as those induced to move into the city by the existence of FDI and remittances related jobs*. The plausibility of FDI-Remittance purchasing power enabled population is articulated as follows: FDI has a tendency to flow into existing agglomerations, especially so with manufacturing and services FDI (Chapter 2). Implications of this tendency are: drawing of population into the economic enclave of jobs; previously unemployed city residents get employed, and become enabled to express “effective” demand for housing, which eventually may cause demand for land to increase (Chapter 2); direct demand for land

for FDI firm operations and expatriate housing demand. Similarly, remittances inflow into a country may be unequally distributed from a geographical perspective, usually in favor of the “primate” city in a developing country setting. If a substantial portion of such remittances is over concentrated in a single large/primate city, the real estate (building and construction) sector of the city receives a boost which would lead to increased demand for land (Chapter 3). Furthermore, jobs created in the building and construction sector as a result of the remittance-induced demand for land employ people who then can express “effective” demand for housing, which if not accommodated through densification, will result in demand for new lands, as has been explained in Chapter 3 of this dissertation research. Consequently, the combined effects of FDI and remittances may reflect in direct and indirect demand for land for urban uses, via population and / or income. As detailed in Chapters 2 and Chapter 3, the unequal geographical distribution of external funds inflow in favor of the primate city in a country would potentially impact population (through induced migration) and incomes of city residents. It does appear, therefore, that inflows of external funds in the form of FDI and remittances could induce expansion in the built up area of the city. However, neither FDI nor remittances have been formally considered as important explanatory variables in the analyses of contemporary urban expansion, with the exception of Seto (2005), for the case of FDI. Chapter 4 seeks to “insert” FDI and remittances (denoted as “F” and “R” in the formulations) into Alonso’s classical economic theory of urban spatial structure without loss of generality and importance. It must be noted from the outset that such “refined” Alonso theoretical framework will be more relevant and potentially applicable to cities in

developing countries that exhibit “primacy” with the tendency to attract disproportionately large amounts of external funds in the form of FDI and remittances.

On Income

Let y = income of city residents who are currently employed (before the advent of FDI and remittances inflow - this is what is usually denoted by GDP per capita in most analyses). Previously unemployed city residents may find jobs in the advent of FDI and remittances. These people can be said to have become “purchasing power enabled” who can now express “effective” demand for housing and / or land. Let y_F = previously unemployed city residents and induced migrants who find work in FDI related jobs and are earning incomes. Let y_R = previously unemployed city residents and induced population who find work in remittance- related jobs and are earning incomes. (Both y_F and y_R include part of expatriate incomes spent in the city). Thus, total income of city dwellers receiving FDI and remittances, denoted by (y_T) can be expressed as:

$$y_T = y + y_F + y_R$$

4-9

On Population

Let L = population of the city before FDI and remittances (as defined in Equation 4-7). FDI and remittances inflows will be associated with movement of population into the city who are in search of jobs (note that this is not the typical rural – urban migration, who may not be skilled) as well as expatriates (Chapter 2; Chapter 4). Let this “induced” population be denoted by L_F and L_R for FDI-induced population and Remittances-induced population, respectively. Thus, in the wake of increasing flows of

FDI and remittances, the total population of the city, denoted by (L_T) changes and can be expressed as:

$$L_T = L + L_F + L_R$$

4-10

Thus, total city population consists of residents (L) before FDI and remittances and induced population (migrants) – L_F and L_R , respectively; following FDI and remittances inflows into the country and city. Holding prices constant for now and assuming that the bulk of demand for housing will be high end, quality housing (by virtue of the possibility that these people who find jobs related to FDI and remittances are relatively higher skilled workers than the average rural-urban migrant); which are usually new houses found in the peri-urban areas of the city (barring any appreciable densification and use of existing vacant houses and land). Logically, the city expands to accommodate the new population who are “purchasing power enabled”, with effective demand for housing and consequently increased demand for land, resulting in new land conversion (assuming little or no densification). It is assumed, for the purposes of the arguments in this dissertation, that buildable land is available if there is effective demand (land market in most of the developing countries in Africa is complex; overseen by chiefs, elders and families, with some market reforms underway but these are unlike the situation in more advanced economies). Also, agriculture is not considered a viable economic activity at the periphery of the ‘globalizing’ city since land in urban use commands high economic value (implying that land owners holding land in agricultural use in the peri-urban areas would incur higher opportunity cost, as Dean Hanink has asserted: “Most urban land uses, including housing development, have higher present values on land near

population centers than do agricultural uses or other rural ones” (Hanink, 1997: 128-129). In short, it is assumed that urban developers who find it profitable to build houses will find land within their budget. Consequently, demand for housing in the wake of increased FDI and remittances inflows into the urban space economy will most likely be translated into demand for new lands in the peri-urban areas of the city. Consequently, the boundary of the city shifts outwards (radius lengthens). This implies that the equilibrium condition: $[r(\bar{x},y,t,u) = r_a]$; may no longer be tenable and necessary; and may change to the inequality below, at least in the short to medium term:

$$r(\bar{x},y,y_F,y_R,t,u_{F,R},u) > r_a$$

4.11

Where; $u_{F,R}$ = the utility of newly employed city residents, induced migrants as well as expatriates. Definitions for the rest of the variables remain the same as previously. Note that so far no fundamental change has been effected to the Alonso theory: only that FDI and remittances have been “inserted” into the original equation as espoused in Angel et al. (2011). Also, note that in addition to the original income “y” of city residents, who were gainfully employed before inflow of external funds (FDI and remittances), it is now possible to include people who are employed in FDI and remittances related jobs in the advent of these external funds. These *FDI-remittances related purchasing power enabled city residents* will add to the original demand for housing thereby increasing total demand for housing and land, as they seek to maximize their utility ($u_{F,R}$). Since urban rent is likely to increase, housing producers will find incentive enough to build more houses. The city may expand until a new zone of low agricultural rent is reached

(note that expansion at the periphery will cause urban rent to reduce). Eventually, equilibrium will be re-established, spatially, far into the surrounding natural areas. This equilibrium is demand driven and is subject to change as soon as there is a new “wave” of urban land demand, especially as induced by FDI and remittances inflows. Consequently, the radius \bar{x} is in “constant” motion as economic globalization drives ‘dynamic’ equilibria of land rents in the peri-urban areas of the city. Density reduces as in the original classical model. As a result, the city population – urban land demand equilibrium (Equation 4-7) can be modified as in Equation 4-12.

$$\int_0^{\bar{x}} 2\pi x \cdot D(x, t, y; y_F, y_R, u_{F,R}, u) dx = L_T (= L + L_F + L_R) \quad 4-12$$

It is important to emphasize that the the city receiving large amounts of FDI and remittances should accommodate the “new” total city population (L_T) within the city limits: $A = 2\pi\bar{x}$. Fortunately or unfortunately, land supply in the city is not constrained by availability of buildable land since it has been assumed that in a globalizing primate city located in a developing country land will be made available for development into urban uses as long as there is effective demand.

“New” Globalization-Related Theoretical Propositions

Resolving the equilibrium Equation 4.12, concentrating on impact of FDI and remittances, will yield the Inequalit (propositions) (after Angel et al., 2011):

Proposition 1: FDI lengthens the radius of the city

$$\partial \bar{x} / \partial y_F > 0$$

4-13

Proposition 2: Remittances lengthens the city's radius

$$\partial \bar{x} / \partial y_R > 0$$

4-14

Proposition 3: FDI induces population migration; lengthens the city's radius

$$\partial \bar{x} / \partial L_F > 0$$

4-15

Proposition 4: Remittances induce population; lengthens the city's radius.

$$\partial \bar{x} / \partial L_R > 0$$

4-16

Assumptions: (a) Substantial portion of both FDI and remittances must be geographically concentrated in the country's largest/primate city, (b) Densification through infilling, gentrification, use of existing structures and homes must be minimal such that the bulk of FDI and remittances induced housing demand would be supplied through construction of new homes on new lands at the peri-urban interface; (c) Agricultural land uses at the peri-urban interface are not economically feasible (low agricultural rent), enough to compete with bids of urban housing producers; (d) Lengthening radius of the city is equivalent to increasing increasing urban extent; (e) Supply of developable land is not constrained. In essence, it is demand-driven in that when demand for housing is generated through FDI and remittances inflow, housing producers will find it economically viable to build more houses. (Note that the

developable land can be bought cheaply at the peri-urban interface because potential agricultural land use market is virtually non-existent).

The situation of agricultural land market at the peri-urban interface in many primate cities of developing countries, including Accra in Ghana is akin to what Dean Hanink (1997) has put it

Any one holding land in agriculture (or any other use) that could earn higher returns if used in a different way is incurring opportunity costs. They are effectively losing money even if their farming operations are profitable (p.129).

Left to market forces then, urban land expansion continues unabated as housing demand is constantly fuelled by induced processes via FDI and remittances. This is the link between economic globalization and contemporary land expansion in “primate” cities in developing countries. For example, in Accra, like all other lands in Ghana, lands are held by chiefs, elders and family heads in trust and are not deemed to be sold. However, if any chief considers the sale of lands as contributing to the development of their areas, arrangements are made for the transfer of the lands to private developers. The point here is that more often than not, individuals are not key players and in many cases the livelihoods of the current users of the land have been compromised without warning. In view of this I don’t see how agricultural land use can compete with urban land uses in the peripheral areas of cities such as Accra in Ghana. Consequently, FDI inflow can influence demand for land in a more direct manner. It would not be too far-fetched to consider remittances as another external “stimulus” that could drive urban land expansion, should the remittance funds be geographically restricted in distribution in favor of the primate city. Given the foregoing, it is not too difficult to see the imprints of economic globalization in the urban built landscapes of

“primate” cities in developing countries with characteristic overconcentration of external funds (GIPC, various years). Such funds inflows, if not geographically diversified, will increase the pressure on demand for housing and land in the urban area. It is argued that this may help explain the contemporary physical expansion of Accra, Ghana’s capital city and other “primate” cities in developing countries elsewhere who have been relatively successful at attracting FDI and increasing levels of remittances but have failed to geographically diversify the inflows into other cities/towns.

From the discussion so far, it can be said that even though Alonso’s theory does not explicitly derive the urban extent, recent formulations have been able to derive the urban extent as a function of the classical determinants - population growth, income growth, distance from the CBD, urban land rent, agricultural land rent, and consumer’s utility (Angel et al., 2011; 2005; McMillen & McDonald, 2010; McGrath, 2005); with population and income being consistently identified as most significant. But these extensions have still largely neglected the external economic dimensions, especially, economic drivers of globalization (including neoliberal economic reforms) and associated increasing international remittances which is now believed to be influencing contemporary urban spatial expansion in cities such as Accra. This underscores the importance of the main motivation in Chapter 4 of this dissertation research, which attempts to refine the Alonso theoretical framework to reflect current realities of economic globalization; which will likely impact positively on our understanding of how globalization-related economic forces impact the urban extent.

Consequently, analyses in Chapter 2 and Chapter 3 as well as discussion so far in Chapter 4 lay the foundations for systematically interrogating the plausibility of

externally induced contemporary land expansion. This paves the way for preliminary empirical testing of the propositions derived in Inequalities 4-13, 4-14, 4-15 and 4-16 which could potentially add to our understanding of the emerging phenomenon of externally/globally induced urban land expansion as economic globalization relentlessly “bombards” primate cities in the developing world; and could have practical implications for urban planners. Consequently, the next section presents an empirical example, attempting to put the “*new*” *globalization related urban land expansion propositions* to test, as “embedded” in the Thunen-Alonso theoretical framework.

Towards Globally-Induced Urban Spatial Expansion Analysis: An Empirical Example

Even though the classical economic theory of urban land use / land value has been criticized from many quarters (Aniya Masamu, 2010; Batty, 2005), this study shares in the believe that the Thunen-Alonso land use theoretical framework still offers as yet the most theoretically simple and ‘elegant’ framework for urban land expansion analysis (Angel et al., 2011; McMillen & McDonald, 2010; McGrath, 2005; Brueckner, 1987; Brueckner & Fansler, 1983) which can be improved upon to reflect current realities of economic globalization as has been attempted. Furthermore, the outcome of the regression estimates can be further implemented in an urban land expansion estimation model / method in order to ‘cumulate’ the expansion process over time for particular cities, formally articulated in Chapter 5.

Data

Data for the empirical analysis of this study have been obtained from several reliable and authoritative sources. Built up area data were sourced from the Lincoln Institute for Land Policy, Atlas of Urban Expansion (2010). Within this database is

found a sample of 120 cities with built up areas pre-selected by Shlomo Angel and his associates; located at (<http://www.lincolnst.edu/subcenters/atlas-urban-expansion/urban-national-data-tables.aspx>). This study took advantage of this and used this sample for our analysis. (Full documentation on the sample of 120 cities and related data as well as the underlying rationale for the sample selection is presented in Appendix A). For this dissertation research, 13 cities were removed from the original list of 120 due to unavailability of FDI and remittances data for some countries in the sample. Also, some countries experienced net negative flow of remittances and / or FDI, rendering the data relating to such countries unusable for log transformation implemented in the regression analysis. Consequently, a total of 107 cities were included in the regression estimation presented in this chapter. Data on annual FDI inflows (net) in US\$, gross domestic product (GDP) per capita and remittances inflows (net) were gathered from United Nations databases (UN, 2011), available at: <http://data.un.org>. (Detailed documentation for the dataset has been provided in Appendix A).

Method

Regression Models of urban structure and expansion have mostly implemented local factors as explanatory variables (Angel et al., 2011; 2005; McMillen & McDonald, 2010; McGrath, 2005, among others). These have generally included population and income changes, GDP per capita growth rates, geographic and topographic factors, transport costs, distance from the center of the city and in recent times, air links (Angel et al., 2005); and FDI (Seto, 2005). However, consistently, the most important urban land use change drivers have been identified as population and income, which have

been found to be highly statistically significant in the regression models estimated. Most recent studies buttressing this assertion are (Angel et al., 2011; 2005; Seto et al., 2011).

Regression analysis has been found to be amenable to urban land expansion modeling as exemplified in studies such as Angel et al. (2011; 2005); McMillen and McDonald (2010) and McGrath (2005), Braimoh and Onishi (2007); for example. According to Rogerson (2005), regression analysis refers to a more complete process of studying causal relationship between a dependent variable and a set of independent, explanatory variables. Relating to land use analysis, Millington et al. (2007) have stated that

Regression analysis is used to improve explanation of the mechanisms and processes of change (by examining the statistical significance of the influence of the predictor variable upon the dependent variable) and / or (ii) prediction of change itself (derived relationships may be used to project future land-use/cover from the current values of the independent variable) (Millington et al., 2007: 564).

The choice of regression analysis in this dissertation research, therefore, is well founded and grounded in the literature. In a specific study, including Accra in the sample of cities, Shlomo Angel and colleagues concluded that: “Multiple regression models were able to explain 93 to 95 percent of the variations in urban land cover among countries” (Angel et al., 2011: 45), a further testimony to the usefulness of regression in land expansion analysis.

It is important to note that this dissertation research does not divide the study area into discrete units as has been the approach in most land cover change modeling (Millington et al., 2007). Cross-sectional multiple regression models have been constructed using urban built up area in individual cities in the sample of 107 cities. Thus, in all models the dependent (respondent) variable is city built up area in 2000 or a

close year, denoted by “land cover” in the models. The independent variables include city population in 2000, GDP per capita in 1999, net foreign direct investments inflow into countries in 1999, and Workers remittances inflow into countries in 1999. These variables are denoted by “CityPOP₂₀₀₀”, “GDP₁₉₉₉”, “FDI₁₉₉₉”, and “REMIT₁₉₉₉”, respectively. It must be noted that the built up area of the city in 2000 (Built₂₀₀₀) remains the response variable in all equations (even though some cities may have their built up areas derived in some other year close to 2000). All the variables are log transformed using ordinary logarithm (Log₁₀).

Log transformation is generally undertaken to attempt to achieve objectives such as ensuring linearity as well as normality of the dataset (Chatterjee & Hadi, 2006: 151-174). Moreover, it could help remove problems of heteroscedasticity (Chatterjee & Hadi, 2006: 168). GDP per capita, FDI and remittances inflows have been lagged for one year, hence the use of 1999 figures as opposed to 2000. The rationale underlying the “lagging” is simply an attempt to capture the notion that changes in the independent variables are not likely to produce change in the response variable instantaneously. For example, it seems rational to expect that increased levels of FDI inflow in a given year may not necessarily effect change in built up area in the same year. However, the city population variable has not been lagged due to data unavailability to cover all members of the sample of countries for 1999. Once all the model variables have been log transformed, the Ordinary Least Squares (OLS) is applied to estimate the equations formulated. All the assumptions of the classical OLS method, which may be found in standard statistics texts apply (Chatterjee & Hadi, 2006; Rogerson, 2005; Burt & Barber,

1996; Agresti & Finley, 1994, for example). The regression models estimation were implemented in the SPSS software (2010).

Urban built-up area expansion regression models.

The basic models (structural equations) are presented below to aid comprehension.

$$\log\text{Built}_{2000} = \alpha + \beta_1(\log\text{CityPOP}_{2000}) + \beta_2(\log\text{GDP}_{1999}) + \varepsilon$$

4-17

Where; α is a constant, β_1 and β_2 are estimable parameters and ε is the error term. All the variables have been defined above. Equation 4-17 attempts to capture the extent to which the “traditional” variables of population and income impact urban land use and spatial structure (Alonso, 1964); specifically, their impact on changes in the urban extent (Angel et al., 2011). It is hypothesized that city population and GDP per capita are positively correlated with built up area of the city, implying that increases in population and per capita GDP will correspond to increase in built up area of the city, all things being equal. Readers are reminded that this is equivalent to the “traditional” variables, which are not the main focus of this analysis but brought in to help build the case for our “new” externally induced economic variables – FDI and remittances. Thus, since the main focus of this study is to explore the external economic influences on the urban extent, we implement a second model.

$$\log\text{Built}_{2000} = \alpha + \beta_1(\log\text{CityPOP}_{2000}) + \beta_2(\log\text{GDP}_{1999}) + \beta_3(\log\text{FDI}_{1999}) + \beta_4(\log\text{REMIT}_{1999}) + \varepsilon$$

4-18

Where; β_3 and β_4 are estimable parameters and all variables remain as described above. Equation 4-18 postulates that in addition to the “traditional” variables of

population and income growth, the city which is linked to the global economy is now receiving global impulses in the form of FDI and Remittances. Since these variables have the tendency to affect land demand in the city through housing demand and demand for other built infrastructure, it seems rational to expect that they would impact the urban extent. Specifically, in Equation 4-18, it is hypothesized that part of the increase in the extent of the built up area of the city in the current year may have been as a result, in part, of increasing levels of FDI and remittances flows into the city in the previous year. It is expected that increasing levels of FDI and remittances in a previous year would correspond to an increase in the extent of the built up area of the city in the current year; and that co-efficients would be statistically significant at the 95 percent confidence level.

In addition to the foregoing it seems rational to try to isolate the two globalization-related economic variables, namely, FDI and remittances, in order to examine their potential effect when population and income are excluded from the model (s). This is approached in two steps. Firstly, the combined effect of FDI and remittance on the built-up area of the city is modeled as in Equation 4-19:

$$\log\text{Built}_{2000} = \alpha + \beta_1(\log\text{FDI}_{1999}) + \beta_2(\log\text{REMIT}_{1999}) + \varepsilon$$

4-19

All variables remain as defined above. Equation 4-19 states that built up area in 2000 is positively correlated with FDI and remittances inflow in 1999;

Secondly, the potential impact of FDI and remittances, separately, are modeled in Equation 4-20 and Equation 4-21), respectively.

$$\log\text{Built}_{2000} = \alpha + \beta_1(\log\text{REMIT}_{1999}) + \varepsilon$$

Equation 4-20 posits that remittances inflow and built up area are positively correlated, increasing remittances inflow corresponds to expanding built up area.

$$\log\text{Built}_{2000} = \alpha + \beta_1(\log\text{FDI}_{1999}) + \varepsilon$$

According to Equation 4-21, built up area and FDI are positively correlated, implying that increasing levels of FDI should induce corresponding increase in the built up area.

Regression Estimation Results

The results of the estimation of the urban expansion regression models formulated in Equation 4-17 through to Equation 4-21 are presented below.

For Equation 4-17, the Adjusted R^2 is .793 implying that this model explains 79 percent of the variation in the urban built land cover of cities in 2000 (Table 4-1). Overall model fit is quite good with F value of about 201 and significant at the 95 percent confidence level (.000). Regarding individual explanatory variables, the coefficient of .779 obtained for city population implies that a 1 percent increase in city population corresponded to about .78 percent increase in urban land cover (built up area); 10 percent increase in city population corresponded to about 7.8 percent increase in the built up area of the average city. These results closely resonate with the results obtained by Angel et al. (2011), which also confirms the theoretical and empirical importance of the 'traditional' variables of population and income in explaining urban spatial structure (Angel et al., 2011; McMillen & McDonald, 2010; McGrath, 2005; Brueckner & Fansler, 1983; Alonso, 1964) and urban expansion. In particular, Angel et al. (2011) have extended the original theoretical model and estimation to cover a global universe of over 3000 cities (Angel et al., 2011; 2005) which have included both

developed countries and developing countries, and the two so called 'traditional' explanatory variables have been found to be robust and highly significant. To an extent, therefore, this can be described as a timely attempt to "globalize" the classical economic theoretical model of urban spatial structure (Alonso, 1964) to reflect current world realities of globalization, but still leaves out FDI and remittances as important economic forces driving urban expansion. The work presented in this chapter of the dissertation research draws extensively on this timely effort. However, it is important to reiterate that the main focus in this dissertation in general, is not on the "important" traditional variables (population and income) per se, but on emerging variables closely associated with economic globalization as they impact the urban spatial expansion.

Generally, the Adjusted R^2 increased from .793 in the previous results (Table 4-1) to .820 (Table 4-2). This implies that the model explains 82 percent of the variation in urban land cover compared to 79 percent explained by the previous model which included only city population in 2000 and country GDP per capita in 1999 as independent variables. In terms of the co-efficients, population and GDP remained positive. Regarding the 'new' variables, results show that 10 percent increase in FDI inflow would result in increase of about 1percent (0.087) in the built up area of the city. In contrast, the results indicate a negative relationship between built up area and remittance inflows. Specifically, 10 percent increase in remittances inflow would lead to about 1.5 percent decrease in the built up area of the city. This is a surprising result given the fact that anecdotal evidence for Accra indicates that about 20 percent of remittances inflow to Ghana found its way into the real estate market of Accra (Tipple et al., 1998) which would be expected to fuel demand for land directly and through income

(job creation) and possible inducement of migration into the city as jobs are created. Theoretically, therefore remittance-induced urban land expansion is plausible as explained above but evidence from the regression estimation points to the contrary. May be remittances inflow has a threshold point which must be attained before showing a positive impact on the built area. One thing that may be taken into consideration is that, remittances unlike FDI, may not be influenced so much by agglomeration hence its geography is likely to show a more diversified distribution, compared to FDI which could be significantly drawn to clusters of economic activities which more often than not are concentrated in the “primate” cities in many developing countries (Rondinelli, 1983).

Next to be examined is the change in the explanatory power and overall fit of the models sequentially as the two globalization-related variables – foreign direct investments and remittances- are included in the same model, together with population and income. For this purpose, stepwise regression modeling approach was implemented, the results of which are presented in Table 4-3. From Table 4-3, the two traditional variables-population and income (GDP per capita) - explain about 79 percent (.793) of the variation in urban built up area. The addition of annual remittances inflow (net) as a predictor results in a slight increase of the explanatory power of the model to about 80 percent (.804). Model 4 incorporates foreign direct investments as a predictor variable, in addition to population, GDP per capital and annual remittances flow. Adjusted R^2 changes from .804 to .820, thus Model 4 explaining 82 percent of the variation in city built up area as opposed to 80 percent in Model 3, 79 percent in Model 2 and 66 percent for Model 1. Together, the two variables related to external economic forces, have added about 3.4 percent to the explanatory power of the model over the

model incorporating only population and income. Additionally, the standard error of the Adjusted R^2 decreased by 6.7 percent $\{(.25347 - .23643)/.25347 * 100\}$, thus improving accuracy of the explanatory power of Model 4 relative to Model 2.

However small this change is, it is important to note that the overall fit of the model remained highly statistically significant at the 95 percent confidence level. Also, it is important to note that globalization is an on-going phenomenon. Even though it has faltered somewhat currently (2008-2009), the general consensus is that it is picking up again. This implies that FDI will continue to flow into urban spaces and regions, including Accra in Ghana. Similarly, international migration is expected to be on the ascendancy, especially migration from developing to developed countries. Thus, other things held constant, remittances flow from developed regions/countries to developing ones is likely to rise significantly (Chami et al., 2008). It is from these considerations that the results for the globalization-related potential urban land expansion drivers may not be trivial. Specifically, the theoretical underpinnings and policy implications call for further investigation. Results from the foregoing indicate that the addition of foreign direct investments and remittances as explanatory variables in the regression analysis (Model 3 and Model 4) alter the outcome, however small the change may be. At this point it would be important to know if the two 'new' variables purported in this study to 'capture' the influences of global economic dynamics on urban spatial expansion can stand on their own. The rationale here is to determine the extent to which the built up area responds to FDI and remittances inflow, leaving out population and income. Consequently, urban built area is regressed on FDI and remittances inflows.

Table 4-4 depicts the results of regressing built up area on FDI and remittances. The R-square is .130, implying that the model explains 13 percent of the variation in built up area, which is highly significant at the 95 percent confidence level. The coefficient of FDI has improved markedly in this model; .193 as compared to .087 in the results of the “full” model displayed in Table 4-2, implying that 10% increase in FDI inflows would lead to an increase of about 2 percent in built up area. However, the remittances coefficient is negatively signed and not statistically significant at the 95 percent confidence level. Overall fit of the model is quite modest ($F = 8.853$) but statistically significant at the 95 percent confidence level. It appears that FDI is more robust than remittances, with superior degree of explanatory power. But how would these variables fare, each on its own? Table 4-5 displays the results of regressing built up area on remittances. The results show that remittances alone do not have any statistically significant impact on built up area in cities in 2000. Specifically, the model explained less than 1% of the variation in built up area, with significance of .238. The constant (intercept), even though not considered in the analysis is, however, positive (3.512) and highly significant at the 99% confidence level (.000). Furthermore, the sign of the coefficient which has been negative when remittances were included with the other explanatory variables has turned positive in this model. The positive sign is consistent with the theoretical postulates above. This notwithstanding, both the overall fit of the model (F-value) and t-value are statistically insignificant. At this point it appears that remittances inflows do not impact urban built area. If model specification is assumed to be correct then remittances may not be playing a significant role in the conversion of land to urban uses (Further investigation is warranted).

Next, built up area is regressed on FDI in order to determine the extent to which FDI alone, as an explanatory variable, would potentially impact the urban spatial expansion process. This model explains 13 percent of the variation in built up area compared to less than 1% explained by remittances alone (Table 4-5), which was not statistically significant at the 95% confidence level, in any case. The co-efficient shows that 10% increase in FDI corresponds to about 1.7% increase in urban built area. Also, the F-value of about 16.77 is highly statistically significant (.000). Compared to remittances, therefore, FDI appears to be a significant urban land cover change driver in contemporary times.

The foregoing results suggest that besides the 'traditional' explanatory variables of urban land expansion (the usual "suspects") -population and income (GDP/GNP per capita) - FDI inflow may be assuming some importance in the era of globalization. However, remittances inflow produced surprising results, showing an inverse relationship with built up area, contrary to the theoretical postulate advanced in this dissertation research.

Discussion

Urban Spatial Expansion Analysis and Globalization. Overlooked Factors?

As noted above, population and income show up as highly significant drivers of urban land expansion in numerous studies, with the general observation to the effect that urban built up areas increase in tandem with growth in population and income (as measured in GDP or GNP per capita). Thus, for example, it has been documented that Accra's population growth of about 4.5 percent per annum is way beyond the national average of about 2.3 percent (GSS, 2002). However, it is highly doubtful how significant this is to the physical expansion of the city during the period covered by this

study (1985-2000/2002). Indeed, whether the population growth is driven by natural increase or rural-urban migration or both it is the opinion of this investigator that this would not have any significant contribution to the contemporary expansion of a “primate” capital city, unless such population receive a boost in purchasing power in order for the people to be able to express effective demand for housing and land. Thus, when urban expansion is viewed narrowly, focusing on the population size living in the urban area, then population increase (presumably without purchasing power) can explain the expansion. In this regard an important fact to be taken into consideration is that, with respect to urban spatial expansion in a primate city, particularly in the case of Accra in Ghana, the urban periphery is usually dominated by relatively high income dwellers, contrary to the norm in many developing countries where the urban periphery may be characterized by “squatter” settlements or tenements (Aryeetey-Attoh, 2010; Yeboah, 2003). For example, Professor Ian Yeboah has asserted that the contemporary expansion of Accra is characterized by “quality residential sprawl” (Yeboah, 2003) implying that affordability is usually above the means of the average Ghanaian worker (Konadu-Agyemang, 2001). This, in effect, rules out any substantial demand by average income earning Ghanaians for those quality houses found mainly in the peri-urban areas of the city. Similarly, the importance of the usual traditional explanatory variables including maximum slope, agricultural rent and shallow groundwater are highly questionable, given technological advancements that enable even the draining of wetlands for urban/real estate development. Consequently, this study takes the view that even though these factors are still relevant, they do not contribute significantly to the contemporary urban expansion process in many fast

globalizing primate cities; at least, not in Accra. The argument being advanced in this dissertation research is that the physical expansion of primate cities in developing countries such as Accra in recent times, usually characterized by overconcentration of external funds, may have more to do with external economic forces flowing from globalization than to the “traditional” urban land expansion drivers in the form of population and income growth (GDP or GNP per capita).

Nonetheless, global urban land expansion analysts have consistently identified population and income growth (as measured by GDP/GNP per capita) as main drivers of urban land expansion (Seto et al., 2011; Angel et al., 2011). Angel et al. (2011), in their study of a global sample of over 3000 cities found that city population and GNP per capita explained over 75% of the variation in urban built up areas across countries. Similarly, Seto et al. (2011) concluded that GDP per capita explained most of the variation in urban land expansion in developed countries, but among developing countries, population was found to be the most significant driver of contemporary urban land expansion. The authors note that:

Our model shows that urban land expansion in the fastest growing regions—China, India, and Africa—is driven by different mixes of factors. Annual growth in GDP per capita is related to approximately half of the observed urban land expansion in China but moderate or no expansion in India and Africa. Instead, urban land expansion in India and Africa is related more to urban population growth. (p. 6).

Moreover, the regression estimation results in this study support these findings. From Table 4-1, city population and GDP per capita, combined, explain about 79 percent of the variation in urban built areas. More specifically, when city built up area was regressed on city population, the variable alone was able to explain about 66 percent of the variation in city built up area. Undoubtedly, the importance of these “traditional”

variables as drivers of urban land expansion cannot be overemphasized. However, as revealed by the conceptual frameworks (Chapter 2; Chapter 3) the theoretical “refinement” or extension Chapter 4, several questions can be raised regarding the extent to which the “traditional” urban land cover change drivers are able to explain contemporary urban land expansion in the light of intensified global linkage of economies with attendant interdependence of places far and near, triggering unrestricted spatial financial flows. For example, could the continued importance of population numbers per se be “superficial”? Are there “hidden” underlying drivers that work through population numbers but which are difficult to untangle for analysis? Yes, population numbers will cause increase of the urban extent, should the new development be characterized by low quality housing in the peri-urban area; but this may not be the case in many instances. Indeed, it has been shown that the urban extent has increased in the face of population declines that may be attributable to changing lifestyles or affluence (Burchell et al., 2005). Thus, it is obvious that even though population increase may be the proximate cause of increasing urban extent, the underlying driver might be something other than population. Again, in respect of the contemporary growth of the city of Accra, Yeboah (2003) has described it as “quality residential sprawl” implying the consumption of land on a massive scale. For instance, in 1985 the urbanized areas of Accra (including Tema) constituted 216 square kilometers, increasing to 555 square kilometers in 2002 and the growth has largely occurred on the fringe lands of the city (Moller-Jensen et al., 2005; Grant & Yankson, 2003). In particular, with respect to urban land expansion in developing countries, the purchasing power of the majority of the increase in population should be taken into

consideration, especially when urban expansion has been mainly ‘accretion’ (or compounding) at the urban periphery characterized by highly priced homes (Aryeetey-Attoh, 2010; Yeboah, 2003). There is the need, therefore, to re-examine this issue, especially under economic globalization for a more comprehensive understanding.

To take a more closer look at population, the conceptual and theoretical analyses in this dissertation have attempted to decompose the population of an assumed, typical globally- linked city, into: resident city population before the advent of increased inflows of FDI and remittances as well as induced population migration; attracted by FDI and remittances – related jobs created in the “large/primate” city as explained above. It is important to re-iterate that these FDI and remittances induced migrants are likely to be more skilled than the traditional average rural-urban migrant and will therefore be able to express effective demand for relatively higher quality housing since they will earn “decent” incomes, all things being equal. It is arguable that the concept of “FDI-remittance purchasing power enabled population” may account for a significant proportion of “effective” housing demand in the “globalizing” city. Attributions have been made to this effect in the case of Accra (Grant, 2009; Grant & Yankson, 2003). In regression analyses of urban land expansion, however, the variable of city population used does not distinguish between resident city population before FDI and remittances started flowing into the city. Consequently, population as an explanatory variable performs impressively but the relevant question one may want to ask is: *Is population increase with little or no purchasing power able to express effective demand for housing and land to result in rapid urban spatial expansion such as observed for Accra during 1991-2000/2002?*

It is a cardinal argument of this dissertation research that the requisite purchasing power, to some extent, has been afforded by inflows of external funds in the form of FDI and remittances.

Similarly, a closer look at GDP per capita as an explanatory factor of urban land expansion raises a simple question: “Does GDP per capita (measured at the country/national) level capture the total income of city residents”? Again, the conceptual and theoretical analyses presented in this dissertation research indicate that total income of city residents in the wake of inflows of external funds could be decomposed into 3 categories, namely; (a) those city residents who were gainfully employed before the advent of FDI and remittances; (b) those previously unemployed people who find FDI and remittance related jobs; and (c) those people who migrated into the city and get employed in FDI and remittances related jobs such as construction and real estate. Obviously, the total income of the residents of a “globalizing” city would therefore contain some induced aspects that could arguably be linked to elements of FDI and remittances. Unfortunately, GDP/GNP per capita usually used to denote income levels in urban expansion modeling and analysis does not capture the “FDI –remittance induced incomes” which residents of a “globalizing” city are likely to enjoy. To this far, therefore, it appears that conventional analyses of contemporary urban expansion may be overlooking important factors related to the economic “impulses” transmitted by globalization into urban spaces which potentially feed into the urban spatial expansion process, supporting the general conceptual framework for this dissertation research as outlined in Chapter 1. In view of the foregoing considerations, it seems reasonable to ask whether FDI and remittances could have direct or indirect impacts on urban land

expansion, especially pertaining to large / primate cities in developing countries which are fast globalizing. In an era of globalization such as we are witnessing currently, it becomes more imperative that a better understanding of the full impacts of global economic forces as key drivers of urban spatial change is sought since these “emerging” drivers have the tendency to influence urban land demand which could potentially increase the rate of land conversion from agricultural uses / natural areas to urban uses.

Do FDI and Remittances Drive Urban Spatial Expansion?

Few quantitative analysis of contemporary urban land expansion have attempted to directly implement FDI as an explanatory variable. Seto (2005) included FDI as an explanatory variable in a regression analysis of the external dimensions in urban land use change modeling in a study of the urban land transformation of the Pearl River Delta in China and the Red River Delta in Vietnam. The inclusion of FDI, according to the author, was motivated by the increasing levels of unrestricted capital inflows into the study areas as a result of increasing economic globalization. The study specifically hypothesized that “land use change is primarily driven by foreign interests in the form of investments and development assistance” (Seto, 2005: 198). The FDI-related explanatory variable used was “completed investments capital construction per capita” and upon testing, the variable was found to be positively correlated with both conversion of agricultural lands to urban uses and conversion of natural areas to urban uses, with statistical significance at the 95 percent confidence level (Seto, 2005: 205). Based on the conclusion reached by Seto (2005) with respect to the external economic influences on the urban land conversion process, it is obvious that foreign funds invested in construction activities in the local economy induced urban spatial expansion in the

areas studied. However, the potential impact of FDI on urban spatial expansion more than likely goes beyond direct investments in capital projects and into less obvious or indirect pathways via “purchasing power enablement” which feed into housing and land demand as well as increasing levels of housing demand by expatriate workers attracted by FDI inflows. In short, FDI could be exerting larger influence on a “globalizing” urban area than identified in the study by Seto (2005). For example, in addition to such investments in construction activities, expatriates demand housing, and FDI firms would require land for the building of offices and operational units such as warehouses and the likes, which would all increase demand for land. Remittances have similar “indirect”, induced tendencies which also feed into the urban spatial expansion process (Chapter 3). Remitters’ reasons for sending money are classified into altruistic and family contract motives as well as self-interest motives in which remitters invest in real assets and businesses (Chami et al., 2008; Addison, 2004; Chapter 3 of this dissertation research). Remittances increase as senders maximize their utility with respect to self-interest motives. The implications are that housing, real estate and other land consuming activities would increase considerably. The key reason for this is that in addition to desire of migrants (Ghanaians, in particular) to own homes in the “flagship” city, the real estate/housing sector offers a relatively safe investment environment. Some research findings have indicated that remittances from citizens of developing countries such as Ghana living and working in developed countries such as UK, USA and Canada form a substantial part of real estate demand in the large cities of their home countries (Grant, 2003; Yeboah, 2003; 2000; Tipple et al., 1998; Diko & Tipple, 1992). Similarly, real property has been noted as becoming one important “haven” for foreign investors in the

urban areas of cities elsewhere (Sassen, 2006). Even though Sassen's (2006) assertion concerned "global cities" similar trends have been alluded to, regarding developing countries (Grant, 2007; Yeboah, 2003; Grant, 2001; Tipple et al., 1998; Diko & Tipple 1992). (It must also be noted that all other "local" factors such as income levels, demographic changes and physical constraints of topography are of secondary importance and are not significant determinants of spatial expansion, especially for cities such as Accra which are fast globalizing). The rationale for this reasoning is that, firstly, the forces driving the real estate markets in such globally-linked cities relate more to "global" demand and supply for housing and land; and secondly, largely due to technological advancements, physical "barriers" do not constitute a major constraint on real estate development. To sum up, the combined effects of FDI and remittances inflow manifest in the urban landscape through real estate boom and other construction activities, usually in the primate / large cities (Yeboah, 2003; Grant & Yankson, 2003; Tipple et al., 1998; Diko & Tipple, 1992); making it imperative that these external variables be integrated into the standard urban land use theory (Alonso, 1964) to facilitate empirical research.

In pursuant of the above, the "new" or emerging globalization-related potential urban land conversion drivers have been implemented in regression Equation 4-18 above, together with the more familiar or traditional explanatory variables. The regression estimation results indicate that the adjusted R^2 changed from .79 (explaining about 79 percent the variation) in the case for population and income combined (Table 4-1); to .820 (explaining about 82 percent of the variation) (Table 4-2). It is important to note that the model is still statistically significant at the 95 percent confidence level,

implying that the model that contained FDI explained 82 percent of the variation in the built up area of cities, representing about 3.4% increase in explanatory power over the explanatory power of the regression model that has only the combined population and GDP/GNP per capita as explanatory variables. The stepwise regression estimation results shown in Table 4-3 give further indication regarding the gradual change in the explanatory power (Adj R²) of the overall model as FDI and remittances are included. It is clear that adding FDI and remittances does not change the significance of the model (from statistically significant to insignificant), but rather, they improve the overall explanatory power of the model, however small the change may be.

In terms of the co-efficients, FDI had 0.087; positively correlated with city built up area and statistically significant at the 95 percent confidence level, implying that 10 percent increase in annual FDI inflows corresponded to about 1 percent increase in urban built up area. Essentially, therefore, if annual FDI doubled in amount this would correspond to about 10 percent in the built up area of the city, according to regression estimation results. It is important to note that FDI inflows can often increase dramatically, such as has been the case for Ghana in recent years. Figures from the GIPC indicate that during 1999-2007 FDI increased by about 290 percent. With this versatility of change in FDI inflows, impact could be small, cross-sectionally, but may increase rapidly over time, hence warranting further investigation. To further examine the potential of FDI as an increasingly important explanatory driver of contemporary land expansion, a bivariate regression, Equation 4-19 was constructed and the regression estimation results are shown in Table 4-6. The results indicate that FDI alone explained 13 percent (Adj R² = .13) of the variation in urban built up area. Also,

the co-efficient of FDI, when implemented alone as explanatory variable remained positive, with a value of .169, implying that a 10 percent increase in annual FDI inflow corresponded to about 1.7 percent increase in the built up area. This is an improvement over the co-efficient of FDI of .087 obtained when FDI was implemented together with population, GDP per capita and annual remittances inflow. Overall, the results of FDI, both when implemented together with the other variables and when implemented alone, indicate that the variable may be a “significant” driver of contemporary urban expansion, which confirms the conceptual formulations in Chapter 2 as well as giving some preliminary empirical credence to two of the initial (new) theoretical propositions (Proposition 1 and Proposition 3); following from the refinement of the Alonso (1964) theory. It is also important to reiterate that the empirical results obtained from the regression estimation in this chapter, implementing FDI as explanatory variable, are in consonance with what Seto (2005) obtained, even though in her case FDI amounts were not modeled directly or explicitly.

Equation 4-19 implements FDI and remittances as the only explanatory variables of urban built area, with the results shown in Table 4-4. The model explains 13 percent (Adjusted $R^2=.130$) and highly significant (.000). The overall fitness of the model ($F=8.85$) is significant (.000) at the 95 percent confidence level. Co-efficient for FDI remains positive and has increased to .193, implying that in this model, FDI’s impact on urban built up earlier was relatively more significant in magnitude; a 10% increase in annual FDI inflows corresponded to 1.9 percent increase in the urban built up area in a subsequent year. To the contrary, however, remittances co-efficient continued to have a negative sign (-0.078). It should be noted that the ‘surprising’ results for remittances

revealed, in quantitative terms, in this study may not be surprising to some geographers like Professor Ian Yeboah (2003; 2000) who, even though agrees that external economic forces have combined with local forces to impact Accra's spatial development in recent times, has stopped short of attributing this to the external economic forces of globalization as described in this dissertation research (i.e. FDI or remittances). To a certain degree, the regression estimation results demonstrated in this study show that such an attitude may be justified but as shown in the discussion a closer examination of remittances and FDI as explanatory variables (drivers) of urban expansion, indicate that the latter variable could have a statistically significant positive impact on contemporary urban expansion. Consequently, it can be argued that even though the preliminary empirical regression results presented in this dissertation research cannot be considered conclusive, the potential influences of external economic forces on the urban spatial expansion process cannot be dismissed entirely.

The “New” Theoretical Propositions in Context

Based on the regression estimation results and discussion above, it is obvious that FDI and remittances differ in their influence on the urban expansion process. In essence, FDI appears to be more relevant, whereas remittances appear not relevant. Consequently, it can be argued that Proposition 1 and Proposition 3 have been validated, indirectly, to an extent. Proposition 1 posited a positive correlation between FDI and the radius of the urban area. Since, *radius* was not implemented directly in the regression models as a response variable, the *built up* area or urban land cover becomes the proxy. In effect, therefore, the positive correlation between FDI and the built up area resulting from the regression estimation will also hold true for the radius. In other words, the expansion of the built up area of the city will also entail an increasing

radius. In short, Proposition 1 is confirmed by the preliminary regression estimation results. For Proposition 3, the argument is that FDI attracts people into the city by virtue of jobs created; employment affords these in-migrants the needed purchasing power to be able to express effective demand for housing and land, which would then feed into expansion of the urban area and lengthens the city's radius. In the context of the regression analysis, therefore, city population implemented as an explanatory variable could be influenced indirectly by FDI inflows into the urban economy. In effect, therefore, part of the estimated co-efficient for population may be attributable to FDI. As explained earlier, FDI gives the requisite purchasing power and will therefore not be entirely out of place to suggest that the magnitude of impact of population to urban spatial expansion may not be that high without the influences of FDI. To sum up, FDI inflows into the urban economy may fuel demand for land, increasing urban land values. But peri-urban lands remain cheaper compared to lands closer to the city core. At the same time, peri-urban land owners would be incurring increasing opportunity cost for holding lands in agricultural use. It would make sense to convert to urban uses, contributing to the expansion of the urban extent into the periphery. This explanation tentatively suggests that FDI induced urban land expansion is grounded in the Thunen-Alonso theoretical framework under globalization (detailed explanation is given in Chapter 5).

Issues with Remittances and FDI as Urban Land Expansion Drivers.

Can the poor performance of remittances as an explanatory variable in urban expansion be explained? A few reasons readily come to mind, the combination of which could help explain the “surprising” preliminary empirical results presented above. Firstly, the statistical ‘insignificance’ of annual remittances as an explanatory variable in

urban land conversion may be due to the fact that the bulk of remittances may not be invested in the real estate sector of urban areas and may be remitted for purely altruistic reasons which would confirm a popular view in the literature (Lucas & Stark, 1985). Secondly, it may be due to the fact that the asset accumulation motive of remitters which underpins the conceptual and theoretical “refinement” presented in this dissertation research may not be sensitive to the “trappings” of urban agglomerations. Unlike FDI which responds to urban agglomerations and will therefore have the tendency to concentrate in already economically vibrant locations within a country, remittances may not necessarily follow agglomerations. The implication of this, from a geographical perspective, is that remittances are more evenly distributed spatially within a country, compared to FDI; implying that enough remittance funds may not be concentrated in any single or a few urban centers (s) to enable a significant influence to be exerted on the urban expansion process. In essence, it is conceivable that some remitters will build or establish business in towns or in their home towns which are not necessarily large urban centers and therefore could not have been captured by the sample of 107 cities for the regression estimation in this dissertation research. Finally, it is important to note that the remittances flow data implemented in the regression estimation presented in this work have been sourced from “official” records, implying that only documented remittances could be captured in such records. It is widely acknowledged, however, that a substantial portion of total global remittances flow go through unofficial channels such as through friends and family members travelling back to the migrant’s origin country (Addison, 2004). Even though these reasons may help explain the “statistical insignificance” observed for remittances in this work, the negative

sign (-) of the remittances co-efficient cannot be readily explained and is very perplexing, for which more empirical investigations will aid our understanding.

How about the “low” magnitude of impact for FDI? The conceptual framework and the “refined” theoretical model reveal the pathways through which FDI could impact urban land expansion. It has been identified conceptually and theoretically in Chapter 2 Chapter 4 that FDI flow into an economy would afford residents purchasing power to enable them express effective demand for housing and land which could potentially contribute to spatial expansion; via demand from previously unemployed residents, induced migrants (indirect channels) as well as expatriate demand (more direct channel) which have been analytically decomposed above. However, the available dataset currently, do not allow for this decomposition for closer examination. Consequently, the dataset used for the regression estimation in this work may not be capturing all of the three pathways conceptualized and theorized in this work. Secondly, induced incomes earned by city residents, which would be more relevant for the argument advanced in this dissertation research, are not captured; neither can the GDP per capita used be decomposed into the different income earners of a globally-linked city to enable robust analysis. Lastly, city population has not been decomposed into the various components arising in the wake of increasing inflows of FDI. A very important fact is the failure by urban expansion analysts and modelers to recognize the purchasing power enablement afforded by FDI, thereby continuing to focus on population numbers (in absolute terms) and their growth rates used as explanatory variables. Indeed, the foregoing conceptual and theoretical analysis suggests that population as an explanatory variable may be ‘riding on the wings’ of “hidden” factors

which have been overlooked by global urban expansion analysts. More importantly, analysts do not question the source of “purchasing power enablement” and take population increase superficially. But it seems obvious, based on our conceptual and theoretical analyses that FDI (and remittances, even though not found to be relevant in this work) do afford purchasing power to city residents which in turn enable them to express “effective demand” (purchasing power backed demand) for housing and land. On a more general note, therefore, this study does not purport to have carried out a comprehensive empirical analysis of these issues, which are better left for future research. The figures used for remittances and FDI used in this study are national figures but the urban built up areas used as a response variable are measured at the city level. Hence, there is no direct correspondence between the explanatory variables on the one hand and the response variable on the other in terms of scale of data measurement. One consequence is that city level dynamics of the explanatory variables might not have been captured. Also, even though the importance of geographical distribution have been emphasized in the conceptual frameworks (Chapter 2; Chapter 3) and the theoretical “refinement” in Chapter 4, the data did not reflect this. Hence, the preliminary empirical analysis presented in this dissertation might have missed the potential impact of unequal geographical distribution of the external funds inflow into the urban spaces of the sample of cities used for the regression estimation. In a nutshell, this chapter might have ended up raising more questions than answers or maybe might have “opened the can of worms” in urban expansion research under a globalizing world, which would be some sort of “mission accomplished” for a budding geographer, however modest.

Globalization-Induced Urban Spatial Expansion?

The world is urbanizing at a faster rate and developing countries have been forecast to have the highest proportion of urban settlements in the near future. According to some projections, about 60 percent of the world's population will live in urban areas by 2030 (UN, 2005; 2003) and scholars have devoted considerable attention in researching what has been described as "sustainable urbanization" in view of the increasing ecological footprints associated with cities and other ecological problems created by rapid urbanization (Keys et al., 2007; Rees & Wackernagel, 2006; 1994; IHDP, 2005; Rees, 1992). More importantly, urbanization is increasingly being recognized as one of the formidable aspects of environmental change, posing one of the greatest challenges of the twenty-first century (IHDP, 2005; Turner et al., 2004; Sanderson et al., 2002; Alberti, 2003; Rees, 1997; 1996; 1992). For example, Rees (1997: 63) asserts that besides growth in population numbers, increasing concentration of people in urban settlements constitute the most significant event for a century. Not surprisingly, therefore, urbanization and its attendant environmental changes have engaged the attention of researchers aiming to offer deeper understanding of human dimensions of global environmental change (IHDP, 2005). For example, the IHDP (2005) has recently focused on the environmental change consequences of urbanization by developing a science plan dubbed 'Urbanization and Global Environmental Change' (UGEC) to help better understand the dynamics of urbanization and its impact on the urban environment as well as human responses to changing urban environments (IHDP, 2005). Current rates of urbanization and attendant loss of environmental resources such as depletion of vegetation cover have raised concerns among researchers largely due to the negative consequences for sustainable urban

development (Keys et al., 2007; McKinney, 2006; Wackernagel, 2006; 1994; Rees & Wackernagel, 1994; Rees, 1999; 1992) which could undermine human well-being in general (UN, 2005; Alberti, 2003). The United Nation's Millennium Assessment (MA) of ecosystems implications for human well-being concluded in no uncertain terms that human well-being was inevitably linked to quality ecosystems and their services to humans; impacting, for example, food availability, energy and good quality air (UN, 2005: 1-25), just to mention a few. The advent of economic globalization, boosted by economic liberalization policies have helped ensure that urban economies are linked to the larger global economy resulting in unrestricted flows of funds across geographic locations globally, some of which are invested in the built environment. Consequently, the contemporary expansion of built up areas, particularly in large / primate cities in developing countries, may be influenced by inflows of external funds into the urban economies. Not only does the expansion of the urban built environment lead to increasing human load on distant ecosystems, the process actually could have more direct and dire consequences on the immediate biophysical environment. Research findings have indicated that urbanization (expanding urban extent) have negative impact on the biophysical environment through loss of vegetal cover and consequently habitat loss, fragmentation and general loss of biodiversity (Alberti, 2003; McKinney, 2002 ; Marzluf, 2001; Vale & Vale, 1976; Luniak 1995). For example, McKinney (2002) has asserted that the species of many taxa often declines along the urban-rural gradient with the lowest richness to be found in the urban core (p. 889), implying that urban expansion has negative impact on biodiversity. In more general terms, this has negative implications for ecosystem functioning as well as ecological integrity thereby

impacting long-term environmental sustainability (UN, 2005). So, does economic globalization impact the contemporary urban expansion process? This question is particularly imperative if the urban extent change is formulated as a function of the changing economic activities in the urban area such as increasing inflows of FDI and attendant population inducements as elaborated on previously in this dissertation research. From the general conceptual framework laid out in Chapter 1, an urban economic system linked to the global economy entails the exposure of the urban biophysical environment to external economic forces of globalization (Dickens, 2003). Also, in many cases, disproportionately large amounts of external funds such as FDI are concentrated in “primate” capital cities such as Accra in Ghana (Grant, 2007; Grant & Yankson, 2003; Yeboah, 2003). Thus, it seems plausible to argue that in an era of intensifying globalization, economic forces generated far away from the urban spaces they are affecting, may be contributing to their spatial changes and re-organization. Not surprisingly, therefore, concerns for a better understanding of the changing planet in relation to socioeconomic forces and global flows are high on the research agenda of geographical scientists (NRC, 2010). In this regard, Julie Winkler has suggested that one area of research that should pre-occupy geographers is: “How to recognize and cope with the rapid spatial re-organization of economy and society” (Winkler, 2011: 317). Spatial re-organization of economy and society entail, almost invariably, land use change with environmental consequences. Furthermore, the NRC’s (2010) strategic directions question number 7 bears directly on the pertinence of globalization and associated flows (Chapter 1). Thus, urban spaces are continuously being shaped by external forces (Grant & Yankson, 2003; Dickens, 2003), in addition to the traditionally

recognized regional and local forces (Cadwallader, 1985). This is especially pervasive in developing countries. Partly due to colonization, large cities in many countries in developing countries, in Sub-Saharan Africa have assumed the status of primate cities. This has been further re-enforced by economic liberalization and globalization as multinational corporations over-concentrate their activities/operations in such cities by virtue of availability of infrastructure and relatively skilled pool of labor. Added to this, is the increased migration which has characterized the era of globalization with associated increase in the flow of remittances into migrant origin countries, substantial portions of which find its way into the real estate market of “primate” cities in developing countries. The combined effect of these can be seen through the rapid land conversion from agricultural use to urban uses, especially at the urban fringes, for residential and industrial purposes. Thus, for example, the rapid spatial expansion of Accra, the capital city of Ghana, like many similar cities in West Africa and Sub-Saharan Africa, has an important external component as drivers of urban land use change. Essentially, spatial changes observed at the local setting are more likely the combination of many forces, some of which are external and beyond the control of urban land managers, among other things. Even though the external aspect of urban change is generally recognized by researchers, research effort has largely concentrated on the proximal (or local) causal agents. Thus, the external dimensions of urban spatial change are still less understood. This is especially worrisome given the fact that increasing spatial interconnectedness of economies has helped exposed the local (urban) environments to the vagaries of global economic forces, which would have implications on the urban spatial change process. In essence, therefore, most urban land / spatial expansion

analyses continue to focus on the “usual suspects” (population and income growth). However, the analysis presented in Chapter 4 should help draw attention to global economic influences on the urban land expansion process. It is gratifying that the process can be embedded in a standard economic theory in order to facilitate further empirical investigations for a fuller understanding of globalization’s imprints in urban spaces.

Summary

So, to what extent are FDI and remittances important as drivers of contemporary urban spatial expansion? Chapter 4 has sought to advance a cogent argument for a ‘refinement’ of the standard urban land use theory/model (Alonso, 1964) in the context of economic globalization. The overriding aim has been an attempt to refine the Thunen-Alonso’s theoretical framework to enable the analysis of externally induced urban spatial expansion, from a geographical perspective. Thus, the theoretical postulates advanced in Chapter 4 are informed by the classical economic theory of urban spatial structure, focusing mainly on the urban extent expansion which has been derived from the theory (Angel et al., 2011; 2005; McGrath, 2005; Brueckner, 1987; Brueckner & Fansler, 1983). Specifically, annual FDI and remittances inflow were introduced into one of the latest extensions of Alonso’s (1964) classical work (Angel et al., 2011; 2005). Propositions relating FDI and remittances to the urban extent were put forward and tested, using log transformed OLS regression estimation approach. FDI was found to be positively correlated with urban built up area, confirming the conceptual framework and theoretical postulates in this dissertation; and also supporting findings by Seto (2005). To the contrary, however, remittances, as a driver of urban expansion, was not found to be relevant since the estimated coefficient was negatively signed as

opposed to the hypothesized positive correlation. These findings imply that, empirically, Hypothesis 1 is partially supported; with respect to the FDI-urban expansion correlation but the empirical evidence does not support the hypothesized positive correlation between remittances and urban spatial expansion. On theoretical and conceptual grounds, however, both FDI and remittances can be 'inserted' into the Alonso theoretical framework, for useful and informed analysis, based reasonable arguments, thereby giving preliminary support to Hypothesis 2.

An important conclusion so far (Chapter 2; Chapter 3; Chapter 4) is that the importance of population as an explanatory variable may be "riding on the wings" of more subtle underlying factors most likely induced by FDI (and remittance) inflows which afford many the purchasing power to be able to express effective demand for housing and land which in turn could result in increasing urban extent. It is also suggested that the use of GDP/GNP per capita as explanatory variable may not capture incomes that city residents might enjoy which have been made possible through FDI and remittances related jobs. In effect, therefore, Chapter 5 has argued that more attention needs to be paid to the growing importance of FDI in particular as an "emerging" driver of contemporary urban spatial expansion, especially in places where such external funds are likely to be attracted into existing urban agglomerations. The case for the inclusion of FDI in the standard economic theory and empirical estimations appears to be supported by the preliminary empirical regression estimation presented in Chapter 4, and is also resonates with previous research (Seto, 2005).

Chapter 4 of the dissertation research contributes to theory building in contemporary urban geographical research and urban economic geography in the

context of economic globalization; examining the significance of the external economic dimensions in the spatial expansion process. The continued intensification of global linkages of cities and economies makes it imperative that urban policy makers and managers be cognizant of the impact of external forces on their object of interest since many primate cities in developing countries such as Accra in Ghana are grappling with the environmental consequences of globalization and urbanization (Grant 2009, Yeboah 2000, 2003, Grant and Yankson 2003 and Moeller-Jensen et al. 2006). The broader perspective of Chapter 4, therefore, is the anticipation that urban planners and urban environmental managers will find insights useful in their decision making, with due consideration given to external forces of globalization in the form of FDI. At the minimum this will help ensure that the external dimension is recognized and anticipated.

Additionally, Chapter 4 provides the necessary economic theoretical grounding for the formulation of the Integrated Urban Spatial Expansion Estimation Method (IUSEEM) in Chapter 5, implementing the estimated co-efficient of FDI in an allometric-based exponential growth model to attempt to 'cumulate' FDI-induced built up area of Accra over time.

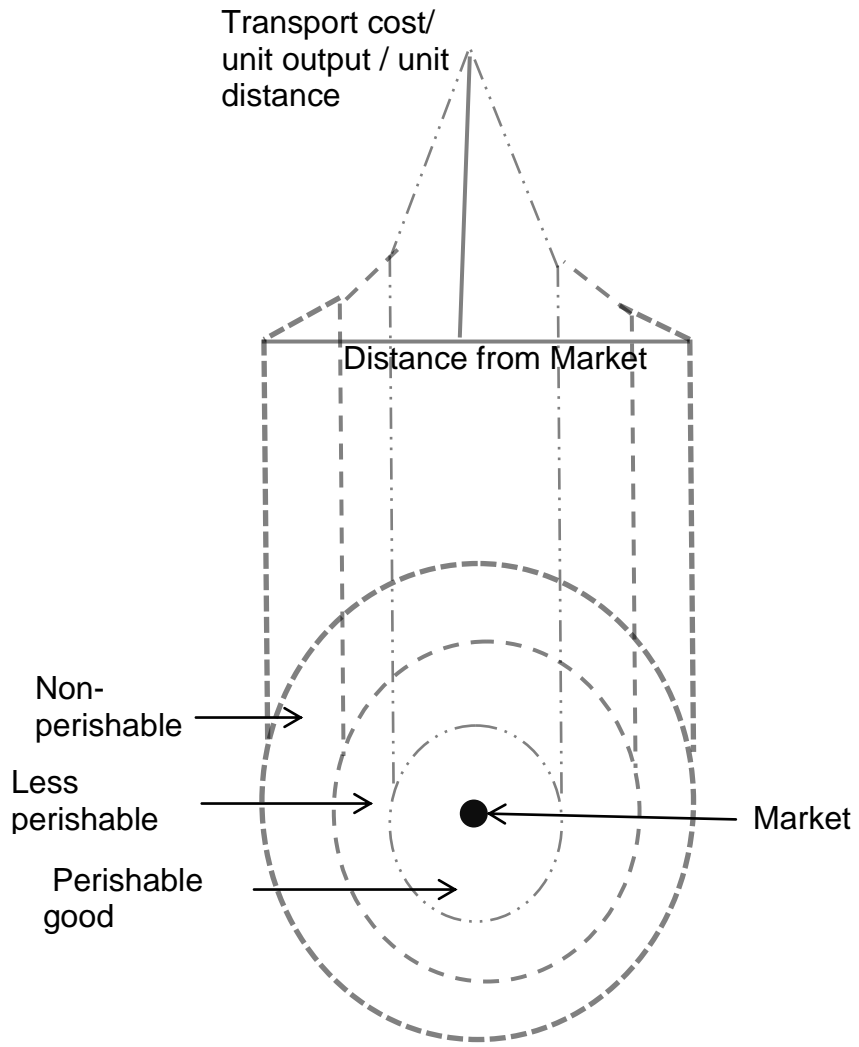


Figure 4-1. Von Thunen's agricultural land use model. Source: Author's construct based on Reid (2002).

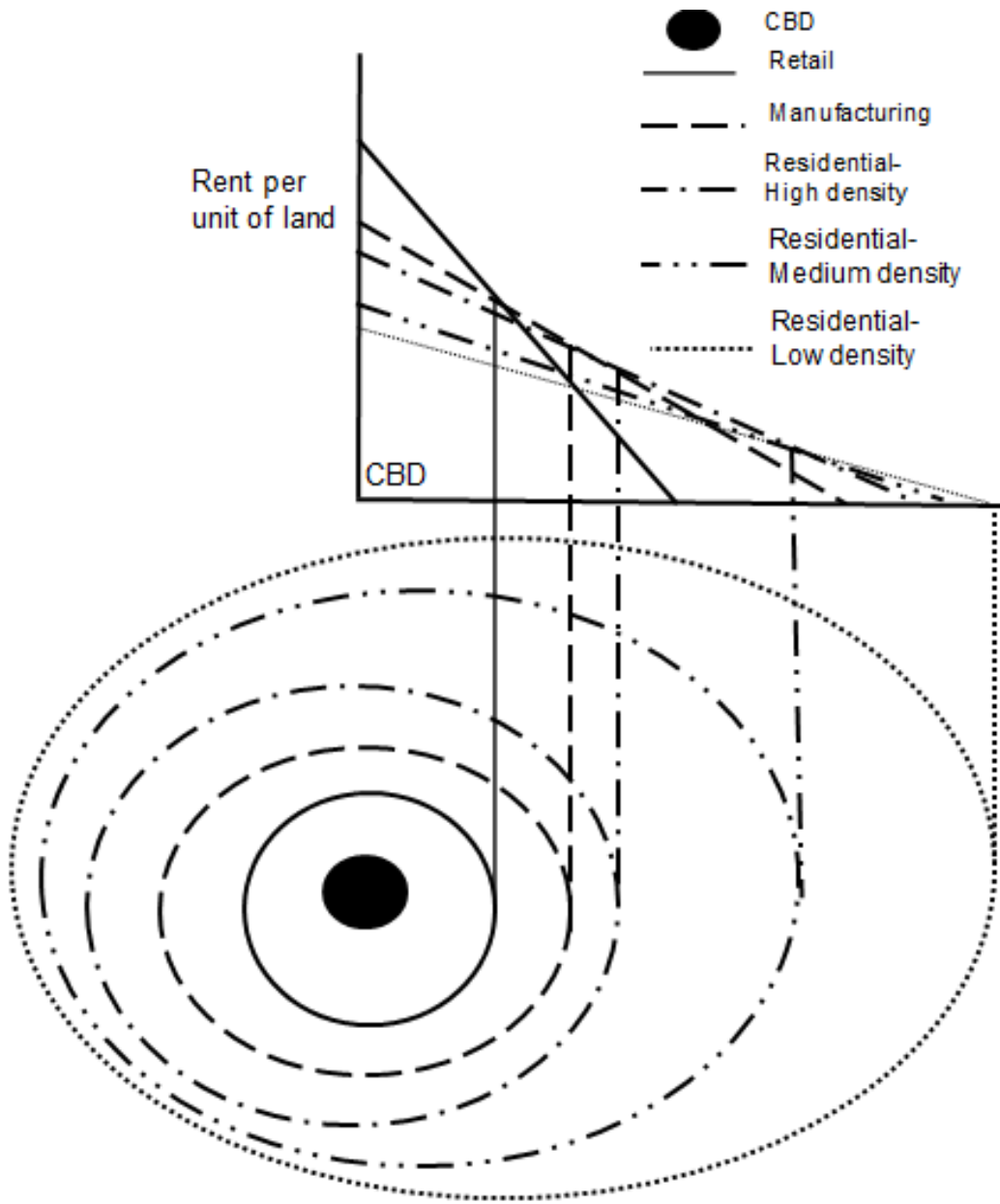


Figure 4-2. Alonso's theory and model, bid-rent curves and urban spatial structure.
 Author's construct based on Reid (2002).

Table 4-1. Regression results with population of individual cities and GDP per capita.

| | Co-eff | Std. Co-eff | S.E | t | Sig | VIF |
|---|--------|-------------|------|--------|------|-------|
| Constant | -1.556 | | .292 | -5.402 | .000 | |
| CityPOP ₂₀₀₀ | .782 | .804 | .035 | 18.373 | .000 | 1.002 |
| GDP ₁₉₉₉ | .290 | .359 | .043 | 8.209 | .000 | 1.002 |
| N = 107 F=209.343 (.000) Adj R ² = .797 S.E of est = .252 D-W= 2.025 | | | | | | |

Source: Author's construct.

Table 4-2. Regression results with population, GDP per capita, FDI and remittances.

| | Co-eff | Std. Co-eff | S.E | t | Sig | VIF |
|--|--------|-------------|------|--------|------|-------|
| Constant | -.959 | | .417 | -2.301 | .023 | |
| CityPOP ₂₀₀₀ | .787 | .810 | .040 | 19.458 | .000 | 1.019 |
| GDP ₁₉₉₉ | .215 | .267 | .046 | 4.645 | .000 | 1.940 |
| FDI ₁₉₉₉ | .087 | .162 | .032 | 2.763 | .007 | 2.034 |
| REMIT ₁₉₉₉ | -.134 | -.139 | .041 | -3.245 | .002 | 1.080 |
| N = 107 F = 121.706 (.000) Adj R ² = .820 S.E of est =.238 D-W =2.096 | | | | | | |

Source: Author's construct.

Table 4-3. Stepwise regression results and R² change.

| Model | R | R ² | Adj R ² | S.E | F | Sig |
|-------|-------------------|----------------|--------------------|--------|---------|------|
| 1 | .815 ^a | .665 | .662 | .32387 | 206.213 | .000 |
| 2 | .893 ^b | .797 | .793 | .25347 | 201.730 | .000 |
| 3 | .900 ^c | .809 | .804 | .24654 | 144.439 | .000 |
| 4 | .909 ^d | .826 | .820 | .23643 | 120.270 | .000 |

1. Predictors: (Constant), CityPOP₂₀₀₀

2. Predictors: (Constant), CityPOP₂₀₀₀, GDP₁₉₉₉

3. Predictors: (Constant), CityPOP₂₀₀₀, GDP₁₉₉₉, REMIT₁₉₉₉

4. Predictors: (Constant), CityPOP₂₀₀₀, GDP₁₉₉₉, FDI₁₉₉₉, REMIT₁₉₉₉

Dependent Variable: Built₂₀₀₀ (Built up area of sample of cities).

Source: Author's construct.

Table 4-4. Regression results with built up area regressed on FDI and remittances.

| | Co-eff | Std. Co-eff | S.E | t | Sig | VIF |
|--|--------|-------------|------|-------|------|-------|
| Constant | 2.895 | | .796 | 3.638 | .000 | |
| FDI ₁₉₉₉ | .218 | .405 | .090 | 4.345 | .000 | 1.068 |
| REMIT ₁₉₉₉ | -.063 | -.065 | .050 | -.697 | .487 | 1.068 |
| N=107 F =9.522 (.000) Adj R ² =.139 S.E of est. =.52034 | | | | | | |

Source: Author's construct.

Table 4-5. Regression results with built up area regressed on remittances.

| | Co-eff | Std. Co-eff | S.E | t | Sig | VIF |
|---|--------|-------------|------|-------|------|-------|
| Constant | 3.512 | | .672 | 4.918 | .000 | |
| REMIT ₁₉₉₉ | .036 | .037 | .094 | .378 | .706 | 1.000 |
| N = 107 F = 1.406 (.238) Adj R ² = -.008? S.E of est. = .56289 | | | | | | |

Source: Author's construct.

Table 4-6. Regression results with built up area regressed on FDI.

| | Co-eff | Std. Co-eff | S.E | t | Sig | VIF |
|--|--------|-------------|------|-------|------|-------|
| Constant | 2.432 | | .394 | 6.860 | .000 | |
| FDI ₁₉₉₉ | .209 | .388 | .041 | 4.095 | .000 | 1.000 |
| N = 107 F = 18.650 (.000) Adj R ² = .143 S.E of est. = .51906 D-W = 1.887 | | | | | | |

Source: Author's construct.

CHAPTER 5
FDI INDUCED PERI-URBAN LAND EXPANSION IN ACCRA, GHANA: THEORETICAL
AND QUANTIFICATION CONSIDERATIONS

Background

In Chapter 5, the IUSEEM is formulated; FDI induced urban spatial expansion theory is more formally articulated and the phenomenon is placed in the broader context of human-induced environmental change.

It has been demonstrated in Chapter 4 that FDI and remittances can be embedded in the classical Alonso (1964) theory in order to help account for realities of economic globalization's influences on the urban extent. However, the regression models employed, like many regression-based urban expansion analysis, have been cross-sectional, static and linear. Thus, multiple regression models such as employed by Angel and colleagues (2011; 2005); and in Chapter 4 can represent the explanatory variables for cross-sectional data, therefore not capable of modeling urban spatial expansion spatio-temporally, in addition to being linear. Even more unsettling, perhaps, is that current urban spatial expansion quantification methods and models in general, do not allow for the incorporation of rapid changes in predictive variables such as FDI, in order to reflect their dynamic impacts on the urban land expansion process through time. Furthermore, the most popular spatially explicit urban expansion models such as cellular automata (CA) and Agent-Based Models (ABM) focus mostly on local "agents" whose land use decisions aggregate to impact physical expansion of the urban area (Batty, 2005). Desirable attributes of such models are their ability to model the city as a complex system, effectively handling non-linearity and being dynamic, which according to advocates, most closely approximate real urban dynamics (Batty, 2005). However, not only are the underlying motivational forces masked, but these models, for the most

part, have not been particularly linked to economic theory even though economic considerations seem to weigh heavily in the decision-making process that lead to urban growth (Pacione, 2009). For example, in a rapidly expanding and globalizing city, decisions made by peri-urban agricultural land holders to convert to urban uses may have been driven by increasing demand for urban land resulting from FDI inflows (Chapter 2; Chapter 4), but would normally not be represented in CA and ABM. In short, the emerging, globalization related FDI –induced urban land expansion phenomenon has neither been systematically theorized nor quantified, leading to a less than complete understanding of the urban spatial expansion process, even though it is widely acknowledged that globalization has led to increased interconnectedness of urban economies; opening up these economies and their lands to economic forces flowing from global sources (Dickens, 2003). Grounding FDI induced urban land expansion in standard economic theory and quantifying the process will increase understanding of urban spatial expansion of primate, fast globalizing and rapidly expanding cities in the developing world, especially, where FDI flows have consistently concentrated. The broad goal in this chapter, therefore, is to seek to understand the extent to which increasing FDI inflows to Ghana might have contributed to the rapid rate of Accra’s physical expansion in contemporary times, especially in the peri-urban areas, as Ghana liberalized economically, with Accra fast globalizing and attracting unprecedented levels of FDI inflows (GIPC, various years). In other words, it is suggested in Chapter 5 that Accra has been experiencing FDI induced physical expansion since about 1991. For the purposes of the analysis in Chapter 5 and tentatively, FDI induced urban land expansion may be described as *expansion of the*

urban extent primarily driven by FDI and related economic activities in the urban economy which impact demand for land related amenities such as housing and infrastructure that necessitate the conversion of new lands to urban uses.

Accra, Ghana's capital city has undergone dramatic and rapid physical expansion in contemporary times, with a marked acceleration of urban annual rate of growth beginning 1991, according to a study by Moller-Jensen and colleagues (Moller-Jensen et al., 2005). The annual rate of physical expansion of Accra far outstripped the rates of growth for population of Accra (Angel et al., 2011) and incomes in Ghana (Table 5.7) during the same period. In short, the rapidity of Accra's contemporary physical expansion seems to defy explanation based on the two most important 'traditional' urban land expansion drivers, necessitating a "thinking – outside-the- box" approach to the analysis, given the imperatives of economic globalization which unleash global capital flows that have the tendency to influence urban land use decisions in distant areas. In some respects, this could well be an example of "global processes producing local changes" with respect to urban land expansion, akin to the impacts of climate change in local places, which cuts across multiple geographical scales. Such globally induced local changes are becoming increasingly common with the intensification of globalization, advanced technologies and increased economic flows. Global economic flows have tendencies to cause spatial re-organization of economies and societies (Dickens, 2003), which almost invariably contribute to land use changes (including land conversion to urban uses). In this regard, some researchers (Aryeetey-Attoh, 2010; Grant, 2009; Grant & Yankson, 2003; Konadu-Agyemang, 2001; for example) have 'faulted' globalization and / or SAP as contributing to Accra's rapid physical expansion,

but such analysis have not been grounded in economic theory and have not sought to quantify the “induced” component as have been asserted. It is the main argument Chapter 5 that the increasing levels of FDI inflows to Ghana during the era of intensifying globalization and economic liberalization (implementation of SAPs), which has had the tendency to geographically concentrate in Accra, may be contributing to the rapid rate of physical expansion of the city, especially beginning from 1991, which may be feeding into peri-urban environmental / land degradation. Arguably, land degradation may not be the most pressing problem affecting urban residents in Ghana, in general, and residents of Accra in particular. For example, researchers and commentators have sought to highlight the worsening situation of urban poverty, malnutrition (Songsore, 2003 cited in Baabereyir, 2009), lack of proper waste disposal management, (Baabereyir, 2009), among other things. Much as these issues are important, meriting attention, the issue of ‘creeping’ peri-urban land degradation in Accra in recent times (Moller-Jensen, 2005; Grant & Yankson, 2003) cannot be wished away either, given the rapid pace and the haphazard nature of contemporary physical expansion of the city (Aryeetey-Attoh, 2010; Moller-Jensen et al., 2005; Grant & Yankson, 2003). So, can FDI be implicated in the peri-urban land conversion process in Accra? In Chapter 5, attempt will be made to present reasonable arguments as to whether or not FDI can be implicated in the rapid physical expansion of Accra into the peri-urban areas and specifically develop a simple spatial expansion estimation method to quantify the FDI induced expansion of Accra’s built up area during 1985-2011.

In Chapter 4 of this dissertation, initial propositions relating FDI to urban built up area, following from a “refined” Alonso theoretical framework, were tested using cross

sectional regression models and FDI was found to be positively correlated with urban built area and statistically significant at the 95 percent confidence level. This, in very general terms, would suggest a link between FDI and urban land conversion such as found by Seto (2005) for the Pearl River Delta in China and the Red River Delta in Vietnam. However, such analyses offer limited understanding from a temporal perspective. Given the dynamic nature of FDI flows, it is reasonable to suggest that FDI contribution to urban built up area expansion would vary according to the fluctuations in the flow volume, and time, other things being. If urban land conversion is virtually irreversible and adversely affects the biophysical environment (Seto et al., 2011), it seems imperative that we are able to account for just how much of a given natural/agricultural area is transformed into built up areas through time, as driven by some identified underlying drivers such as FDI.

Indications are that the FDI linkage to urban land expansion is theoretically founded, which can be modeled analytically for estimation of FDI induced urban built up area over time. Furthermore, preliminary estimation results using the allometric based urban expansion model (IUSEEM) formulated and implemented in Chapter 5, indicate that the role of FDI as a potential land cover change driver influencing Accra's rapid physical expansion cannot be ruled out completely, thereby suggesting that further empirical research in this area may be warranted. Thus, even though the analysis presented in Chapter 5 cannot be considered empirically rigorous by any stretch, it is hoped the work will help lay the conceptual framework and theoretical foundations for modeling and estimating the linkage between FDI and urban land conversion over time, which in the absence of proper land use and effective environmental management

policy, could lead to land and environmental degradation such as is believed to be happening in Accra currently. Moreover, the analysis in this chapter has the potential of motivating further research into the construction of simple estimation models and methods more realistically reflecting the dynamic FDI – urban land conversion relationship which are also theoretically grounded. Research outcomes in this area would likely have important research applications and policy implications beyond Accra and Ghana, particularly, for urban planners, policy makers and urban environmental conservationists interested in understanding how the “coveted” FDI could have unintended consequences for the urban biophysical environment. This need would be especially imperative for urban planners and urban land managers tasked with controlling growth and development of the “primate” cities of developing countries, especially in sub-Saharan and West Africa, that are ‘fast globalizing’.

FDI Induced Urban Spatial Expansion in the Context of the Literature

FDI flows have characterized globalization, with the tendency of concentrating in urban locations largely due to benefits of agglomerations. FDI induced urban spatial expansion has received little attention in the mainstream urban expansion analysis literature, yet it is difficult to deny that economic globalization increases economic activities, drive urbanization usually resulting in increasing urban extent. Hence, the FDI urban expansion linkage should be obvious. However, a very basic but important question still needs to be answered: How does foreign generated money (FDI) impact urban spatial expansion at destination locations such as Accra? One aim of this dissertation is demonstrating the need for urban and economic geographers to seriously begin considering the emerging globalization related phenomenon of FDI induced urban spatial expansion, especially as relating to primate cities in developing country settings.

Consequently, this literature review will seek to contextualize the emerging phenomenon of FDI induced urban spatial expansion in the relevant literature and demonstrate the need to formally incorporate FDI in the Thunen-Alonso theoretical framework. It will be shown that it is about time FDI is incorporated in standard urban economic theory, particularly analyzed from a geographical perspective, especially bordering on the fundamental geographical themes/concepts of “Spatial differentiation” “Movement” and “Human-Environment Interactions”. From a geographical perspective, FDI is a movement of global capital across locations on the surface of the earth. Similarly, urban land expansion is an instance of human-environment interactions (one-sided, though), whereby human made capital is used to convert agricultural and natural lands to human made structures; in turn, the existence of such structures induce further rounds of human economic activities resulting in more land conversion. Arguably, therefore, FDI induced urban spatial expansion should form a major focus of urban and economic geographical research as a cardinal contribution to human dimensions of global environmental change (IHGEC) research efforts.

The main themes of the literature review are three-fold: (1) *Human-environment relationship context of FDI induced urban spatial expansion* which provides an overview of the economy- environment relationship which generate human-induced environmental change (environmental degradation) to which, this dissertation argues, FDI induced urban spatial expansion could be contributing; (2) *theoretical background to FDI induced urban spatial expansion* outlines the relevant theories that have been concerned with human-land relationship, considering land as a vital input to human economic endeavors, particularly for housing and other similar purposes. The focus has

been limited to perspectives from economic geography, urban geography and urban economics. The overall aim here is to identify the theoretical gap in the literature necessitating the formal theorization of FDI induced urban spatial expansion; and (3) *Quantifying FDI induced urban spatial expansion* is aimed at identifying the need for an appropriate method/model that can be used to estimate urban built up area expansion in response to increasing FDI inflows into the urban economy. Being a relatively new area of theoretical exploration, quantifying FDI induced urban spatial expansion will aid understanding as well as enhance the process of theory development in this area. Consequently, a new model/method is suggested, drawing on regression analysis, exponential growth modeling (similar as espoused in population ecology) as well as the principles of allometric growth (empirical law in biological science). This integrated urban spatial expansion estimation model (IUSEEM) proposed in this study is capable of handling non-linearity, is 'truly' dynamic and is suitable for quantifying human induced environmental change, with specific reference to FDI- urban land expansion over time.

Human-Environment relationship - Induced Environmental Change

Human induced environmental change and degradation have been a major concern of geography since the days of George Perkins Marsh, through to Carl Sauer and to the present. The United Nations International Strategy for Disaster Reduction (UNISDR) defines environmental degradation as “the reduction of the capacity of the environment to meet social and ecological needs and objectives” (UNISDR, 2009). Going by this definition of environmental degradation the concern with ecological needs is obvious but, perhaps, a more comprehensive definition would be that

Environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife (Wikipedia, 2012).

Environmental degradation is increasingly being recognized as a formidable global problem and is noted to be one of the Ten Threats officially cautioned by the High Level Threat Panel of the United Nations. The United Nations' Millennium Ecosystem Assessment concluded that as much as 15 of 24 identified ecosystem services had been degraded within the last 100 years (UN, 2003). The report noted that key human activities such as increasing use of fossil fuels and natural resources were undermining critical ecosystems services which could have adverse consequences on food supplies, freshwater resources, wood and fiber, among other things. Thus, environmental degradation is staring humanity in the face. Important components of environmental degradation include changes in the atmosphere, biosphere and specifically, the land and its resources. Deterioration in the conditions of the last category, usually described as land degradation has some resonance with FDI induced urban land expansion as espoused in this dissertation.

According to the United Nations, land degradation is: "any process that results in loss of biological resources, the soil, vegetation or water systems as a result of drought" (United Nations, 1994 cited in Adewuyi, 2011: 32). However, land degradation can be attributed to numerous causes, spanning natural occurrences and human-made activities. It is widely held that land degradation is an important issue plaguing mankind currently, having potentially negative implications for agricultural productivity, environmental sustainability and food security. Even though land degradation may result from numerous causes, anthropogenic causes have been found to be more enduring and even accentuate naturally occurring events that degrade the land (UN, 2009). For example, it has been noted that structures built across watercourses and

wetlands for urban development have contributed significantly to worsen flooding in Accra (Grant & Yankson, 2003). From this perspective, the major causes of land degradation may include land clearance, depletion of soil nutrients, overgrazing, dumping of industrial wastes, mineral exploitation, oil spill, urban development in general and sprawl, in particular. That these human activities are driven mostly by economic motivations is not too difficult to see. For example, the World Bank researchers Lelia Croitoru and Maria Sarraf have noted that: "That environmental degradation can be a by-product of economic activities is no secret." (Croitoru and Sarraf, 2010: 1). What is more contentious, though, is the fact that economic globalization drives environmental change; and the extent to which globalization can be implicated in environmental change and degradation.

Globalization and Environment

Jennifer Clapp and Peter Dauvergne write:

Globalization is a multidimensional process, broadly restructuring and integrating the world's economies, institutions, and civil society. It is a dynamic, ongoing, and accelerating process that is increasing the links among actors, as well as the structures within which they operate, both within states and across borders. Trade, production, and finance are now more globally integrated than ever before, as are global organizations and social movements. In simple terms globalization means that the events and actions in one part of the world are affecting people in distant lands much more quickly, and with greater frequency and intensity. (Clapp & Dauvergne, 2005: 20).

The authors further assert that: "It further suggests that we are moving toward an effectively borderless world, especially for ideas and money" (p. 20). Two important observations relevant to the argument in this chapter can be drawn from the foregoing:

(i) consequences of decisions in one location may generate change, including land use/land cover changes, in locations far away from the origin within a short time; and (ii)

almost seamless transmission of ideas and money across the surface of the earth. In a similar vein, investment decisions made elsewhere trigger the flow of global money (mostly in the form of capital such as FDI) across the surface of the earth. Thus, globalization also embodies economic flows whose impact on origin and destination locations alike could be analyzed. However, this is a daunting task due to the complexity of the phenomena involved, a source of worry to analysts as has been rightly pointed out by Clapp and Dauvergne(2005): “Separating the drivers from the consequences of globalization is difficult, because the consequences are themselves constantly reshaping the drivers” (p. 21). It is generally accepted that economic activities do have environmental repercussions as has been noted by Lelia Croitoru and Maria Sarraf:

Industrial production often discharges pollutants into clean rivers and air, preventing the use of these resources for other purposes and harming the health of those exposed them. Unsustainable agricultural practices can reduce crop productivity and cause dam sedimentation. Overexploitation of groundwater increases pumping costs and, if it leads to saltwater intrusion, may make aquifers unusable. (Croitoru and Sarraf, 2010: 1).

However, what is not too clear is the globalization-environmental change linkages usually bordering on the causes and impacts. In effect, whereas environmental change driven by human economic activities may be less contentious, it is not easy for people to agree on a set of environmental problems that can be linked to causes due to globalization, resulting in people having their own preferred worldviews. Four of such worldview categories, presumably most dominant, have been described by Clapp and Dauvergne (2005) which may provide further elucidation for the present argument. Firstly, *Social greens* make social and environmental justice their main focus with the view that “social injustice at both local and global levels feeds environmental crisis”

(Clapp & Dauvergne, 2005: 14). According to proponents of this worldview, large-scale industrialization such as brought on by economic globalization leads to exploitation and degrades the environment. Thus, globalization, according to social greens, accelerates exploitation, inequalities, and ecological injustice; arguing that the acceleration of globalization enables overconsumption by developed economies which put enormous stress on the environment (Clapp & Dauvergne, 2005: 14). Secondly, *Bio-environmentalists* focus their attention on ecosystems, believing that human survival is increasingly being threatened by eminent ecological crisis as the earth's carrying capacity is exceeded by overpopulation, excessive economic growth and overconsumption. To the bio-environmentalist, therefore:

Economic globalization drives unsustainable growth, trade, investment and increasing debt, which accelerate the depletion of natural resources as well as problems of waste disposal. (Clapp & Dauvergne, 2005: 14).

It is to be noted that the *social greens* and the *bio-environmentalists* both emphasize human consumption as a contributor to global ecological crisis but differ on the specifics. Bio-environmentalists believe strongly that growth should be limited, population controlled and consumption reduced but social greens do not specifically concern themselves with these, believing that social justice will mitigate the world's problems resulting from globalization, including the ecological crisis. Again, whereas ecological crisis is only one of the concerns for the social greens, it is the main concern of the bio-environmentalists. Thirdly, *Institutionalists* do not acknowledge that there is already ecological crisis but believe there is the potential if humanity fails to strengthen and improve institutional capacity in order to address environmental problems and underdevelopment, among other things. They believe that economic globalization can be managed to promote stronger institutions that will ultimately improve human welfare

and enable people to manage the global environment. In effect, therefore, *Institutionalists* believe economic globalization would impact positively on the environment if properly managed through stronger institutions, but advocate a cautious approach to human development. This view contrasts sharply with both the social greens and the bio-environmentalists who believe globalization should be “tamed”, in essence. Lastly, *Market Liberals* focus their attention on the free market functioning of economies, acknowledging that there are “some inevitable problems but overall, modern science, technology, ingenuity, and money are improving the global environment.” (Clapp & Dauvergne, 2005: 14). Motivated by neoclassical economics, Market Liberals hold the view that economic growth and increasing levels of per capita incomes are necessary to sustain human welfare, seeing “globalization as a positive force, because it promotes economic growth as well as global integration” (Clapp & Dauvergne, 2005: 14-15). Consequently, market liberals “believe in the value of economic growth, globalization, trade, foreign investment, technology and the notion of sustainable development” (Clapp & Dauvergne, 2005: 4). One cardinal assertion of market liberals is that economic growth and poverty alleviation can best be pursued with increasing globalization, not less (Clapp & Dauvergne, 2005). Since market liberals favor increased globalization, perhaps it is fair to say that their worldview as described above has dominated the *economy-environment* relationship thinking, as has been exemplified by Kuznets’s theory which postulated an inverted U-shaped relationship between economic growth and environmental quality in what has been described as the environmental Kuznets curve (Antle & Heidebrink, 1995; Grossman & Krueger, 1991). The basic tenet of the theory (or hypothesis) is that at the initial stages, economic

growth would impact negatively on environmental quality, but as economic growth and development proceed, countries would be better equipped to take good care of the environment leading to improved environmental quality. Essentially, therefore, the Environmental Kuznets Curve (EKC) theory attempted to associate economic growth and environmental quality degradation but, in the view of some researchers (Clapp & Daugverne, 2005; Costanza et al., 1997, among others), the theory sought to “water down” the environmental impacts of economic growth by postulating that even though there would be deterioration in environmental quality, society would be able to protect the environment in the end. The flaws inherent in this argument have been documented in the literature (Clapp & Daugverne, 2005; Costanza et al., 1997), and widespread environmental quality deterioration has been observed. Gradually, therefore, “popular” thinking seems to shift in favor of seeking some “middle-ground” that will seek to address simultaneously the world’s social, economic and environmental problems. This formed the focus of United Nation’s conference on Environment and Development in 1987, giving birth to perhaps the most popular phrase in global development-environmental discourse currently -“Sustainable Development” in the famous “Brundtland Report” (UN, 1987). It appears that the concept of sustainable development captures many of the concerns from the four camps enumerated above, at least, literally. The World Commission on Environment and Development (WCED) defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987, cited in Clapp & Dauvergne, 2005: 4). Sustainable development is usually conceived of as comprising of the three components of economic, social and

environment (Costanza et al., 1997), and its appeal cuts across traditional disciplinary and political boundaries, attesting to its perceived usefulness to the social-economic-environment discourses. For instance, Bettencourt and Kaur (2011) note that

The concepts of sustainable development have experienced extraordinary success since their advent in the 1980s. They are now an integral part of the agenda of governments and corporations, and their goals have become central to the mission of research laboratories and universities worldwide. (p. 1).

Many researchers would agree that the pursuance of the 'noble' notions inherent in sustainable development has contributed immensely to the new field of *Sustainability Science* that is currently gaining enormous popularity among a wide community of researchers. Judging from its scope, Sustainability Science appears to be the most relevant discipline yet that tackles the social-economic-environmental conflicts head-on.

For example, Bettencourt and Kaur assert that

The main themes that define the field, the concept of integrated management of human, social, and ecological systems and of the engineering and policy studies that support and enable them, are the true crosscutting subjects that unify the field. (Bettencourt and Kaur, 2011: 4).

Thus, Sustainability Science with its focus on "integrated management" embodies researchers from traditional disciplines-both in the physical and social sciences, including geographers, economists and urban planners, attempting to use scientific tools and methods to effectively address issues bordering on human-environment relationship. Importantly, that sustainability science is the 'bedfellow' of sustainable development is not shrouded in secrecy, according to Bettencourt and Kaur (2011); asserting that

The single most important feature of growth in the field is the steep rise in its growth rate in the late 1980s and early 1990s. This corresponds to the years that followed the publication of the Brundtland report, a widely acknowledged formative document for the field published in 1987 and

around the time of the important publication of Agenda 21 at the Rio Earth summit in 1992. (Bettencourt & Kaur, 2011: 5).

This is not to suggest that the problems have been resolved to the satisfaction of everyone, at least not to some urban planning scholars and practitioners. For example, Scott Campbell, a well-known urban planner and professor of Planning has a take:

In the coming years planners face tough decisions about where they stand on protecting the green city, promoting the economically growing city, and advocating social justice. Conflicts among these goals are not superficial ones arising simply from personal preferences. Nor are they merely conceptual, among the abstract notions of ecological, economic, and political logic, nor a temporary problem caused by the untimely confluence of environmental awareness and economic recession.... And though sustainable development aspires to alluring, holistic way of evading these conflicts, they cannot be shaken off easily. (Campbell, 2003: 435-458).

Coming from a seasoned urban planner, the concern would imply that cities have not been spared by the controversies surrounding the economy-environment relationships and that there is yet to be an enduring solution. Thus, with particular reference to the economy-environment linkage in the urban setting, it is not clear Sustainability Science has developed tools and methods that can be used to trace specific economic drivers of globalization to some specific types of urban change in destination locations in quantitative terms. For example, how does foreign money invested in urban economies of countries other than the origin of the money affect the urban biophysical environment by way of spatial expansion? Understanding such a linkage is imperative because there are good indications that increasing globalization fuels high levels of economic activities. Furthermore, high levels of economic activities would require more environmental resources as input and also for waste disposal both of which have been known to increase environmental stress. Also, that the city is the “engine” of economic growth for nations has long been recognized. High levels of economic activities, with

increasing levels of urbanization, could impact negatively on the environment, potentially degrading the natural system. Consequently, in very general terms, considerable research efforts have been geared towards understanding the impacts of economic growth on the physical environment, especially on land and its biological resources (Turner et al., 2004; McKinney, 2002; Sanderson et al., 2002).

Concerns about global land cover change has increased considerably, particularly since the 1980s when remotely sensed data became available and other methods of analyzing land cover change became sophisticated (Lepers et al., 2005: 115; Turner, 2002). Land cover change can simply be described as the alteration of the surface of the earth by humans in order to enhance their well-being such as “replacing existing vegetation with species more suitable for human consumption” (Defries et al, 2004: 1). In so doing, therefore, natural ecosystems and bioregions are greatly altered and modified. The process has contributed significantly to species habitat loss and consequently to a general decline in biological diversity – biodiversity loss (IUCN, 2006). In particular, it is generally acknowledged that global biodiversity is seriously under threat (UN, 2003). Other ramifications of rapid land cover change globally that have been identified include modification of hydrological processes and climate change (Defries et al., 2004), for example.

Biodiversity can be conceived at three levels – ecosystems, species and genetic biodiversity (Spray et al., 2003: 29-33) and land cover change, especially, those resulting in impervious surfaces such as urbanization (urban land conversion), has the potential of affecting all three levels of biodiversity (Defries et al., 2004), mostly driven by increasing economic activities. These are just a few examples which go to buttress

the assertion that economic activities are increasingly impacting negatively on the biophysical environments of the world. As noted above, urban areas are at the center of global economic growth and therefore the fact that natural areas of cities have been caught in the global environmental change process is no longer in dispute .

Urban Environmental Change

Viewed from a purely economic perspective, urban spatial expansion can be considered as progress for people since such urban growth usually occurs when the national and urban economies are booming. However, urban size and its change over time have several implications, including increasing costs of commuting, rising levels of carbon dioxide emission, loss of sensitive ecological lands, among other things, often resulting in poor quality environment or environmental degradation (Seto et al., 2011; Wackernagel, 2000; Costanza et al., 1997). Major urban environmental quality deterioration (often termed environmental degradation) may be grouped into: (1) pollution (2) congestion, and (3) degradation of natural support systems (World Bank, 2004). The latter is generally held to encompass pollution, loss of biodiversity, waste or toxic accumulation and disposal, and general depletion of natural resources through activities such as deforestation, depletion of fresh water resources, paper consumption, among other things (Jha & Murthy, 2003, cited in UNDP, 2006: 35). In order to measure the extent to which urbanization impact these important ecological constituents a number of studies have focused on identifying and quantifying the extent of human impact on the earth's resources. A particularly relevant effort which resonates with this work is the human footprint or ecological footprint analysis (Wackernagel, 2006; Sanderson et al., 2002). Sanderson et al. (2002) were able to map the human footprint based on factors such as land transformation rates, human access to resources, human

population density and power infrastructure (pp. 892-895). According to the authors, more economically advanced countries such as USA and the Western European countries were found to score higher (high impact) than developing or poor countries. The general conclusion was that human beings are fast depleting the 'wild' (Sanderson et al., 2002). This supports the fact that increasing urbanization levels, usually associated with economic growth could also lead to increasing depletion of natural / environmental resources. Similarly, Wackernagel et al. (2006) have argued that rapid urbanization is putting considerable strain on the earth's ecological resources since in addition to land conversion for city expansion, increasingly, resources from distant locations are required to support the urban population. Therefore, even though the urban built environment occupies a far smaller proportion of earth's lands, high urbanization levels usually correlate with high levels of economic growth, implying that corresponding ecological footprint would be high in high economic growth, highly urbanized areas. For instance, it was found that the average Canadian needed 7.5 hectares of land to support his/her consumption. The average urban dweller in Mexico and India, on the other hand, required about 2.4 hectares and 0.7 hectares, respectively (Wackernagel et al., 2006: 105). Thus, it would seem that increased economic growth and attendant increased urbanization exert larger ecological impacts and would have the potential of lowering environmental quality and sustainability, if not properly managed. Arguably, therefore, within a given country, urban dwellers would appropriate more ecological resources compared to their rural counterparts. Generally, therefore, as discussed above, Sanderson et al. (2002) and Wackernagel (2006) have shown that cities need large volumes of earth's resources to support city dwellers and that these

resources could come from afar and encompass large areas far in excess of their physical sizes, thanks to international trade and globalization. Hence, it has been asserted that even though urbanized areas constitute only about 2 percent of the land surface of the earth, urban dwellers consume over 75% of the earth's resources and generate over 70% of wastes which would require increasing capacities of assimilation and natural recycling by the environment (Wackernagel, 2006; Turner et al., 2004; Costanza et al., 1997). A particularly disturbing aspect of urbanization in relation to urban natural areas is the increasing "built footprint" which entails almost complete removal of the entire vegetation cover when pristine and agricultural lands are converted into urban uses. More formally, as more lands are transformed into built up area, a proportionate amount of vegetation cover is lost in the biophysical system. This is plausible because unlike other components of ecological footprint such as the food footprint, built footprint cannot be "exported" (Rees & Wackernagel, 1996); implying that the full impact of the spatial expansion must be borne by the regional biophysical system of which the urban area is a subsystem (Chapter 1). It is this "In Situ" nature of the ecological consequences of urban spatial expansion, according to the argument advanced in this dissertation, which could result in environmental and land degradation in the absence of effective urban growth management policy. It would not be gainsaying to suggest that such a situation would have negative implications for environmental quality and undermine urban sustainability efforts since "land degradation is a long recognized environmental issue, which straddles both the physical and social sciences" (Adewuyi, 2010: 29), placing it in the purview of subjects like urban economics, economic geography and urban geography. Many researchers in these traditional

disciplines who study land change processes and consequences are contributing to Sustainability Science under *Land Change Science*. Integrating GIS, remote sensing and statistical modeling, scholars have studied land change dynamics in agro-ecosystems, forest systems, with some few attempts relating to peri-urban land conversion. However, it seems that by focusing on local agent behavior and masking economic motives, such approaches may be giving less than fuller explanation of contemporary urban land expansion, especially as pertains to peri-urban land expansion in primate cities in developing country setting. Again, even though such works may be grounded in economic theory they fail to incorporate influences of global economic forces explicitly in the peri-urban land conversion process. Given the preponderance of FDI to concentrate in urban areas, human-induced urban environmental change studies would benefit from contextualization in a broader *Globalization-Economy-Environment* framework, rather than the usual *economy – environment* framework. This is because the latter would have the tendency of limiting the focus to the urban economy since it corresponds to the urban environment. However, in an increasingly globalizing era with linked urban economies and liberalized national economies, economic forces of globalization may be more potent as drivers of urban land use decisions than traditionally recognized, giving rise to what has been described in this study as *FDI induced urban spatial expansion* which may contribute to urban environmental degradation via land degradation. Nonetheless, FDI may be found in places other than urban areas, and contribute to environmental degradation in such areas. For example, FDI in mining have been known to cause land degradation and pollution of water bodies in rural areas in Ghana. However, what makes urban

environmental degradation more precarious in an era of intensifying economic globalization is the fact that economic globalization has been characterized by increasing FDI flows which have tendencies to concentrate in existing economically viable locations that are usually urban areas. In effect, FDI could contribute to urban environmental degradation as economic activities increased in the wake of increased FDI inflows into the urban economy; by accelerating the land conversion process but has not been contextualized in standard urban economic theory that would allow for “rational and consistent explanation” in the words of Harvey (1969) as would be expected. Consequently, it may be worthwhile to integrate concepts, ideas and theories from some relevant disciplines, which perhaps, may add to the efforts aimed at constructing an acceptable and useful theory of sustainability. We are reminded that:

We are in an era of globalization. As a process that touches on many aspects of our economies, societies, and cultures, it is important to investigate how it interfaces with global environmental change. (Clapp & Dauvergne, 2005: 19).

In this regard economic geography, urban geography and urban economics appear to have some prospects worth considering.

Globalization-Economy-Environment: Geographical Perspectives and Urban Economic Theory

Economic globalization is a major driver of economic activities across the surface of the earth; therefore, economic globalization is partly to blame for global environmental change, falling into the realm of human induced environmental change. However, the globalization -economy– environmental change relationship is a complex one with different worldviews bordering on the causes and ways to mitigate adverse consequences as has been noted above. It seems obvious that geography as a discipline that straddles the socioeconomic and the biophysical processes is relatively

better positioned, from a single subject perspective, to offer valuable insights. Thus, human impacts on ecosystems, including lands and its resources, can be best understood from a geographical perspective. Indeed, it is common knowledge that geography, from the beginning of its inception as an academic discipline has concerned itself with human-environment interactions (Ruhl et al., 2007; Johnston et al., 2002; Johnston, 2000). However, it is no secret that geography lacks a single all-encompassing definition but it is hardly the only discipline plagued with this; it is especially so among the social sciences. Nonetheless, perhaps, R.J. Johnston's definition of Human Geography will best suit the purpose here. Johnston has defined Human Geography as

That part of the discipline of geography concerned with the spatial differentiation and organization of human activity and its interrelationships with the physical environment. (Johnston et al., 2002: 353).

Thus, even from a *human geographic* perspective, supposedly concerned with "social" phenomena, the need for geographical analysis to link the human activity being studied to the physical /environmental basis is stated without ambiguity. One cannot help, therefore, but to agree with J.B. Ruhl and colleagues when they note that

Although terms have changed and concepts have become more precise over the decades, geographers have been keenly interested in natural capital and ecosystem services, and in human impacts on these, throughout modern times. (Ruhl et al., 2007: 36).

Essentially, Geographers' attempts at generalization of the human – environment relationship led to two important but relegated "theoretical" debates in geography which have come to be known as *Environmental Determinism* and *Environmental Possibilism*. Proponents of Environmental Determinism (William Morris Davis, Ellen Chruchill Semple and Griffith Taylor, for example) argued that humans were passive and

responded to environmental and climatic influences. Indeed, Ellen Semple is noted to have written that “Man is the product of the earth’s surface” (Johnston, 2001: 42), implying that human behavior is governed by physical environmental dictates. That this was an important endeavor in its era has been underscored by R.J Johnston, thus:

Instead of merely presenting information in an organized manner, either topically or by area, geographers sought explanations for the patterns of human occupation of the earth’s surface. Their major initial source for explanations was the physical environment, and a theoretical position was established around the belief that the nature of human activity was controlled by the parameters of the physical world within which it was set. (Johnston, 2001: 42).

However, Environmental Determinism was found to be overly simplistic as well as containing racist connotations which were in bad taste, drawing adverse criticisms.

Consequently, reactions to Environmental Determinism gave birth to the opposite side of the same coin, Environmental Possibilism. According to R.J Johnston (2001),

Environmental Possibilism

Presented the individual as an active rather than a passive agent. Led by French geographers, followers of the Annales school historian Lucien Febvre, Possibilists presented a model of people perceiving the range of alternative uses to which they could put an environment and selecting that which best fitted their cultural dispositions (p. 43).

The key notion, and important point, is that the environment offered humans possibilities that with culture (tools and implements), humanity can achieve their economic agenda.

Carl Sauer’s (1925) work is often cited as a shining example of geographical scholarship in this regard. For example, J.B. Ruhl and colleagues note:

Carl Sauer, in his 1925 *The morphology of the Landscape*, conceptualized the landscape as a product of what today we would call “coevolution” between nature and society. His work contrasted strongly with the environmental determinist school dominant at the time. (Ruhl et al., 2007:37).

Thus, before concerns that human activity was causing major environmental changes gained popularity beginning in the 1960s, geographers had been grappling with how to better conceptualize and analyze human-environment relationships. Admittedly, both Environmental Determinism and Environmental Possibilism went to extremes, they cannot be ruled irrelevant. Even with regard to the so called infamous Environmental Determinism, it is not too clear if we have totally abandoned the notions expressed. It appears that even people outside mainstream geographical research are still holding on. For example, Ruhl et al. (2007) concur that Environmental Determinism “was resoundingly rejected in the 1940s due to its association with racism and imperialism” (p.37). But the authors continue

Nevertheless, Jared Diamond, in his Pulitzer Prize – winning book, *Guns, Germs and Steel* (1999), has reported the issue of the powerful influence of geographical relationships and ecosystem characteristics on the unfolding of human history in a manner that rejects racism while embracing the archeological record, modern genetic analysis, and history as a natural laboratory. Diamond theorizes, for example, that the existence of domesticable wild plants such as wheat and barley and wild animals such as goats, sheep, and cattle launched the Fertile Crescent, the northern part of what is now termed Middle East, onto a trajectory of social development that includes urbanization, political hierarchy, metallurgy, writing, and, unfortunately, pandemic diseases derived from livestock. The longitudinal diffusion of these social innovations east and west, and to similar latitudes in the Western and Southern Hemispheres, explains, according to Diamond, why Europeans, and to a lesser extent East Asians, have been able to dominate indigenous peoples of the Americas, Australia, and southern Africa. (Ruhl et al., 2007: 37-38).

That a book containing this assertion should win a respectable prize is food for thought. Perhaps, a middle ground between Environmental Determinism and Environmental Possibilism would have put geographers ahead in the area of human-environment relationship study but this never materialized. As a result, the assertion that:

For over a century geographers have not come to agreement over the *raison 'etre* of the discipline, whether it is spatial analysis or nature-society

relationships, and this leaves geography lacking a core theory that can be applied to the subject of ecosystem services. (Ruhl et al., 2007: 38, citing Turner, 2002).

may not be too far-fetched . In effect, there is no core geographical theory explaining human-environment interactions. However, human economic activities continue to change the physical environment. Global capital continues to flow into distant locations (including urban areas) and effect environmental changes in these localities. Even without a core theory, the discipline of geography has rich perspectives to offer in understanding globally induced urban environmental change such as FDI induced urban land expansion (and degradation), especially from the perspective of economic and urban geography. More specifically, it has been noted:

As a field of study, economic geography focuses on the flows in the economy: the activities of distribution....The economic flows of interest in economic geography are not confined to goods and other materials, however, because flows of people, services, and information also are necessary in an economy. (Hanink, 1997: 2).

Global capital moves from one location to the other in search of high returns on investments. Basically, from a geographical perspective, there is a *spatial differentiation* (a core focus of geography) in the distribution of returns on investments, necessitating *movement* (an important fundamental theme of geography). Similarly, the sub-discipline of urban geography takes an integrative approach seeking to understand *human-environment interactions* (an important fundamental theme of geography) “holistically” in an urban setting. Consequently, from a geographical perspective, FDI flow across the surface of the earth is an instance of geographical imperative of spatial differentiation at work whereby foreign investors seek out locations with potentials for high returns on capital. Once such a place is located and capital flows in, human economic activities requiring the use of some environmental resources, including land, get reinforced or get

started giving rise to an instance of human-environment interactions. In the context of the concept of *FDI induced urban spatial expansion*, inflows of FDI leads to more lands being converted to built-up areas; once built, these may attract more rounds of FDI inflows, more land conversion follows, and so forth. However, more details can be added for a more comprehensive understanding by integration of the geographical perspectives with urban economic theory, particularly relating to the Thunen-Alonso theoretical framework (Chapter 4 of this dissertation), drawing on current extensions such as provided by Angel et al. (2011; 2005).

The Thunen-Alonso Theoretical Framework

The basics of the Thunen-Alonso Theoretical framework, drawing heavily on current extensions capable of modeling urban extent expansion as a function of socioeconomic variables, have been laid down in Chapter 4 of this dissertation. Distance, a key geographical imperative, is an important unifying concept affecting the geographical distribution of urban land values - lands close to the CBD command higher prices compared to lands in the urban periphery, generally. This reflects an original attempt by economists to input geographical considerations in economic theory, after years of relative neglect (Alonso, 1964). In formalizing the classical urban land value theory, therefore, William Alonso commented that “the method is that of economics, and the concern ultimately geographic’ (Alonso, 1964: preface). Distance was to play a pivotal role in the explanation of differential land values in the city. Even though a progress, urban land value theory constructed this way leaves out many important considerations from the perspective of geography which when included may give a more complete understanding, especially for the emerging phenomenon of FDI induced urban land expansion. For instance, the concept of spatial differentiation may help

explain why FDI is /can be concentrated in the city, which in turn may partly explain increasing demand for land, even when local population and incomes (traditionally most important urban land expansion drivers) may remain unchanged or even decline. In this regard geography offers the critical perspective needed to look beyond what is happening in the local urban economy and country. The importance of this cannot be overemphasized given ever-increasing economic globalization in the current era. On the national and local scales, spatial differentiation may help explain why FDI concentrates in primate cities within the national urban systems – unequal geographical distribution of potential high returns on investments- such locations offer better prospects compared to other urban areas in the country. However, the details still requires economic theoretical analysis of agglomeration economics for example. For now, focusing on what FDI does once in the urban system: Economic activities rejuvenated, demand for land increases (Chapter 2; Chapter 4), and driving urban land values higher. Peri-urban land values are lower compared to inner city lands but higher than agricultural land because returns of peri-urban land put to urban uses would earn higher returns than in agricultural uses. In short, holding lands in the urban periphery in a rapidly expanding and fast globalizing city may not be a wise land use decision since one would be incurring rising opportunity cost. Importantly, land will be put to “its highest value and best use” by converting from agricultural to urban uses. Consequently, in such a city peri-urban land expansion gets accelerated.

Following from the foregoing discussion, preliminary hypotheses may be developed by the integration of economic geography, urban geography and urban economics. Urban economic theory informs the geographic perspective just as the

geographic perspectives and themes inform economic theory akin to what the geographer, I. Burton, said many years ago and concurred by Harvey (1969): “one role of an economic geographer is to refine and adapt available economic theory” (Burton, 1963: 159; cited in Harvey, 1969: 119).

Premises for the initial hypotheses

- Distributions of Potential Returns on investments are geographically uneven: locations with high (at least, perceived) returns attract high inflows of FDI
- Foreign investors move global capital to attractive locations resulting in the spatial differentiation of FDI distribution globally: FDI peaks and troughs.
- Urban areas, usually characterized by agglomerations, skilled labor pool, infrastructure and the likes, serve as attractive foreign investment locations, drawing increasing volumes of FDI
- FDI inflows into the urban economy rejuvenate economic activities; create jobs, contribute to increasing demand for housing and land.
- Increasing demand for housing and land cause urban land values to rise: But peri-urban land is cheaper than land in the inner city.
- Peri-urban land value is less than inner core land value but higher than agricultural land value. For urban use purposes, therefore, peri-urban land is cheaper, and profitable. To the peri-urban land owner, the land will be put to its highest and best use by converting to urban uses (sell to developers or self-build), at least to avoid increasing opportunity cost associated with holding the land in agriculture.

Based on the outlined premises above, the following initial hypotheses are advanced:

Hypothesis 1a: Sustained FDI concentration in urban location accelerates rate of expansion of the urban extent.

Hypothesis 1b: Varying levels of FDI concentration will result in differential rates of urban land expansion.

Hypothesis 2: Rate of FDI inflows to urban location and rate of expansion of the urban extent are related by exponential function; best explained by exponential model.

Testing the hypotheses above would require an appropriate method capable of *quantifying the rate of urban land expansion as a function of the change in the volume of annual FDI inflows.*

Quantifying FDI Induced Urban Spatial Expansion

It is common knowledge that the socioeconomic system and the biophysical system are interrelated in complex ways (Costanza et al., 1997; Jansson et al., 1994). Humans affect and are affected by the environment as has long been forged by geographers and relationships are more likely non-linear and dynamic, especially when put in temporal perspective. Tracing the environmental footprints within a given region of an economic activity, generated even within the same region, is a daunting task which is further compounded by the fact that observed environmental change in a locality might have been 'engineered' by economic decisions made far away before impacting local land use decisions elsewhere. FDI induced urban spatial expansion is a typical case in point-investment decisions made by people all over the world result in the flow of global capital into desirable high returns locations, with urban areas being particularly attractive locations. The following review will lay the foundations for developing an integrated urban spatial expansion method or model (IUSEEM) which is non-linear, dynamic and stochastic in functional form, in order to closely approximate the process interfacing the socioeconomic-biophysical systems. Moreover, and perhaps more important, it would be desirable if such a method is effective but simple enough to be widely accessible to interested researchers as well as being firmly grounded in some standard or acceptable theory, especially in an urban economic theory. The question

then is: is such a model / method readily available? Indications are that such a method or model, specifically capable of quantifying FDI induced urban spatial expansion over time in a manner described above is not currently available, hence the need for the proposed model / method formulated in this work.

Modeling

Models often are structured by some theoretical framework, and yet theories have been defined in a multitude of ways in the social sciences (Jaccard & Jacoby, 2010: 28).

Jaccard and Jacoby (2010) cite Hollander (1967: 55) thus:

Basically, a theory consists of one or more functional statements or propositions that treat the relationship of variables so as to account for a phenomenon or set of phenomena. (Jaccard & Jacoby, 2010: 28).

In spite of the numerous definitions, it is generally believed that at the core of all theories is made up of concepts and relationships, leading Jaccard and Jacoby (2010) to simply define a theory as “a set of statements about the relationships between two or more concepts or constructs” (p. 28). The importance of theory to scientific explanation is widely recognized and appreciated among researchers to the extent that some have argued that “the development of theory is at the heart of all explanation, and most writers doubt if observation or description can be theory-free” (Harvey, 1969: 87). In the light of the foregoing, it is not too difficult to understand why a model or estimation method with solid theoretical foundation is likely to be viewed favorably within the scientific research community and would have the potential for practical applications. Regarded as a process, theory consists of formulating concepts and developing them into symbolic expressions (Jaccard & Jacoby, 2010: 28). It must be noted that in the social sciences the dividing line between a theory and a model is often thin and blurred (Jaccard & Jacoby, 2010; Harvey, 1969) A more simplified perspective on theories

shared by this author is that: “The quest for an explanation is a quest for theory” (Zetterberg, 1965, cited in Harvey, 1969: 87). Just as there are numerous definitions of what a theory is there are multitude of theories that purport to explain urban growth and spatial structure. These include but not limited to, location theory, the rank size rule and central place theory, the growth pole theory, Von Thunen’s agricultural land use theory and Alonso’s urban land use theory, to mention a few (Aniya Masamu, 2010: 12-13). The elaboration of the theory types is not the focus of this chapter, however. Aniya Masamu (2010), for example, provides more insights in this regard. But, in seeking to model urban spatial expansion, as driven by an external economic force (FDI), the study shares in the view that: “without theory we cannot hope for controlled, consistent, and rational, explanation of events.” (Harvey, 1969: 486). Consequently, this chapter attempts to link spatially explicit urban growth modeling to the standard classical economic theory of urban land use, in the light of economic globalization to construct a simple *urban spatial expansion (urban land conversion) estimation method*. However, the complexity of the human-environment interactions study requires gaining some control by isolating only the potentially relevant variables for closer scrutiny. Consequently, model construction becomes inevitable, if not desirable. In other words, the complexity of the relationships between socioeconomic variables and biophysical systems (to which this writer argues FDI-induced urban spatial expansion belongs) necessitates some simplifications in order to focus on the most important aspects, hence the importance of modeling in order to achieve the goals in this chapter.

There is no single definition for what model is. However, in very broad terms, according to the renowned geographer Ron Johnston and colleagues, a model can be

defined as “an idealized and structured representation of the real” (Johnston et al., 2002: 508). Most important from the geographical viewpoint, it has been argued that it can also include reasoning about the real world by means of translations in space (to give spatial models) or in time (to give historical models) Meadows (1957, cited in Chorley & Haggett, 1970). Thus, spatio-temporal relationships study which occupy many geographers benefit from model construction, encouraged by the view that “reality exists as a patterned and bounded connexion which has been explored by the use of simplified patterns of symbols, rules and processes” (Chorley & Haggett, 1970: 22). For Chorley and Haggett (1970), therefore, a model is thus a simplified structuring of reality which presents supposedly significant features or relationships in a generalized form (p. 22). It is commonly accepted, therefore, that a model is an abstraction from real world phenomenon in an attempt to generalize in order to focus on the fundamental (presumably most important) aspects of some real world process. This requires some degree of selectivity, leading some researchers to characterize models as highly subjective approximations in that they do not include all associated observations or measurements, but as such they are valuable in obscuring incidental detail and in allowing fundamental aspects of reality to appear (Chorley & Haggett, 1972: 22). In effect, therefore, model building is a worthwhile exercise which can result in rounds of increasing understanding about real world phenomena since it is simplified and may guide further development; and in this regard the author of this dissertation research agrees with other researchers that a promising model is “one with implications rich enough to suggest novel hypotheses and speculations in the primary field of interest” (Black, 1962: 232-233, cited in Harvey, 1969).

Models may be *causal* or *correlational*. Causal models assume a “cause-and-effect relationship”, whereby the explanatory variable usually lags the response variable in time meaning that the change in the explanatory variable precedes the change in the response variable, ideally. Correlational models, on the other hand, normally assert some correspondence between the response variable on the one hand and the explanatory variable(s) on the other, without making causal inferences in an explicit manner. Either implicitly or explicitly models contain propositions in order to test their validity and fitness based on observed real world behavior. Generally, two main propositions may be assumed by the model builder which would result in being classified as *deterministic* or *stochastic*. Firstly, based on observation of the process to be modeled a modeler may assume that the observed variation in the dependent variable can be explained by the selected set of explanatory variables in that an exact relationship is postulated between the dependent variable on the one hand and the set of selected explanatory variables on the other. In short, the change in the dependent variable is determined by the explanatory variable (s) – This is what has been described as a deterministic model. More formally, a deterministic model can be defined as “a mathematical representation in which every variable alters according to a mathematical formula and not to random fluctuations”. (http://www.biology-online.org/dictionary/Deterministic_model). A key aspect of such models is that they do not allow for randomness in the change process in that any randomness may be assumed away or may not be deemed to have any important effect on the dependent variable. In practical terms, these models work well when they are applied to physical processes such as those studied by the disciplines that deal with physical phenomena

such as physics, chemistry, computer science and the likes. With regard to decision making, such models would be useful if all or almost all required information (data) are available and can be quantified with some reasonable accuracy (Malczewski, 1999). Deterministic (mathematical) models have been utilized extensively in optimization, goal programming as well as simulation approaches. For example, the usefulness of optimization modeling in decision making is well known and are believed to yield best results under given constraints—which according to Malczewski “is a normative approach to identify the best solution for a given decision problem”. (1999: 66, citing Wilson et al., 1981).

Secondly, the observed variation in a phenomenon (dependent variable) may not be completely explained by a set of selected explanatory variables. This may result from inadequate information, difficulty of measurement (quantifying) or the existence of general randomness in the process. Given this situation it would be reasonable for the modeler to incorporate randomness in the explanatory portion of the model in order to account for the random fluctuations in the variation. Thus, the inherent ‘probabilistic’ nature of the process could be reasonably accounted for. Models built on such assumption are known as stochastic models. By definition, therefore: “a stochastic model is a mathematical model which takes into consideration the presence of some randomness in one or more of its parameters or variables.” (http://www.biology-online.org/dictionary/Stochastic_model). It must be noted that, unlike deterministic models, even though such stochastic models are characterized as *mathematical* they do not posit exact relationship between dependent variable and independent variables. By design, therefore, stochastic models are well suited to deal with social and economic

phenomena most of which show high degree of probability and randomness in their behavior. Generally, statistical models are mostly stochastic in form and function. Regression modeling, by far the most popular explanatory modeling technique in the social sciences, is based largely on the assumption of randomness in the behavior of the response variable (Rogerson, 2005; Agresti & Finlay, 1999). According to Rogerson (2005: 105) “regression analysis is used to specify and test a functional relationship between variables”. Of particular importance in stochastic modeling is the recognition of the existence of random behavior and its explicit incorporation in the models which is directly included in regression models. Thus, in such models part of the observed variation in the response variable is deemed explainable and can be accounted for by the selected independent variable (s) whereas part of the variation cannot be explained by the available data in the model – represented by an error term (to depict randomness). The integrated urban spatial expansion estimation method to be formalized below incorporates *stochasticity* by implementing coefficients of estimated regression model as the exponent in an exponential growth model; and at the same time is *deterministic* because it utilizes the exponential function.

Since geographers deal with a combination of subject matter cutting across both the physical and the social sciences, modeling appears unavoidable. Richard Harvey has been particularly emphatic stating that

With very weakly developed geographic theory and a highly complex multivariate subject-matter, it is inevitable that the model-concept should play a part in geographic explanation. (Harvey, 1969: 168).

Harvey further advances the argument that given the peculiar situation of geography that deals with complex phenomenon, we cannot help it but rely extensively on models since theories are lacking, if our research efforts are aimed at explanation and

prediction (Harvey, 1969). In the final analysis, Harvey seems to believe that the route to developing a geographical theory is none other than through modeling when he contends that “but in terms of basic research the primary function of model-building in geography must be directed towards the creation of geographic theory” (p. 168). In this regard, models become a means to an end; an end which continues to be viable in the face of mounting societal problems bordering on the socioeconomic - biophysical environment interface which in the opinion of this writer (agreeing with a broad spectrum of geographers) is firmly grounded in the fundamental geographic theme of human-environment interactions. Even though complex, one is encouraged by the fact that applying scientific models afford us the necessary control over such complex phenomena (Ackoff, 1962: 108, cited in Harvey, 1969: 168). In this sense, therefore, the approach adopted in this study to model contemporary urban spatial expansion would be an attempt to exercise control over a complex phenomenon, isolate important features for scrutiny in order to understand how the city’s spatial size changes in response to increasing flows of FDI through time.

Overview of Current urban spatial expansion modeling

Ideally, the cardinal goal of urban researchers would be geared to understand, in a comprehensive manner, all the interrelated, complex functions of the city but it is generally acknowledged that it will be next to impossible to deal with all the important variables and elements at any particular point in time. Thus, Aniya Masamu has stated that

Understanding the dynamic process of urban growth should be based on the linkage with decision-makers. The interaction between the spatial, temporal and decision-making process is much more complicated and decision-making behavior is subjective and fuzzy. (Aniya Masamu, 2010: 22).

And so has it been with the urban growth modeling process. Very generally, urban modeling prospered in the Post World War II era, largely as a result of the quest to find solutions to urban blight and deteriorating health conditions in many cities (Hall & Tewdr-Jones, 2010). Even though the momentum slowed in the 1980s, there has been current resurgence, with particular focus on dealing with the inadequacies of the traditional urban models that had been largely static, linear, and cross-sectional, among other things. One important programmatic outcome of this turn of events is the focus on complexity theory which advocates believed would “cure” the “ills” of the traditional urban models, with proponents like Professor Michael Batty (2005). Thus, the dawn of complexity theory approaches in urban modeling (Batty, 2005; Aniya Masamu 2010) were upon us. Usually used in conjunction with GIS, the defining characteristics of these computationally-intensive models are believed to be dynamism, non-linearity, disaggregated-micro, bottom-up, process-oriented, and the merging of space and time (Sui, 1998, cited in Aniya Masamu, 2010: 22-23). In very basic terms, proponents argue that the city is a complex system (Batty, 2005), with the processes characterized by irreducibility, emergence, instability and unpredictability, among others (Aniya Masamu, 2010; Batty, 2005; Sui, 1998). The most successful, so far, among the “modern” urban growth models is believed to be the approaches that disaggregate the urban landscape into “cells” at fine-grained scale of equally sized grids; and simulated according to some pre-defined rules, generally known as Cellular Automata (CA) models. A further step in this direction is the addition of “agents” to the system who act to change the state of a cell given some constraints - physical, economic, and the likes- also known as the Agent Based Modeling (ABM). Implemented in GIS, these

computationally intensive modeling approaches have promised to better simulate urban growth, urban sprawl in particular, in a most accurate manner with some researchers believing they could better handle spatial dynamics than the traditional urban growth models (Batty, 2005). A particularly ambitious objective has been the claim to accurately represent time and space dimensions, which are integral to the urban system, for a comprehensive understanding of the city through time and space (Batty, 2005). Even though these are noble objectives, they are still yet to be realized as affirmed by Batty (2005), and witnessed by Aniya Masamu:

Batty (2004) notes that most of the new generation models are not inspired by the kind of practical imperatives that forced planners and modelers first to simulate the city in the 1950s . . . and 1960s but technical developments in GIS, urban remote sensing, and by what still remain largely abstract arguments concerning the need to explore cities as emergent complex systems from the bottom-up. (Aniya Masamu, 2010: 24).

It is further noted that

The new generation of models provides a great potential for understanding urban complexity. However, they remain theoretical exploration and still have a long way to go to model urban systems effectively. (Aniya Masamu, 2010: 24).

In addition to yet to be realized “golden” promises, it is also important to note that most of these so called modern urban growth models are not grounded in standard urban economic theory. These observations should be unsettling given that these models were meant to replace the traditional models. It appears that urban simulations have been fun so far but are still not the only way to go. Thus, it seems therefore, that there is a need to re-examine the call for the “whole sale” abandoning of the traditional urban models which are steeped in urban economic theory such as the classical economic theory of urban spatial structure postulated by Alonso (1964). Motivated by these developments the argument is advanced in this chapter to the effect that in modeling we

are reminded that one does not necessarily have to understand all the individual behaviors of the actors in the system, albeit cells, in order to understand how the urban system works, such as the approach taken by most researchers in the so called Land Change Science community. To a large extent “Land Change Science” seems to be the most relevant approach to understanding land conversion from agricultural to urban uses. Methods include use of GIS, Remote Sensing and Statistical modeling. However, Land Change Science approaches seem to be more concerned with the effects of decisions made by landowners that result in the change in the cover of the land, focusing on individual parcels of land as they change over time, sometimes requiring that these change “agents” or “actors” be monitored. In these approaches to land cover change modeling, almost invariably, the force driving the decision is neglected. Sometimes attempts are made to link survey results to the land change process but the focus will still be limited to processes at the local urban or national scale whereas the major driver may be flowing from sources originating outside the country in which the city is located. Additionally, this leads to increasing complexity and error-prone, not to mention the ambiguity explaining exactly how the simulation model works. However, the situation can be simplified if one could link the underlying driver (such as FDI) to the land cover change in a systematic way. The argument is as follows: (a) Land owners are interested in maximizing their utility, and will put the land to activity that brings the highest return (of course there would be exceptions). (b) Particular socioeconomic conditions would motivate land owners to put their lands to some particular uses. For instance, agricultural land owners in the peri-urban areas of a fast globalizing city with expanding real estate demand will more than likely profit from the

land by putting it to urban uses. (c) If such a situation prevails in many instances, one can bypass the decision maker and link the land cover change to the specific socioeconomic conditions supposedly motivating the land owners to seek to turn the land into urban uses. *This is the key underlying assumption for the estimation method developed in this chapter.* In this regard, Alonso's (1964) theory with its current extensions (Angel et al., 2011) comes in handy. Such theoretical postulates can be formalized using mathematical formulations (calculus) and validated using cross-section regression models (Angel et al., 2011; 2005; Chapter 4 of this dissertation). With log-transformation, the estimated coefficients can be interpreted as elasticity or percentage change, denoting the *percentage change in the built up area in response to percentage change (s) in relevant socioeconomic explanatory variable(s)*. In other words, the estimated coefficients of the log-transformed regression models can be regarded as "rate of change". This is a very important, desirable attribute that can be used to integrate regression models and exponential growth modeling as espoused in the IUSEEM, aimed at overcoming the linear and static nature of the cross-sectional regression models. The allometric growth principle (or Allometric Law) is drawn upon to help account for the system-subsystem relationship between urban biophysical system and economic sub-system which is postulated in this dissertation to the effect that the economic subsystem (urban economy dominated by built structures) grows at the expense of the biophysical system. Thus, FDI induced urban land expansion depletes natural vegetation proportionally since land conversion to urban uses removes the vegetation cover almost completely.

Exponential growth function (Model) and the Allometric law: The population growth model.

Generally, the exponential function is denoted by e^x and used as a standard model approximating the relationship in which an independent variable induces a proportional change in a dependent variable. The exponential growth function has been applied in subjects like physics, finance and Biology, among others. More relevant to this study is the application in the study of human population (ecology), whereby the number of births and deaths per person per year can be used to estimate the size of a given population at some given point in time. In this regard, a very popular version of the exponential growth function is the *Malthusian growth model*, also known as the simple exponential growth model. For example, the formula below is used to compute the population growth rate:

$$PGR = \frac{\ln(P(t_2)) - \ln(P(t_1))}{(t_2 - t_1)}$$

5-1

Where, \ln = natural log, P = population, t = time (in years).

To estimate the population at current time (t), therefore, the following formula is usually employed:

$$P(t) = P_0 e^{rt}$$

5-2

Where, P_0 = Initial Population, r = growth rate, t = time (in years). When ' r ' is positive, increasing population is posited, negative r denotes 'negative growth' or decreasing population and when r is zero, population remains the same. Note that in Equation 5-1, ' r ' is equivalent to 'PGR' from Equation 5-1).

The exponential function can be linked to the Law of Allometric growth to attempt to capture the impact one system has on another system or the impact of the change in one part of a system on the whole system. This linkage is necessary for the conceptual approach taken in this dissertation (Chapter 1) in which the urban economic system is viewed as a subsystem of the “larger” regional biophysical system, conforming to some formulations of the Allometric Law or Allometric growth principles.

The Allometric law (or Allometric growth principle)

The Allometric Law is said to have been originally discovered by the biologist John Huxley (Savageu, 1979). In its simplest form, it states that the rate of relative growth of an organ is a constant fraction of the rate of relative growth of the total organism (Savageu, 1979; Nordbeck, 1965). A common allometric equation may be represented as:

$$Y = \alpha X^{\beta}$$

5-3

Where α and β are constants, Y = the size of an organism and X = an organ of the organism. This formulation of the law of allometric growth speaks to the notion of the growth of a component of a system impacting the growth of the whole system (or organism) (Coffey, 1981; Savageu, 1979; Nordbeck, 1965). Of particular importance to geographical research is that as far back as in 1969, David Harvey observed that: “this allometric law has recently been introduced into geography by Nordbeck (1965), Woldenberg and Berry (1967) and several others, to be characteristic of both human and physical geographical systems. (Harvey, 1969: 466).

He further explains that

If we take measurements on some parts of a system and compare them with measures taken on other parts of the system (or over the whole system), we frequently find a basic mathematical relationship holds good, namely the ALLOMETRIC LAW, which has the form: $Y = aX^b$. (Harvey, 1969: 465).

Essentially, therefore, this dissertation research shares in the belief of such luminaries in the geographic discipline regarding the potential usefulness of the allometric law for analyzing geographical systems, hence the attempt to adopt the postulates of the allometric law as the underlying principles for estimating quantity of land consumed by a city at any point in time, driven by economic activities. Even though the allometric growth law is an empirical one the theory of allometric growth, suffice here to say that many researchers have attested to the fact that postulates of the allometric growth law would hold true for both biological / physical systems on the one hand and social and economic systems on the other hand (Harvey, 1969). Consequently, since its formalization the allometric law or principle of allometric growth has been refined and modified to study different systems, both physical and social-economic, as these systems have been identified as generally obeying the postulates of the law (Wartzt, 1975, cited in Thomas & Huggett, 1980; Nordbeck, 1965). In current formulations and applications, particularly, in urban geographical research which is of relevance to this study, is the relationship between the population density and distance to the core of a city (Wartzt, 1975, cited in Thomas & Huggett, 1980; Nordbeck, 1965). Essentially, it has been observed that population density of a city declines as the built up area increases. In other words, population density decreases with distance from the center of the city based on a negative exponential logarithmic function (Wartzt, 1975, cited in Thomas & Huggett, 1980). Furthermore, in broad terms, Coffey (1981) has argued that

Allometry refers to the study of size and its consequences, and relates the differences in proportions of one component of a system to changes in either the absolute magnitude of the system or a second component of the system. (p. 185).

The foregoing outline of the allometric law (principle of allometric growth) shows that *the allometric equation has been conceived and used as a special form of general exponential functions*. This conception opens the equation to numerous applications in both the natural sciences and the social sciences, and will be useful for spatio-temporal modeling of urban spatial expansion, but has not been attempted yet. Thus with reference to exponential functions in relation to their applications in social science, Jacard and Jacoby (2010) have observed that: “social scientists often modify the exponential function to create functions that reflect growth or change with certain properties” (p.195). More specifically, they go on to state that “for example, using the fact that any number raised to the power of 0 is equal to 1, the following equation can be used to describe exponential growth over time” (Jacard & Jacoby, 2010: 195-197):

$$Y = S_0 e^{(kx)}$$

5.4

Where Y = population size at a given point in time, x = the distribution in time since a predetermined start time, and S_0 , e (natural log) and k are constants. The value of S_0 is fixed at a value equal to the population size at a predetermined start time. This formulation is particularly useful for the urban spatial expansion analytical model being proposed in this chapter of the dissertation research. The list of applications for this kind of formulation of exponential functions and variants has been noted to be long and cuts across disciplinary boundaries. For example, Yuri Shestopaloff notes that

In psychology and biology, the sensitivity of different organs to irritation is described by exponential laws; . . . Statistics, probability theory, economics, social sciences and many other areas of science and technology use these functions as the main components of adequate models. (Shestopaloff, 2010: 33).

For geography, one only has to look a little back into history when David Harvey asserted that “the Allometric law could be used to mathematically link a growth process over time to spatial change with the potential to enhancing geographic theory” (Harvey, 1969: 466), citing Nordbeck’s works in this area.

For the purposes of Chapter 5, the formulation of the allometric law (equations) which denotes “evolution of a single system” is adopted (the built up area of the city). In this instance, urban growth is conceptualized as the development of a single system (the built up area) over time. In other words, the focus is on the quantitative change (additions of built structures, translated into land area consumed) over time or the outward shifting of the urban boundary over time. Consequently, the spatial expansion of a city (land conversion from agricultural usage to urban uses) could be considered as a growth process in the urban built environment, in which the city constantly “adds” to itself a number of built structures in any given period of time, akin to “compounding” in financial parlance.

A particularly important aspect of the Allometric Law, of importance to the modeling exercise undertaken to develop the IUSEEM, is the version of the allometric equation which utilizes the natural logarithm to form a logarithmic exponential function as in Equation 5-2. This formulation has been found to be typically useful for the study of “compounding” processes, not only in geographical phenomena but also in economic ones (Coffey, 1981). It should be noted that by “compounding” processes the implication is not necessarily limited to only the increasing aspect of phenomena. Thus,

similar to Coffey (1981), “growth” as used in this chapter could be positive (increasing as in IUSEEM) and negative. Consequently, urban spatial expansion could be interpreted as decline in urban vegetation cover since the city is embedded in the regional biophysical system and also the fact that increasing built area (as pertains to new land conversion) amounts to decreasing regional vegetation cover. Therefore, *tracking and quantifying built up area expansion over time would reflect the extent to which regional vegetation cover is being lost to urban development. By extension, if the expansion process could be linked to FDI, it can be concluded that the loss of the vegetation cover has been induced by FDI.* Admittedly, processes that impact urban expansion are numerous, encompassing physical geographic influences, technological advancements, social and economic processes which influence the evolution of the city, it is not too far-fetched to agree with the urban geographer, Michael Pacione, that economic activities and processes hold sway in the city (Pacione, 2009). For instance, technological advancements have made it possible to overcome physical constraints, to the extent that wetlands can be effectively drained for urban development (effectively removing a physical geographic barrier), whereas economic agglomerations continue to influence decision making affecting urban land use, drawing global capital to selected, preferred urban enclaves. It is not too difficult to see, therefore, that any model of urban growth that misses out on the linkage to urban economic theory may be telling only half of the story, literally speaking. This provides one main rationale for the urban expansion model advocated in this study and in this chapter in particular. In addition to being computationally less intensive, it is simple and analytically tractable as well as theoretically grounded. Such a model should be useful and handy to urban expansion

modelers in developing countries, especially, who are often challenged by unavailability of resources, including new technologies needed for simulation. Urban expansion modeling should be made as simple as possible as well as accessible to most “average” researchers; and should also be informed by urban economic theory, hence the analytical model being proposed in this chapter. Many researchers have observed that the ease of analytical models and their relatively less demanding computational and data requirements make them easily accessible to researchers in developing countries and are being utilized to study current urban expansion (Angel et al., 2011; 2005; Seto, 2005). The attraction of analytical models stem from some advantages over other modeling approaches such as simulation including cellular automata and agent-based modeling. Importantly, even though these complexity-inspired spatially explicit urban models take a systems perspective of the urban expansion process, it leads to an incomplete conceptualization; theorization and understanding since global economic influences are largely ignored and do not usually link to economic theory. As a result, the linkage among the urban biophysical environment, the urban economy and the broader global economy (economic globalization influences) are neither explicitly articulated nor represented, potentially leading to a less comprehensive understanding. In particular, such models are likely to underestimate the increasing influences of external economic forces on the urban expansion process, which are assuming unprecedented relevance with intensifying economic globalization. Inspired by the allometric principles, the model proposed in this chapter, IUSEEM, allows for incorporation of all kinds of explanatory variables, provided they are borne out by economic theory, (following from the Thunen-Alonso theoretical framework, for

example); regression estimation results are found to generally fit the data and significant at the 95% confidence level. Such a method is currently lacking hence the relevance of the Integrated Urban Spatial Expansion Estimation Method (IUSEEM) proposed in Chapter 5.

The IUSEEM: General Considerations

Basically, IUSEEM is a modified exponential growth function, utilizing the natural log 'e' as a special number for growth along the lines described above and premised on ideas underlying the Allometric Law. IUSEEM attempts to reflect the transmission of economic 'impulses' from the socioeconomic system (from sources external to the country in which the expansion process being modeled is located), translates this into change in the built up area, over time. Further, IUSEEM invokes the Allometric law (or principle), which can be formulated as a form of exponential function. The rationale for the link with the Allometric law is that urban land conversion is deemed as essentially a "compounding" process, which rarely declines in absolute size. In other words, urban built up area expansion is more or less a 'compounding' process.

Essentially, the IUSEEM is informed by the allometric principle (or law) whereby the urban built up area expansion is conceptualized as an allometric growth process, by virtue of its "compounding" nature. Thus, the main interest in this chapter is about the *urban extent expansion* as opposed to the description of the land use patterns in the urban area. Urban size and its change over time have several implications, including the costs of commuting, emission of carbon dioxide, loss of sensitive ecological lands, among other things (Seto et al. 2011; Wackernagel, 2000; Costanza et al., 1997). The IUSEEM implements the estimated co-efficient of FDI in the formulated allometric function as the exponent, to estimate the total built up area in any given year as well as

the cumulated built up area up to a given point in time. The conceptualization, modeling and methodological approach presented in this chapter could be very useful to urban geographers in the area of theory development to help explain contemporary urban spatio-temporal modeling and analysis as well as suitable method for estimating FDI induced urban spatial expansion. It is important to reiterate that the IUSEEM is suitable for the estimation of the “quantum” of built up area, without the “geometric” aspect of the expansion process. In other words, the focus of IUSEEM is on estimating the total area of peri-urban land likely consumed, resulting from increasing FDI inflows into urban areas. It is not meant to observe the behavior of individual parcels or particular cells, per se. It is also not meant to describe spatial patterns. These are useful intellectual pursuits, no doubt, but spatio-temporal estimation methods for urban expansion currently in existence fail to link to standard economic theory and poorly incorporate “global” economic influences, if they ever do.

More formally, the IUSEEM methodological approach advanced in this chapter invokes the principles of allometric growth to integrate the results of log-transformed regression model in a simple allometric (exponential) equation which can be used to estimate the total built up area of a city at any point in time, given the total area at some initial time. Theoretically, urban growth could be considered as an ‘expanding’ organism whose behavior could be reasonably approximated by the postulates of the Allometric Law, especially from the perspective of the concept of “compounding” (Coffey, 1981). The importance of the allometric growth law to the analysis and understanding of geographical systems change over time has long been noted or alluded to in the geographical research literature (Coffey, 1981; Warntz, 1975 cited in

Thomas & Huggett, 1980; Harvey, 1969; Nordbeck, 1965). Richard Harvey, in particular, gone to the extent of appearing to encourage geographical researchers to make productive use of the allometric law in asserting that

The allometric law promises to become an integral part of geographic theory, since it can be used to account for such phenomena as population-density gradients, the rank-size rule, and so on (Harvey, 1969: 466).

He further notes that

Nordbeck thus shows that the area of a city is related to its total population by the allometric law and this suggests that a process of growth over time can be connected mathematically to size in space (Harvey, 1969: 466).

To build on this, *this dissertation research advances a further perspective to the effect that the allometric law holds good prospects of helping link “stochastic” modeling approaches (statistical modeling such as regression analysis) to their “deterministic” counterparts such as the exponential growth models (function) which will be useful for studying human-induced (socioeconomic-driven) changes in geographical / environmental systems over time such as urban land conversion.* If the contributions of socioeconomic variables to change (s) in a physical system can be estimated with reasonable accuracy - deriving the rate of change in the physical system with respect to the socioeconomic variables – it would be reasonable to expect that one can use this approach to estimate the “cumulative” change in the physical system. This is the main rationale for the spatial expansion estimation method outlined in this chapter of the dissertation.

Essentially, the city is viewed as a Spatial Socio-Economic Unit –SSEU (following Frank et al., 2001) changing through time and space, and the change has mainly been ‘compounding’ (Figure 5-1), and whose expansion may be circular or semi-circular depending on presence or absence of physical constraints. By ‘compounding’,

the reasoning is that initial built up areas are rarely removed even in the face of decline of the urban economies or populations (Burchell et al., 2005) which is akin to interest rate compounding, from the perspective of money and banking. In effect, urban extent expansion is characteristically *additive*. In developing the IUSEEM, attention is focused on the ever *shifting boundary of the city*, viewing urban spatial expansion as essentially a *moving boundary*, and modeling urban expansion as a *continuous motion_of the boundary* as opposed to the snapshot approaches in many land use land cover change modeling in general and urban land cover change in particular. Focusing on 'cells' and observing 'one-time' period change offers limited understanding of the 'motion' (implied processes) of the phenomenon through time. Usually, such studies implemented by detecting the change in the phenomenon of interest (say land cover) through the use of a few images selected for two or more years. The change is then associated with the socioeconomic 'causal' agents focusing on the pixels or cells such as parcels of land. Consequently, behavior of the variables between time periods, are largely unknown; implying the lack of 'genetic' explanation. Harvey (1969) has argued that even though all explanations in geography need not employ genetic explanation (temporal) the explanation of growth, as a matter of necessity, will be better served if genetic explanation is employed. Urban land conversion over time could be viewed as a cardinal aspect of the spatio-temporal evolution of the city, as peri-urban natural areas are "appropriated" and changed to built-up areas. More specifically, urban growth could be considered as an 'expanding' organism whose behavior could be reasonably approximated by the postulates of the Allometric law. One rationale for focusing attention on the shifting city boundary is that it affects the size of the built area which in

turn has implications for other variables of interest such as transportation systems, infrastructure, urban ecosystems, urban hydrology and climate, among other things.

The importance of the above cannot be overemphasized. From ecological perspective, urban land conversion or spatial expansion greatly affects the city's ecological health due to its encroachment on natural areas, with the potential to undermining sustainable urban development efforts in the long run. Beyond the practical needs of sustainable urban development, it is often desirable in geographical analysis to better understand the evolution of some spatial unit such as a city over time (Coffey, 1981; Harvey, 1969). The relevance of the IUSEEM is placed firmly in these contexts.

Developing the IUSEEM: The main steps

Step1: The first step in developing the IUSEEM is the formulation of a multiple regression with all variables log-transformed using the common logarithm (log to base 10). As much as possible one must ensure the use of economic variables (since these are likely to possess multiplier properties which would resemble the behavior of exponential growth, non-linearity, among other things. More importantly, these variables must be borne out by economic theory. For the purposes of implementation in the IUSEEM, the explanatory variables must result from the theoretical propositions of the classical economic theory of urban spatial structure (Angel et al., 2011; 2005; McGrath, 2005; Brueckner, 1987; Brueckner & Fansler, 1983; Muth, 1969; Mills, 1969; Alonso, 1964), with particular reference to their current extensions deriving the urban extent as a function of relevant socioeconomic variables – population, income, among others

Step 2: The second step entails the regression estimation and diagnostics. The regression model so formulated (log-transformed) can be estimated using the standard Ordinary Least Square (OLS) regression method. The estimated model should be subjected to the usual regression diagnostics particularly focusing on overall fitness of the model, multicollinearity, among other things. The co-efficients are also examined for statistical significance which must be, at least, at the 95% confidence level for all estimated co-efficients. Also, for the purposes of this chapter, only the co-efficients which have positive values (contributes to urban built area expansion) are considered to be relevant.

Step 3: The third step involves the extraction of the estimated regression coefficients that have positive values. A caution is in order here. If one is interested in the totality of the impact of the socioeconomic drivers modeled in the regression, then one should sum up all the estimated co-efficients (to be used as the 'exponent'). Alternatively, one can focus on individual explanatory variables, one at a time. In all cases the value obtained must be translated into a decimal by dividing by hundred (100), since the estimated co-efficients of the log-transformed regression are percentages. Another important issue to be noted is that even though the regression model may include the 'constant' term, it is difficult to interpret hence is omitted from the analysis. This is not to suggest that urban growth would stall in the absence of the socioeconomic variables. It is simply that the issue gets complicated beyond the scope of this dissertation research.

Step 4: The final step is the implementation of the regression estimation results (extracted co-efficients) in the allometric-based exponential function which will be used

to estimate the built up area of the city at any point in time, given the current size of the build area. The IUSEEM has the natural log (e) as the base of the exponent whereby e = 2.718. It is widely believed that the natural log (with value of 2.718 is most suitable for growth processes, with wide applications across both the natural and the social sciences. Figure 5-2 illustrates.

More formally, the general mathematical formulation of the stages outlined above is summarized below:

Given an estimated log transformed (OLS) cross-sectional regression, with urban built up areas of a representative sample of cities:

$$\hat{Y}_t = \hat{C}_0 + \hat{C}_{1t-1}X_{1t-1} + \hat{C}_2X_{2t-1} + \dots + \hat{C}_nX_{nt-1}$$

5-5

Where, \hat{Y}_t = the estimated mean of the response variable, built up area of the city; $\hat{C}_1, \dots, \hat{C}_n$ estimated co-efficients of log-transformed multiple regression model; $X_1 \dots X_n$ = explanatory variables (preferably related to economic activities, or socio-economic variables, likely to have multiplier effects in an economy). The explanatory variables are lagged one step behind the response variable to reflect the notion that change in the explanatory variables may not necessarily reflect instantaneously in the response variable. In other words, economic processes take some time to effect noticeable change in some other system(s). The IUSEEM is formally stated as:

$$B = B_0 e^{c(1+f)}; B_0 > 0, c > 0$$

5-6

B = the current urban built up area, e = the natural log, with the numerical value, 2.718, c = the estimated FDI co-efficient from Chapter 4 of this dissertation. Note, however,

that in any study, “c” may be multiple co-efficients as well, if the modeler is interested in more than one explanatory variable. For the purposes of IUSEEM, based on the arguments advanced in this chapter, however, the focus is on FDI. It is important to note that the IUSEEM (E5.4) above incorporates the temporal aspect of the urban land conversion process as well as the spatial aspect, akin to what Harvey alluded to, which because of its centrality to the goal in this dissertation research, is quoted here again to strengthen the present argument: “the Allometric law could be used to mathematically link a growth process over time to spatial change with the potential to enhancing geographic theory” (Harvey, 1966: 466).

The exponent (the ‘constant’ rate of change) in IUSEEM is calculated in two stages: (1) the formulation and estimation of log-transformed regression (OLS) from which the FDI co-efficient is extracted. The use of estimated regression coefficients implies that the urban spatial expansion process entails stochastic (random) elements, requiring provision for an error term in the quantification process, (2) annual adjustment of the co-efficient. In this case the change in the volume of FDI inflows, relative to the volume at the beginning period (1999 in this case), is computed and used to adjust the FDI regression co-efficient estimated for the base year (1999). This allows for the ‘updating’ of the co-efficient in order to reflect the current flow levels of FDI. In IUSEEM, therefore, $c(1+f)$ = adjusted FDI induced change in urban built up area. This is the “parameter” that controls the extent of FDI impact on the urban spatial expansion process. Even though IUSEEM and the classical population growth function (Malthusian population growth model) are similar in many respects, there are many differences between the two.

IUSEEM Vs. the Population Growth Model: Similarities and Differences.

The Similarities are: (a) use of natural log to model growth processes in both models; (b) both have the exponential function with the natural log 'e' as the base; (c) both describe a “compounding” phenomenon. Thus, similar to human population, even though the growth rate may decrease, the absolute size of the phenomenon of interest is likely to continue to increase, albeit at a slower pace. For example, even though world population growth rate may decline, still some numbers will be added in absolute terms. Similarly, for IUSEEM, even though FDI flow volume (rate of inflow per annum, hence relative change) may decline, net additions to built up area may be positive; and (d) Both have fixed, initial value that is a given.

The Differences are: (a) In IUSEEM 'time' is not explicitly represented. Instead what makes the model dynamic is the annual relative change in net FDI inflows, derived from the measurement of the FDI; (b) the rate of change (estimated regression co-efficient) updated on annual basis using actual FDI inflows.in IUSEEM; (c) estimates built up area, using the rate of change as induced by a second variable. It has been noted in the formula (5.1) above, that PGR = the exponent 'r'. In this case the absolute size of the population is computed using the “rate of change of population per annum” or the population growth rate. In IUSEEM, the regression co-efficient is similar to PGR – the rate of change. However, in the case of the population growth model, the rate of change is not derived with respect to a second, separate variable. Thus, different elements of population- birth rate, death rate, net migration-are used to compute the size of population at any given time. *It is important to note that population growth model does not reference any explanatory variable outside population itself.* Consequently, and in essence, the formula explains change in quantum of population based on internal

dynamics of population itself-growth per unit of time. On the contrary, IUSEEM does explicitly refer to a second, explanatory variable in the form of FDI. Consequently, the explanation of expanding built up area is attributed to inflow of FDI from the economy as a subsystem, flowing into the urban biophysical system; (d) Grounded in standard urban economic theory, refined to reflect realities of economic globalization; (e) IUSEEM exponent partly results from regression estimation, allowing for the stochastic nature of social and economic variables such as FDI; (f) The IUSEEM method embeds *elasticity* such as income elasticity of demand or cross elasticity of demand - quantity demanded of one commodity changes in response to change in the price of another (second) commodity. In the case of IUSEEM, the elasticity can be described as “urban built up area expansion elasticity of FDI”, denoting the percentage change in built up area in response to percentage change in annual FDI inflows into the urban economy. With respect commodity, change is induced by a factor exogenous to the commodity whose quantity changes in response to the ‘outside’ factor (price of another commodity). Similarly, in IUSEEM, the built up area expansion is quantified based on change in FDI, which in this case has originated from sources outside the city (and outside the country where the city is located) whose physical expansion process is being quantified; (g) IUSEEM is also premised on the Allometric principle to exemplify the fact that FDI originates from the global economic system, a subsystem of the global ecosystem, into the urban economy (which is also a subsystem of the regional biophysical system). As FDI inflows influence the urban economy, via real estate, housing and other land consuming activities, the regional biophysical system is being changed accordingly (through vegetation cover depletion). In effect, therefore, the expanding built up area

represents a “decay” in the biophysical system as vegetation cover gets depleted in the process, by virtue of the fact that conversion of land to urban uses almost invariably entails complete removal of the vegetation. In short, IUSEEM quantifies the FDI induced change in urban vegetation cover, via a proxy - “urban built up area”. In other words, IUSEEM results can be interpreted as environmental impact through loss of vegetation cover, indirectly quantified by estimating the expanding urban extent.

It is particularly important to emphasize that “f” replaces the “time” element usually found in exponential functions. The reasoning behind this is that in the case of IUSEEM, time is not considered to be a “causal” agent. Thus, even though it takes time for FDI to accumulate in a given urban space and it takes time to manifest in increase of urban extent, *time* is not the key element attracting the FDI and as a result may not be appropriate to implement directly in the exponential function. Nonetheless, IUSEEM does take “time” into consideration by using annual FDI flow figures and computing the relative change in FDI, “f” from year to year, with respect to the starting year for the period covered by the study under consideration. In so doing, “rise” and “fall” in FDI flows are reflected and explicitly modeled, which is then used to adjust the coefficient estimated by regression.

It is expected that this estimation method (IUSEEM) potentially will be capable of estimating quantum of the built up area, given the flow levels of FDI into the country’s urban spaces. For an individual city, the IUSEEM will be useful for describing and explaining the change in the spatial extent of the city as a dynamic geographical system; with the potential to contribute to a noble objective in geographical research. A

preliminary operationalization of IUSEEM using data for Accra, the rapidly expanding and fast globalizing capital city of Ghana, has been attempted below.

Methodology

Overview

Why should FDI be considered as a key driver of Accra's contemporary physical expansion? As has been discussed elsewhere in this dissertation, citing authoritative and reliable sources, Accra's urban extent has expanded rapidly during 1985-2002, with a particularly steep growth rate beginning from 1991 (Table 5-1). The full physical extent of Accra is generally defined to encompass the Greater Accra Metropolitan Area (GAMA) as shown in (Figure 1-3 in Chapter 1). Estimations for the urban extent of Accra and change vary somewhat. However, IUSEEM will draw on two main authoritative sources (Angel et al., 2011; 2010; 2005; Moller-Jensen et al., 2005). In 1985 the urbanized areas of Accra (the GAMA) constituted 216 sq. km, increasing to 276sq.km in 1991 and to 555 sq. km, in 2002 (Moeller-Jensen et al., 2005). According to Moeller-Jensen et al. (2005), this growth has largely occurred on the fringe lands of the city which can be seen from Figure 5-4. According to traditional urban expansion analysis such as the studies by Angel et al. (2011; 2005) and Seto (2005) would normally attribute such rapid increase in urban extent to population and income growth. However, there is a discrepancy between the population growth of Accra and Ghana's income growth rate during the rate of Accra's physical expansion (Table 5-7). Hence, it seems reasonable to question the extent to which the traditional urban land expansion drivers –population and income growth-contributed to the process and to explore the possibility of some other driver (s) being responsible, at least in part, for the rapid physical expansion of Accra. Incidentally, the period of Accra's rapid physical

expansion rate coincides with the implementation of economic liberalization policies (SAPs) in Ghana, which facilitated inflow of foreign capital (FDI) into the country. A quick review of historical data suggest that the FDI flow rate (annual change in FDI flow volume) and rapidity of change (Table 5-7) closely resemble the characteristic of rate of physical expansion of Accra during the period under study. Furthermore, it is documented that Accra absorbs about 80% of annual FDI inflows to Ghana (GIPC, various years). Consequently, indications are that this may be resulting from unequal geographical distribution of FDI in in Ghana's urban system, given the urban population of Accra compared to all urban areas in Ghana combined (Chapter 1).

A recap: Based on analysis in Chapter 2 and Chapter 4 of this dissertation, FDI appears to be a potent driver of numerous economic activities in receiving urban locations; increasing demand for land via housing demand and demand for land for FDI related activities, which if not mitigated by urban growth management policies and tools could result in conversion of new lands to urban uses, almost inevitably at the peri-urban areas where urban land is comparatively cheaper compared to inner locations. It is therefore reasonable to suggest that Accra's recent rapid rate of physical expansion might have been induced in part by FDI inflows to Ghana. This is what the IUSEEM will seek to quantify. *The claim is that the Rapidity of physical expansion of Accra in contemporary times especially resonates with the rapidity of change in volume of FDI inflows to Ghana during the same period.* The evidence adduced so far can be summed up simply that: Accra is sprawling and is characterized by high concentration of FDI funds, compared to other urban areas in Ghana. The question then is: how much of the sprawled development (rapidly increasing built up area) of Accra may be attributed to

FDI inflows to Ghana and its disproportionately large concentrations in Accra? In order to ascertain the extent of FDI involvement, therefore, it would be necessary to be able to estimate the built up area of the city as induced by FDI inflow over time. Such a quantification exercise, at the minimum, may help create awareness, drawing the attention of urban planners to FDI as a potential driver of urban land conversion as well as contribute to the conversation on the all –important topic of human-induced global environmental change, especially in the area of urban environmental change. As argued above, urban expansion modeling have taken various approaches but in this chapter a new model / method (the IUSEEM) is suggested which is deemed more appropriate for Accra and like cities which are fast globalizing and being characterized by sprawl but situated in countries generally characterized by generally sluggish population and economic growth.

Research Design

A four-phase approach is taken. Firstly, a theoretical model linking the rate of Accra's built up area expansion to the growth rate in population of Accra, GDP per capita growth rate of Ghana and annual change in the volume of FDI (FDI growth rate), is formulated (Equation 5.7). Population and GDP/GNP per capita (income) have been consistently identified as the most relevant urban land expansion drivers (Angel et al., 2011; 2005; Seto, 2005; McGrath, 2005). FDI is included based on the argument of this dissertation about the increasing importance of FDI as a potential urban land expansion driver. However, for the case of Accra, this study has argued that the traditional explanatory variables – population and income – may not be as relevant as it appears in model estimations. Consequently, the theoretical model is reduced to a more relevant one (Equation 5-8) which specifically links built up area expansion and FDI, to be quantified

by IUSEEM. Secondly, to zero in on the most relevant land expansion driver in Accra potential variables are considered and eliminated or kept based on how closely their growth rates have come close to the rate of physical expansion of Accra. Simple calculations have been employed to compare the population growth rate of Ghana and income growth (GDP per capita) with that of Accra's physical growth, all during the period 1985-2002, to highlight the discrepancy mentioned above. This is to buttress the point made above to the effect that population and income might not have significantly impacted Accra's physical expansion rate during 1991-2002. This paves the way for consideration of FDI as a potential important contributor to Accra's rapid physical expansion in recent times. Subsequently, annual FDI inflows to Ghana will be compared to the physical growth rate of Accra during 1985-2002 (Table 5-7). Thus, based on the simple calculations, it is suggested that since population growth has not been as dramatic and GDP growth has been sluggish, it would be worthwhile to focus on FDI, given the discussion and arguments advanced so far in this dissertation. FDI induced urban spatial expansion seems to be in order at this point. Thirdly, therefore, the IUSEEM is implemented to quantify the incremental growth in the built up area of Accra from 2001-2011. The IUSEEM results are aimed at testing the initial hypotheses developed above (end of the literature review), specifically emphasizing the rate of growth in the urban extent. Finally, a comparative analysis is attempted, pitching the IUSEEM results against a study of Accra's physical expansion conducted by Moller-Jensen et al. (2005). It is important to note that the data used in IUSEEM were obtained from Angel et al. (2011) and are therefore independent of the data in Moller-Jensen et

al. (2005). Comparing IUSEEM results to data from an independent source is necessary in order to assess the extent of FDI impact on the land expansion process.

Data

The IUSEEM is operationalized using processed remotely sensed land cover change data sourced from reliable, published database (Angel et al., 2011). Furthermore, the city of Accra is captured in the sample of 120 cities used in the regression models in Chapter 4 in this dissertation. Hence, the use of this data for preliminary operationalization is consistent. Note that all that is required for IUSEEM computation are (a) built up area of the city at the beginning period (b) the relevant estimated regression coefficient and (c) the annual FDI flow figures.

Method

The estimation focuses on quantifying the cumulative build up area and the rate of physical expansion of Accra through time as induced by increasing levels of FDI inflows to Ghana, with an estimated 80 percent concentration in urban Accra. Most urban land expansion analysts /researchers would agree that population and income growth are the two most important urban land expansion drivers, even though the relative importance of the variables differ depending on the economic development level of the countries being studied. (Seto et al., 2011). However, as has been argued in this dissertation, FDI appears to be an emerging potent driver of urban land conversion which may help account for Accra's rapid physical expansion in recent times. Thus, the relationship between the expanding built up area of Accra on the one hand and population, income and FDI may be expressed as in Equation 5.7:

$$B_{gr} = f (P_{gr}, Y_{gr}, FDI_{gr})$$

5.7

Where, B_{gr} = Rate of growth in the built up area of Accra (annual average growth), P_{gr} = Annual population growth rate of Accra, Y_{gr} = Annual rate of growth in income (measured by GDP per capita), FDI_{gr} = annual growth rate of FDI inflows to Ghana. Essentially, the Equation 5.7 posits that rate of growth of urban land in Accra is a function of population growth rate, income growth rate and FDI growth rate, respectively, other things being equal. In other words, it is postulated that increases in the growth rates of Accra's population, Ghana's GDP per capita and annual FDI inflows to Ghana will accelerate the growth in the built up area of Accra. However, it has been argued in this dissertation, and documented evidence from published research to support the argument, to the effect that in the case of Accra, population and incomes growth have remained largely 'stagnant' and rates of growth do not match the rate of physical growth of Accra. Therefore, for the purposes of the arguments in this chapter attention will be focused on the built area-FDI relationship. Consequently, Equation 5-7 may be reduced to:

$$B_{gr} = f (FDI_{gr})$$

5.8

Equation 5.8 posits that the growth rate of the built up area is a function of the rate of "growth" in FDI (annual fluctuations in the volume of flow). This is not to suggest, however, that population and income are not relevant urban land conversion drivers in Accra. It is simply that these variables may be 'masking' the potential influences of FDI, given that in real terms, their rates of growth did not experience increases during the period Accra expanded rapidly. Hence, in the IUSEEM estimation procedure, the estimated co-efficient of population and income will be adjusted for incorporation in the

IUSEEM. Consequently, the IUSEEM formulated above and restated below is applied from this perspective.

$$B = B_0 e^{\hat{g}} \quad B_0 > 0, c > 0$$

5.9

B = estimated built up area for a current period, B_0 = existing urban land cover at beginning of estimation period (same as year of urban land cover used for regression modeling and estimation), e = natural log (2.718 for the IUSEEM computation purposes), $\hat{g} = \hat{c} * (1+f)$, \hat{c} = adjusted estimated regression coefficient (for FDI in this case). (Note that \hat{c} can comprise of the sum of all adjusted estimated regression coefficients for all variables if necessary. This will be elaborated on further in the text). f = relative change in annual FDI inflows to Ghana, with reference to the base year used for the regression estimation (1999 for the present discussion). The term $(1+ f)$ is the temporal dimension (similar to the “time” factor found in regular exponential functions. Using this term ensures that the exponent, \hat{g} , is “updated” to reflect the actual dynamics of annual FDI flows). It is also important to note that \hat{g} is the “parameter” controlling the FDI – induced urban built up area expansion over time. Essentially, therefore, the IUSEEM as formulated above posits that urban built up area expansion in Accra as induced by FDI inflows followed an exponential growth path. It states that since the urban land expansion process is essentially a “compounding” one, estimate of the current built up area takes into account the built up area value in the start of the period, since already built up areas don’t get removed. Again, a growing urban area, reinforcing agglomeration and infrastructural enhancements would serve to attract more economic flows, increased land demand and increasing expansion. This is analogous to a single

organism; say an animal, growing in size as a function of food intake, for example. In terms of the IUSEEM, the urban economy of Accra, fed by increasingly high FDI concentration levels, will manifest in the acceleration of the physical expansion of the city over time. This is the rationale for linking IUSEEM to the Allometric Law (or the allometric growth principles). (Of course, this is simplistic but it is the essence of the whole enterprise of modeling, more or less).

The exponent or the parameter used in the IUSEEM, \hat{g} , is composed of two parts: the estimated FDI coefficient from regression model, \hat{c} , and the calculated annual relative change in FDI inflows, f . I used the results for FDI in the regression estimation presented in Chapter 4 as input to Equation 5.9 (also shown in Table 5-2). Again, I used the estimated FDI co-efficient as part of \hat{g} (the exponent in the IUSEEM) because the interpretation of the log-transformed regression posits elasticity, implying “rate of change” in built up area with respect to FDI (percentage change in built up area induced by percentage change in annual FDI inflows). I reasoned that I could use this characteristic to formulate the exponential function, since the "exponent" in regular exponential functions (such as the population growth model outlined above) usually denotes "the rate of change". Consequently, to reiterate, the IUSEEM works by 'translating' change in FDI inflows into change in urban built up area, taking into consideration the compounding nature of urban built up area expansion. The estimated co-efficients of regression Models in Chapter 4 are inserted in Equation 5-10.

$$Built = -0.959 + 0.787(POP) + 0.215(GDP) + 0.087(FDI) - 0.134(REMIT)$$

5.10

All variables remain as defined in Chapter 4. The constant and coefficient for remittances are negatively signed, contrary to the theoretical postulates advanced in Chapter 4, needing further investigation. However, this has not been undertaken in this dissertation so these coefficients have been eliminated and not included in the IUSEEM implementation. In IUSEEM, the estimated coefficients of the cross-sectional, static, linear regression model have been used to create an urban spatial expansion model (IUSEEM) which incorporates temporality, dynamism and non-linearity in a simple and analytically tractable manner. Also important is the fact that IUSEEM is linked to postulates of standard urban economic theory since the regression model whose coefficients have been used as exponent is firmly grounded in the Thunen-Alonso theoretical framework and extensions (Chapter 4).

For a better understanding of the workings of the IUSEEM, it is important to make the following clarification with regard to quantifying change in systems (variables of interest). Three main approaches may be envisaged. Firstly, absolute change in a variable can be measured or quantified by observing the variable from two successive stages and documenting the change that has occurred. For example, basic urban land cover change data derived using remote sensing methodology falls into this category. In this case the 'size' of the built up area can be quantified without recourse to some second ('causal') variable. Quantifying change in this way is without reference to rate of change in some element of the variable of interest or in a second variable. Secondly, change in a variable can be measured with reference to rate of change in some 'element' associated with the main variable to be quantified (system of interest). For example, the computation of the size of a population using Equation 5-2 utilizes the

population growth rate (based on birth rate, death rate and migration as in Equation 5-1 to estimate the size of the population (absolute) at a given time. Finally, the change in a main variable can be quantified with reference to the rate of change in some other variable. For example, in regression analysis, prediction in a response variable is sought through the implementation of a single or set of independent explanatory variables. A typical example in this work is implemented in Chapter 4 to quantify the relationship between urban land cover and a set of explanatory variables, cross-sectionally. In this case, the change in the response variable with respect to change in the predictive / explanatory variable is measured, which may be interpreted as quantifying change in a system of interest (response variable: urban built up area in this case) with respect to change in another variable (the explanatory variable), deriving the rate of change. The IUSEEM builds on this latter category, attempting to quantify the change in urban built up area over time based on an established rate of change involving the built up area and a second variable (FDI in this case), obtained from regression estimation (Chapter 4). In short, results of regression analysis is integrated into exponential growth function (and drawing on allometric growth principles) to estimate change in urban built up area over time. In some sense, therefore, the IUSEEM takes ordinary cross-section regression estimation results to the next level, adding the temporal dimension without having to deal with problems associated with time-series regression analysis and also allowing for the appropriate modeling of rapid physical expansion in a primate city characterized by nonlinear growth. In the case of Accra, the IUSEEM seems the appropriate method based on the following premise. Accra's physical expansion for the period 1991-2002 has been especially rapid,

involving the conversion of large agricultural and natural areas to urban uses, characterized by declining density (sprawl). For example, Angel et al. (2011) note that Accra's population increased about 53% during 1985-2000 but its physical size increased over 150%. Furthermore, two distinct phases of the physical expansion of Accra have been identified with regard to the change in annual growth rate of urban land conversion (Moller-Jensen et al., 2005). For the period 1985-1991, it has been estimated that Accra's urban land cover increased from 216sq.km to 276, averaging an increase of 10sq. per annum (Moller-Jensen et al., 2005). However, for 1991-2002, the physical size of Accra increased from 276sq. km to 555sq. km, with an average increase of 25sq. km per annum. Clearly, this is quite a rapid change within a very short time, and can be described as an 'exponential' growth in many respects. As noted elsewhere in this dissertation, such rapid urban expansion, theoretically, would be attributed to population and income growth in the country where the city is located. However, in the case of Ghana, it is important to emphasize that none of the traditional urban land expansion drivers – population and income – changed so dramatically around the same period (Table 5-7). Incidentally, however, during this same period FDI inflows into Ghana appear to be the most highly relevant economic variable that experienced similar dramatic growth (Table 5-7) periodic averages) as the rate of physical expansion of Accra. Even though levels may fall in some years, increases in FDI flows can be dramatic within a relatively short period of time. For example, the average annual inflow of FDI to Ghana for the period 1986-1990 amounted to US\$8,760,000. The average annual FDI inflows for the periods 1992-1996 and 1997-2001 were US\$121,400,000 and US\$149,620,000, representing about 1054% and

1608%, respectively; above the average annual FDI inflow figure. From the foregoing, therefore, the rapidity of change in FDI flow levels in Ghana around the same period Accra underwent an unprecedented spatial expansion is obvious. In recent times the situation has not been much different. Generally, since 2006 FDI inflows to Ghana have generally been on the ascendance (UN, 2012; GIPC, various years). Thus, FDI inflows to Ghana during this period appear to exhibit rapidity of growth rate similar to the physical growth rate of the capital city of Ghana, Accra, where the bulk of FDI has been concentrated. Are the two related in any significant way? How best can the relationship be modeled to incorporate the temporal aspect as well as reflect the fluctuations in FDI flows? What are the implications of FDI concentration levels for the rate of physical expansion of the receiving urban area? To what extent can Accra's contemporary physical expansion be described as FDI-induced? These are the main underlying motivations for the formulation of the IUSEEM which will attempt to provide answers to these questions, in addition to the potential importance for economic/urban geographical theory construction as well as urban policy. It is important to note, from Chapter 4 that FDI has multiple pathways through which it can induce urban land conversion. Again FDI is likely to be associated with multiplier effects. Thus, with the dramatic change in urban growth coinciding with equally dramatic increase in FDI inflow to Ghana, with Accra attracting disproportionate amounts, both can be said to have experienced 'exponential' growth. The relevance of FDI to urban land cover expansion has been established in Chapter 4, with high statistical significance. These considerations, among others, informed the choice of the functional form for the IUSEEM. To sum up, the argument is advanced in this chapter to the effect that Accra's

contemporary physical expansion bears some resemblance to exponential growth process, which has more to do with inflow of FDI than population and income growth. In other words, FDI is playing a significant role in urban land conversion in Accra but has not been adequately recognized as of now, hence the need to conceptualize, theorize, and quantify FDI-induced urban expansion under intensifying economic globalization. Essentially, therefore, one important argument advanced in this chapter is that Alonso's land use theory can be linked to an integrated allometric based – exponential function and simple regression to build a non-linear, stochastic, and dynamic estimation method that can be used to estimate the “quantum” of urban built up area in Accra over time.

The use of the exponential function for estimation of some quantities has been noted in the literature (Jaccard & Jacoby, 2010). However, the approach advanced in this chapter is more in-depth, integrating regression analysis with exponential function and allometric principles; and a deliberate attempt has been made to link the method to the Thunen-Alonso theoretical framework. Specifically, the IUSEEM uses the coefficient of FDI estimated from a cross-section regression, which together with the relative change in annual FDI inflows into Ghana, are implemented as the exponent of the allometric based exponential function (Equation 5.8). Using “relative change” in FDI as opposed to “time” IUSEEM better reflects the dynamic nature of FDI. Also, the allometric analogy is well suited to the built up area expansion process since this is essentially “compounding”. The use of IUSEEM, an allometric based, integrated regression and exponential growth built up area estimation method could be potentially useful for tracking FDI impacts on urban spatial expansion in Accra, thereby detailing the loss of agricultural and rural lands to urban growth.

Table 5-2 shows relevant portions of the regression estimation results in Chapter 4. The results indicate the high significance of population as an important driver of urban land conversion compared to income; and FDI in particular. The results in Table 5-2 are used in the IUSEEM calculations for the built up area of Accra over time as will be explained below. All procedures carried out in IUSEEM (apart from the regression analysis) were implemented in the Microsoft Excel software (2010).

The three main test questions are: (a) Do high volumes of FDI inflow into Ghana accelerate the growth rate of the urban extent of Accra? (b) Do varying degrees of FDI concentration result in varying growth rates of the urban extent? (c) Do IUSEEM results support the hypothesized exponential relationship between built up area and FDI? For question (a), if IUSEEM results show that accelerated rate of physical growth corresponded to rapid change in FDI flow volumes, it may indicate that overconcentration of FDI may be the key driver of the rapid rate of physical expansion, all things being equal. In the case of question (b), if the IUSEEM results show that varying FDI concentration levels produce differential growth rates in the built up area of Accra, it could be inferred that varying FDI concentration levels among urban locations in Ghana may help explain, in part, why Accra might have grown so rapidly compared to other urban centers in Ghana. This would suggest that a more geographically diversified FDI distribution among urban centers within Ghana might have helped reduce the rapid rate of Accra's physical extent expansion. Finally, for question (c), if IUSEEM results confirm the hypothesized exponential growth relationship, IUSEEM may be deemed an appropriate method for modeling and estimating FDI induced urban spatial expansion in

a primate city, which could then be replicated to study other urban areas with similar characteristics as Accra.

Results

Table 5-3 displays the results of IUSEEM computation using only the estimated FDI co-efficient of 0.087 resulting from the regression estimation in Chapter 4, adjusted to 0.0696 (assuming 80% FDI concentration in urban Accra), (Table 5-2). Before the details of the IUSEEM results are analyzed, however, understanding of the operation of the IUSEEM may be further enhanced by explaining the underlying mechanisms. Thus, specifically, how does the IUSEEM work?

The extracted estimated regression results in Table 5-2 are deemed to be the outcome of 'global' regression as presented in Chapter 4 and in this chapter (above). According to the results, 1 percentage increase in FDI inflow to a given country (in 1999) induced a corresponding 0.087 percentage increase in the urban land cover of that country in 2000. This inference holds for Ghana as well. In the case of Ghana, however, only the capital city, Accra, is contained in the sample of cities (Appendix A). (Note that one country may have more than one city in the sample used for the regression estimation). Hence, the inference refers to the urban land cover of Accra as opposed to the aggregate of all urban land cover in Ghana. However, since the FDI data were captured at the national level, it is logical to assume that the estimated FDI coefficient is "national" hence must be adjusted to the level of the city (Accra in this case). Even though not all of the FDI amounts received in Ghana are invested in Accra, reliable sources have indicated that the geographical distribution of FDI funds in Ghana is highly skewed in favor of the Greater Accra Region (GIPC, 2011: various years) in which Accra is the "flagship" urban center. More specifically, it has been estimated that

on the average between 75 to 85 percent of annual FDI inflows to Ghana concentrate in Accra's economy (GIPC, 2001-2011). For the purposes of the IUSEEM computations, therefore, the estimated FDI coefficient is adjusted using an estimated FDI concentration level of 80% for Accra, implying that about 80% of all annual FDI inflows to Ghana is concentrated in urban Accra and its environs. Thus, the adjusted estimated regression coefficient for FDI = $0.087 * 0.8 = 0.0696$ (or 0.000696 as decimal). With this adjustment, it can be inferred that 1 percentage increase in the volume of FDI inflow to Ghana in a given year (1999 in this case) would induce 0.0696% increase in Accra's urban land cover in the subsequent year (2000 in this case). In other words, an increase of 10 percent in FDI inflow to Ghana corresponded to an increase of about 0.7% in the built up area of Accra. It is important to note that the urban land cover data for Accra used to estimate the regression in Chapter 4 were for 2000 and all FDI figures from 1999. Thus, these years serve as the base years for the operationalization of the IUSEEM. It is interpreted that FDI inflow to Ghana in 1999 would induce change in the built up area of Accra most probably in 2000. By the IUSEEM convention and as per the "lagging" assumption underlying the regression models presented in Chapter 4, therefore, FDI flow in any given year can induce change in the urban land cover in the subsequent year (s). Consequently, it is not necessary to estimate the built up area for Accra in 2000, since FDI figures beginning from 2000 are used in IUSEEM. Hence, the IUSEEM estimation period in this exercise begins in 2001, using the relative change in FDI inflows to Ghana in 2000. Using the 1999 FDI flow to Ghana as the base year, relative changes in FDI flow (f) in subsequent years are calculated by the formula:

$$f = \text{FDI}_y - \text{FDI}_{1999} / \text{FDI}_{1999}$$

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FDI_y = FDI flow volume in the current year (in US\$), and FDI_{1999} = Base year (1999) FDI flow volume. For example, the “ f ” for 2000 is calculated as follows:

$$f = (165900000 - 243700000) / 243700000 = -0.319245$$

This means that the FDI inflow to Ghana in 2000 decreased about 32 percent compared to FDI inflow in 1999 (the 1999 FDI inflow remains the common denominator for calculating “ f ” throughout the IUSEEM computation exercise). This also means that the exponent, “ \hat{g} ”, in IUSEEM cannot remain “constant” (as in a regular exponential function) because FDI flow levels change every year. Consequently, for the purposes of the IUSEEM computations, the estimated and adjusted FDI co-efficient for Accra must be ‘updated’ to reflect the actual FDI inflow level in 2000 as follows:

$$\hat{g} = \hat{c} * (1+f) = 0.000696 * [1+ (-0.319245)] = 0.000696 * (0.680755) = 0.000474$$

It is obvious from the foregoing calculation that due to change in FDI flow levels, the IUSEEM exponent “ \hat{g} ” gets reduced, from 0.000696 (1999 FDI flow level) to 0.000474 (2000 FDI flow level), a decrease of about 32%, thereby updating “ \hat{g} ” accordingly. And this would be reflected in the urban land cover change in 2001. In this way, actual FDI flow level is used to estimate the built up area in the subsequent year. Thus, relative change in FDI for 2000 is used to compute the built up area in 2001, reflecting a lag in order to buttress the point that FDI inflow will not be translated instantaneously into built up area expansion in the same year. So for example, in estimating the built up area in 2001, the change in FDI in 2000 relative to the 1999 FDI flow level is used to update the

estimated regression coefficient as shown above to derive “ \hat{g} ” (the exponent). Similarly, to estimate the built up area in 2011, the FDI flow level of 2010 is compared to the 1999 flow level to obtain the relative change in FDI flow (f), which is then used to update the FDI coefficient (1999) and used as the exponent (\hat{g}) to estimate the built up area for 2011 (Table 5-3), a two-step lag. For example, in 1999 the adjusted coefficient was 0.000696 (changed to decimal), which decreased to 0.000474 in 2001 because the FDI volume in 1999 decreased about 32 percent in 2000 (as indicated by the calculated relative change). Realistically, therefore, this fall in FDI flow volume should reflect in a decline in the rate of FDI-induced urban spatial expansion in Accra.

In Table 5-3, relative change in 2000 is shown in italics in 2001, relative change in 2001 is shown in bold in 2002 in that order, with relative change in 2010 shown in 2011. Thus, in IUSEEM, the FDI inflows to Ghana for 2000-2010 are used to estimate the built up area of Accra (co-efficient adjusted by 80% FDI concentration in Accra) for the period 2001-2011. More specifically, the built up area in Accra over time is estimated by feeding the initial urban land cover data, 328sq.km in 2000 (Angel et al., 2011; 2010), into the IUSEEM (Table 5-3, column 6) which is then used to estimate the “current” level of FDI induced built up area (Table 5-3, column 7). This figure (also shown in column 6) becomes the input (B_0) for the estimation of FDI induced urban built up area in 2002, reflecting the ‘compounding’ nature of urban built up area expansion over time. Now, the temporal dimension comes in when “ f ” is recalculated annually, reflecting the current amount of FDI (relative to the value of FDI in the starting period-1999 FDI level); together with the number “1” the recalculated f is used to update \hat{g} .

Following from the above, the built up area of Accra in 2001 is estimated, using the IUSEEM as follows:

$B_0 = 328 \text{ sq.km (approx.)}$, $e = 2.718$, $\hat{c} = 0.000696$, $f = -0.319245$ (from 5.9),

$\hat{g} = \hat{c} * (1+f) = 0.000696 * [1+ (-0.319245)] = 0.000696 * (0.680755) = 0.000474$

Substituting in model (5.9):

$$B = 328 * e^{\hat{g}} = 328 * 2.718^{(0.000474)}$$

$$B = 328 * 1.000473889 = 328.1554355 = 328.16 \text{sq. km (approx.)}$$

The outcome of the calculation above is shown in column 7, row 1 in Table 5-3.

In 2000 the built up area of Accra was about 328sq. km (Angel et al., 2011; 2010).

Using this as the initial input, the IUSEEM results show that the estimated built up area in 2001 came up to 328.16sq.km. As per IUSEEM assumption of “compounding” growth, this then logically becomes the input for the next year’s (2002) estimation, which yields 328.24sq.km (Table 5-3, column 7).

The rest of the entries in column 7 are computed using the procedure described above. In terms of FDI inflows to Ghana for the period 2000-2010, a total of US\$7,627,630,000 in FDI funds were received, averaging US\$693,420,909.1per annum. For the period 2001-2011, according to IUSEEM estimation results, a total of about 7sq.km land converted to urban uses in Accra could have been induced by FDI inflow to Ghana (and a concentration of 80% of it in Accra); averaging 0.66 sq. km (or about 0.7sq.km) of FDI induced urban land conversion annually. The cumulative built up area at the end of 2011 as estimated by IUSEEM with the 80 percent FDI concentration amounted to 335.22 sq. km, from 328 sq. km in 2000. On the surface of it, this change is not quite impressive. However, the results highlight several important

characteristics which seem to support the hypotheses formulated above which also appear to support the conceptual and theoretical arguments of this dissertation.

Firstly, the manifestation of the fluctuations in FDI inflows to Ghana in the built up area expansion of Accra is obvious from Table 5-3 (column 8), which is calculated by subtracting column 6 (existing built up area at beginning of the year of estimation) from column 7 (the estimated built up area at the end of the year). In 2001 the estimated built up area was 0.16sq. km which reduced to 0.08sq. km in 2002, with a further reduction to 0.06sq. km in 2003. However, in 2004 the estimated built up area rose to 0.10sq. km, further increasing to 0.13sq. km in 2005 and to 0.14sq. km in 2006, with the increasing trend continuing up to 2011. Even with all positive changes, the values for the respective years differ, reflecting the dynamics (fluctuations) of FDI inflows to Ghana, from year to year. This is a very important outcome because it appears the IUSEEM results then confirm the postulate that the model is capable of reflecting the fluctuations in annual FDI flows to Ghana; *increasing volumes of FDI inflow to Ghana corresponded to rapid rate of Accra's physical expansion*. This is made possible through the implementation of the relative change in FDI flow annually (f) as part of the coefficient in IUSEEM, replacing the explicit representation of "time" in the model which would not have reflected adequately the FDI fluctuations in the built up area expansion process. If unit of time had replaced (f) in IUSEEM, the estimated coefficient would have been increased by "units" of time instead of actual FDI flow levels which are subject to fluxes (fluctuations) from year to year.

Secondly, the *exponential* expansion process is also indicated in Table 5-3 (column 8). For example, the estimated built up area for 2003 was 0.06sq.km (note: for

one year only). In 2006, the estimated built up area was 0.14 sq. km, representing an increase of about 146 percent over the estimated built up area in 2003. This change occurring within a period of 3 years can be considered quite rapid. Similarly, in 2007 the estimated area was 0.60 sq. km. In 2011, the built up area was estimated to be 2.41sq. km, representing a dramatic increase of about 303% over the estimated figure for 2007. Again, this change occurred within 4 years and can be considered “exponential growth”, if not explosive. (Note that exponential growth here refers to the annual change in urban built up area, not the cumulative or the absolute size of the urban extent). It is important to emphasize that these results correspond to periods of dramatic increases in FDI flows to Ghana as displayed in column 2 of Table 5-3. It can be deduced that FDI induced rate of change in built up area follows an exponential growth rate path. Thus, the IUSEEM results so far exhibit the postulated non-linearity of growth as well as the exponential nature of the FDI induced urban expansion process. *IUSEEM results suggest, tentatively, that FDI inflow into Ghana exhibited an exponential growth in volume, therefore, the same exponential growth manifested in the rate of physical expansion of Accra which absorbs estimated 80% of all annual FDI inflows to Ghana.*

So far the results from IUSEEM obtained from the assumed 80% FDI concentration in Accra even though not impressive, do appear to give some credence to the basic argument in this dissertation. However, it would be even more insightful to examine whether or not the estimated IUSEEM results will be sensitive to varying FDI concentration levels. Specifically, how would different FDI concentration levels in Accra impact the urban built up area expansion over time? For example, what would have

been the rate of Accra's physical expansion if the city had been receiving 10 percent of all annual FDI inflows to Ghana?

Table 5-4 depicts the results of the IUSEEM estimation based on assumed varying concentrations of FDI in Accra, using only the estimated FDI coefficient of 0.087, adjusted to 0.0696 for Accra. It is shown that when FDI concentration level in Accra increased to 100%, (from the 80% estimated concentration based on the literature) IUSEEM estimates that the cumulative built up area in 2011 amounts to about 337sq. km, with the total FDI induced change in built up area amounting to about 9sq.km and averaging about 0.82 sq. km per annum for the period 2001-2011(Table 5-4). This means that increasing FDI concentration by 20% (from 80%) resulted in an increase of 2 sq. km in the built up area of Accra with the average at 0.82sq.km annually (compared to the average of 0.66 sq. km for 80% FDI concentration in Accra); about 24 percent increase in annual growth rate has been induced by 20% increase in FDI flow volume. With FDI concentration of 10% in Accra, the corresponding cumulative built up area is estimated to be about 329 sq. km for the period 2001- 2011, totaling a change of about 0.9sq.km, with an annual average of 0.08 sq. km. Clearly, IUSEEM shows sensitivity to varying FDI concentration levels, reflected in the annual rate of FDI induced spatial growth. Tentatively, therefore, *it can be deduced that within a given city, different FDI concentration levels in different years would have differential impacts on the rate of physical expansion of the city over time; by implication, unequal geographical distribution of FDI within a country's urban system may help explain differential physical growth rates in the urban system.*

From the foregoing, IUSEEM results do confirm the initial hypotheses proposed. However, it is important to further interrogate whether or not the full impact and significance of FDI have been captured, using the estimated FDI coefficient alone as implemented so far. There are reasonable grounds to suggest that the magnitudes of the estimated results might have been underestimated (Chapter 2; Chapter 4). Thus, the IUSEEM estimation results shown so far appear to underestimate the full impact of FDI on the urban spatial expansion process in Accra. It may be recalled that multiple pathways through which FDI impact urban land conversion have been identified, conceptualized and theorized in chapters 2 and 4 of this dissertation. In particular, this study has argued that *FDI inflows into a city enable people to gain or increase their purchasing power to enable them demand the kind of quality residential units such as driving the rapid rate of urban land conversion and expansion process in Accra*. It is therefore suggested that the purchasing power behind population numbers must be properly considered when analyzing drivers of contemporary urban spatial expansion in 'primate' cities of the developing world such as Accra in Ghana (Chapter 4). In effect, this study questions the overwhelming importance and statistical significance of population as a driver of urban land conversion as shown in Equation 5.9. Similarly, the increasing concentrations of FDI in primate cities would have the tendency of increasing per capita incomes of the city residents or, at the minimum, would lead to more people earning relatively higher incomes. It sounds reasonable; therefore, to assert that in the globalizing city receiving disproportionate share of FDI inflows would lead to relatively higher income levels above the country's GDP per capita which may have more to do with increasing FDI inflows than the general economic growth in the country. In effect,

for the case of Accra, contribution of GDP per capita to the spatial expansion process shown in Equation 5.9 might have been brought on largely through FDI-related economic activities. However, these cannot be captured by the current measurement of GDP per capita, necessitating an adjustment. To sum up, FDI inflows may trigger the transmission of economic impulses through the traditional land expansion drivers - population and income-resulting in an indirect FDI impact on demand for housing and land which feed into the urban expansion process, especially when the overall national economy has not experienced equally rapid rate of growth as the growth rate of the urban extent. In view of these considerations and depending on the nature of the spatial expansion process and the regional context of the urban location, it seems plausible to reason that some FDI influences might have been transmitted through population and incomes. Thus, for example, in the regression estimation results in Chapter 4 the coefficient for the population of the city is 0.787 implying that 1% increase in population induced about 0.8% increase in urban built up area, an almost one-to-one correspondence, with high statistical significance (95% confidence level). The real situation in places like Accra is far from this, whereby low income residents find themselves “bulked” together in high density areas such as Nima, Chorkor and Newtown, to mention just a few. The same argument goes for the case of GDP per capita since the housing units constructed in peri-urban Accra is widely acknowledged to be above the means of the ordinary Accra residents (Aryeetey-Attoh, 2010; Yeboah, 2003; Konadu-Agyemang, 2001). It seems fair to suggest that the contribution of the low income populace to the rapidly expanding built up area, into the peri-urban areas, must be very minimal, if not insignificant. For the purposes of analyzing the peri-urban

land expansion in Accra, therefore, it is important that both the population and GDP per capita resulting from the regression estimation (Table 5-2) are adjusted to reflect the possible “transmission” of FDI “impulses”, thereby attempting to *capture the indirect effects of FDI on the urban land expansion process*.

Based on the reasoning so far, FDI, in its high concentration, is deemed to be a major source of income directly or indirectly, for many residents in a rapidly globalizing city such as Accra. Consequently, the regression co-efficients for population and GDP per capita must be adjusted to reflect the “purchasing power push” they may be deriving indirectly from FDI. Due to lack of an established approach to this problem as of now, tentative calculations can be made based on the estimated percentage of FDI received annually in the city under consideration. Thus, for Accra where it is estimated that about 80% of the FDI inflows to Ghana annually is received, this percentage can be applied as follows: (a) GDP per capita co-efficient * 80%; and (b) city population co-efficient *80%. The results of this exercise may be described as the *indirect FDI related purchasing power*. It should be noted that the use of the assumed 80% FDI concentration to adjust the population and GDP per capita coefficients is not to suggest that population and GDP per capita are not important land expansion drivers in Accra. The argument is that estimated regression coefficients such as obtained in Chapter 4 of this dissertation would normally be ascribed to population and income. But Ghana’s economic growth (income) and population growth do not match the rate of urban extent growth of Accra (Table 5-7). Incidentally, however, FDI flows into Ghana in contemporary times appear to be the only economic variable whose “growth rate” paralleled that of the physical expansion of Accra. For the purposes of the analysis in

this chapter, therefore, it is suggested that as much as 80% (following the assumed FDI concentration level in Accra as described above) of the induced built up area expansion ascribed to population and GDP per capita (as per the estimated regression coefficients in Chapter 4) can be attributed to indirect influences of FDI inflow to Ghana. (It is to be noted that the relevant interpretation here is limited to the results of the regression model formulated in this dissertation only. This attempt is being made to capture the possible masking of FDI influences on urban land expansion in peri-urban Accra only; and should not be taken out of context).

Following from the foregoing discussion, the population and GDP per capita coefficients are adjusted by the estimated 80% FDI concentration level in Accra as follows: Population: $0.787 * 0.8 = 0.6296$ (0.006296 as a decimal); and GDP per capita: $0.215 * 0.8 = 0.1720$ (or 0.001720 as a decimal). In short, it is assumed that about 80% of the induced change in built up area of Accra in 2000 attributed to population and GDP per capita, in reality, is likely to have been brought on by FDI related economic activities in the economy of Accra. (It would be recalled that in Chapter 4 these coefficients were interpreted as percentages or elasticity and therefore being unit-free. As a result, they can be summed up). Put in perspective, it is the argument in this chapter that the adjusted co-efficients for population and GDP per capita must be added to the adjusted coefficient of FDI in order to 'unmask' the effect of FDI "impulses" transmitted through these explanatory variables. Hence, the total adjusted co-efficients deemed to better reflect the full impact of FDI on built up area expansion in the case of Accra will be the sum of the adjusted co-efficients for all three explanatory variables: 0.6296 (Population) + 0.0696 (FDI) + 0.1720 (GDP per capita) = 0.8712 (or 0.008712 as

decimal). In this case the 'c' in the IUSEEM now corresponds to 0.008712 (as opposed to 0.000696 for FDI alone shown in Table 5-3).

Table 5-5 displays the results of the IUSEEM estimation for the period 2001-2011, implementing the combined adjusted coefficients of population, FDI and GDP per capita. According to the results, the total change in built up area of Accra for the period as induced by FDI and related activities is 102.81 sq. km, a dramatic increase compared to the total FDI induced change in built up area of 7.22 sq. km for the FDI coefficient alone (Table 5-3). The average built up area change per annum is about 9sq.km (about 0.7 sq. km for FDI alone) which is also a remarkable increase. Of particular importance to the arguments of this dissertation are the values in column 8 in Table 5-5) which conforms to the non-linearity and exponential growth postulates illustrated by the IUSEEM results above, just as in the case where with only the adjusted coefficient of FDI. The estimated built up area in 2001 is 1.95 sq. km, decreased to 1.05 sq. km in 2002 and further decreasing to 0.70 sq. km in 2003. These were the manifestation of the fluctuations in the annual FDI flow volume. Comparing the estimated built up area in Table 5-5 and Table 5-3 reveal that adjusting for the coefficients of population and GDP per capita dramatically increases the magnitudes of the estimates. For instance, the total change in estimated built up area in the combined coefficients scenario is 102.81sq. km; compared to 7.22 sq. km for the FDI coefficient alone, an increase of 1323 percent. In terms of the average (per annum) estimated values, the combined coefficients results came up to 9.35 sq. km per annum, compared to 0.66 sq. km per annum when only the adjusted FDI coefficient was implemented. This represented 1316 percent increase. These results show that using the FDI

coefficient alone in the IUSEEM computation may lead to gross underestimation of the potential impacts of FDI and related activities on the spatial expansion of Accra. Even though not conclusive, these results highlighting the dramatic change in the built up area expansion incorporating the adjusted coefficients of population and GDP per capita, cannot be dismissed given the conceptual and theoretical analysis relating FDI to urban land conversion as advanced in this dissertation (Chapters 2; Chapter 4). Thus, *in addition to supporting the non-linearity and exponential growth, the IUSEEM estimation results would suggest that population and GDP per capita may be “masking” some of the economic impulses transmitted by FDI which are translated into rapid urban land conversion, especially in primate cities in developing countries such as Accra in Ghana.* (It should be noted that the choice of 80% for the adjustment of population and GDP co-efficients were based solely on the estimated 80 percent FDI concentration level for Accra. This may not be the accurate figure or the best adjustment procedure. But for an exploratory study, the outcomes seem to suggest that FDI may be a potential driver of spatial expansion in Accra).

Further insights can also be gained by computing the resultant estimated built up area of Accra for the period 2001-2011 at different FDI concentration levels (percentages), using the combined adjusted co-efficients. Table 5-6 displays the IUSEEM results from 10% to 100%, at intervals of 10. It is shown that at 100% FDI concentration level in Accra, a total of 133sq.km of land would be converted to urban uses during 2001-2011 (compared to 9.05 sq. km previously estimated for FDI alone). The annual average FDI induced land converted at the 100% concentration level is 12.11 sq. km, a huge increase compared to the annual average of 0.82 sq. km per

annum induced by the FDI co-efficient alone (Table 5-4). On the other end of the scale, 10% FDI concentration in Accra would induce an average of 1.03 sq. km in built up area per annum, compared to average of 0.08 sq. km per annum estimated from the FDI coefficient alone. It is obvious that *the higher the concentration levels of FDI, the more rapid the physical expansion process; highly accentuated when population and GDP coefficients were adjusted and added to the FDI coefficients*. This suggests that FDI coefficient alone that result from normal regression analysis is more likely to underestimate the full impact of FDI in the urban expansion process in Accra, given the high levels of FDI inflow to Ghana, with equally higher concentration in Accra.

To sum up, IUSEEM results show close positive correlation between FDI concentration levels and rate of urban land / spatial expansion. Higher FDI concentration levels result in more rapid land conversion in Accra. When viewed from the perspective of rapidity of rate of physical expansion, therefore, FDI does appear to contribute to the acceleration of the urban physical growth process in Accra, with the magnitude of impacts varying with varying FDI concentration levels. Again, the magnitudes of estimated built up for Accra appears to be grossly underestimated if only the estimated regression coefficient of FDI is implemented in IUSEEM. Overall, with the regression adjusted R-square of .820, IUSEEM can be said to have a reasonable fit for the data used so far. When viewed from this perspective, it may therefore not be surprising why Accra has been expanding at such a rapid rate in contemporary times, far outstripping the growth rates of the traditional urban expansion drivers –population and income. The results confirm the various conceptual and theoretical postulates underpinning the IUSEEM, which would seem to explain the rapid rate of built up area

expansion in Accra. It does appear that the results obtained from the operationalization of the IUSEEM resonate with characteristics and nature of both the physical expansion of Accra and FDI inflows to Ghana during the economic liberalization era in Ghana with attendant globalization of Accra. It is important to note that the overall contribution of FDI alone to the built up area expansion may not be very impressive, about 7 sq. km in 11 years, averaging about 0.7 sq. km annually during 2001-2011. However, the situation changes dramatically as the coefficients of population and GDP are adjusted and added to the coefficient for FDI, seemingly buttressing the assertion that population and income when used as urban land expansion drivers, might mask the contribution of FDI to the urban spatial expansion process, at least in the case of Accra. Based on the results from the built up area expansion estimation using IUSEEM, therefore, it can be deduced that even though the contribution of FDI to built-up area expansion in Accra may not be huge in absolute terms, it can multiply within a very short time, underscoring the need to begin to pay attention to this external economic force in considering the rapidity of physical expansion in Accra and other similar cities.

Furthermore, IUSEEM's functional specification, including parameter choice, seems to fit the preliminary data for Accra, with some resonance to historical precedence for the spatial expansion of Accra between 1985-2002 as documented by Moller-Jensen et al. (2005). Therefore, IUSEEM seems to be capable of modeling nonlinear and exponential urban spatial expansion process as induced by high levels of FDI inflows into a restricted urban space, where population and income growth have been far outstripped by the rate of physical expansion of the urban area under study. It appears that FDI inflow to Ghana and its characteristic tendency to concentrate in urban

agglomerations in Accra and its environs has contributed in some measure to the rapidity at which Accra's built up area has expanded in contemporary times - during the era of economic liberalization and intensifying economic globalization-1991-2011. It is important to emphasize that FDI is more likely to engender a more rapid expansion in built up area compared to population and GDP per capita. One geographical implication of these results is that spatial inequality in the distribution of FDI could have significant unequal impacts on the rate of built up area expansion as induced by levels of FDI concentration. Consequently, it sounds reasonable to suggest that urban areas receiving disproportionate share of FDI inflows should expect to experience rapid rate of physical expansion, all things being equal.

Discussion

Accra: Highly Urbanized, Globalizing and Spatially Expanding

Farvacque-Victovic et al. (2008) have observed, generally for Ghana that

Although urbanization rates have been lower than in neighboring countries of West Africa, Ghana is following similar trends where by 2030, 65 percent of the population will be located in urban areas, averaging an annual growth rate of 3.1 percent from 2000-2010 and 2.2 from 2020-2030, respectively. (Farvacque-Victovic et al., 2008).

Such urban expansion assertions have generally tended to bother on demographic aspects, but in this case the authors went further to state that

The urbanization pattern reveals strong physical growth, which is typified by moderate and patchy densification within the inner city core, involving the replacement of residential by commercial users, and uncontrolled and low density peripheral growth. (Farvacque-Victovic et al., 2008: 3).

And more specifically for Accra:

A gradual extension of the urban boundaries towards the rural space is being observed. For example, localities adjoining Accra such as Dome, Taifa, Gbawe, New Achimota, Anyaa, Santa Maria, Amanfrom, Nii Boye Town, Mallam, Kissieman, and Agboba, which were classified as rural in

the 1984 census, have attained urban status in the 2000 census. (Farvacque-Victovic et al., 2008: 2).

Accra rose from a cluster of small fishing villages during the colonial era to the major urban center and agglomeration hub in Ghana (Chapter 1), currently accounting for about 20% of Ghana's GDP, hosting majority of manufacturing firms in Ghana; the seat of government and largest concentration of urban population in Ghana and continues to attract in-migration than any other urban area in Ghana (Chapter 1). To reiterate, it is suggested in this dissertation that Accra's contemporary physical expansion, particularly the rapid rate of land conversion from rural and agricultural areas to urban uses (Grant & Yankson, 2003) could partly be the result of high volumes of FDI inflows into Ghana in recent times. To sustain this argument, it would be necessary to establish that the rapid physical expansion of Accra has been characterized by sprawled development.

According to Moeller-Jensen et al. (2005), Accra's contemporary physical expansion has largely occurred on the fringe lands of the city (in the peri-urban areas).

Furthermore, Professor Ian Yeboah has described the contemporary physical expansion of Accra as being characterized by 'quality residential sprawl' (Yeboah, 2003). By "quality residential sprawl" it is being asserted that the new residential developments in the urban periphery of Accra were being patronized largely by relatively rich people. Moreover, Professor Samuel Aryeetey-Attoh lends credence to the assertion of sprawl residential development in Accra (Aryeetey-Attoh, 2010) and this is illustrated in Figure 5-5 and Figure 5-6. Figure 5-5 depicts a representation of Accra, showing some important areas and localities. In the north east corner of the map, a portion of the area is labeled "Sprawled Development". This is a clear indication of the emergence of urban sprawl in Accra, eating into peri-urban natural and agricultural

lands, judging from the distance from the core areas of Accra (close to the coast) such as Jamestown. Even though Figure 5-5 shows the emergence of sprawled development in Accra, it may give the impression that the process is restricted to the small area on the map shown. Thus, to show that urban sprawl is widespread in Accra, Professor Aryeetey-Attoh again provides a more revealing picture (Figure 5-6).

Essentially, Accra's residential sprawl is shown to cover the urban periphery in virtually all directions, with the housing units being predominantly patronized by "upper income" people as labeled in Figure 5.6. Indeed, this seems to be in line with the conceptual and theoretical analyses advanced in this dissertation (Chapters 2; Chapter 4) where it has been argued that such quality housing are more likely to be owned by relatively rich people, who are purchasing power enabled in large measure by FDI as opposed to rural-urban migrants and other less economically endowed people who flock into the city. It must be troubling; therefore, if a blanket attribution is made to population growth as the main driver of urban land expansion (land conversion) in Accra, neglecting to examine the purchasing power aspect of the whole urban land demand dynamics.

Is Population a Major Driver of Rapid Spatial Expansion in Accra?

Firstly, it is generally acknowledged that contemporary physical expansion of Accra has been driven mainly by the construction of new residential housing units mostly in the peri-urban areas of the city, much of which are of high quality (Yeboah, 2003), indicating relative affluence, which by all indications cannot be attributed to the population numbers per se, without the backing of an effective purchasing power. Secondly, the rapidity of the rate of Accra's physical expansion is worth considering. According to the study by Moller-Jensen et al. (2005), between 1985-1991, the physical size of Accra grew from 216 sq. km to 276 sq. km, thus growing at an annual average

rate of 10 sq. km. For the period 1991-2002, Accra grew from 276 sq. km to 555 sq. km, averaging 25 sq. km per annum (Moller-Jensen et al., 2005). The annual growth rate of Accra for 1991-2002 showed 150% increase over the annual growth rate recorded for the period 1985-1991. Going by the conventional explanation of urban land expansion, population and income growth in Ghana (and Accra) around these periods should indicate similar dramatic increases in order to effect the dramatic and rapid rate of physical growth of Accra. There appear, however, to be a wide gap between these two rates of growth as will be shown. Table 5-7 displays five-year periodic averages for all the three explanatory variables used for the present analysis: FDI, population and GDP per capita. For the period 1980-1984, Ghana's population grew at the rate of 3.12 percent per annum, declined to an annual growth rate of 2.78 percent for the period 1986-1990. For the period 1992-1996, the population grew at an annual rate of 2.72 percent, declining to an annual growth rate of 2.38 percent for the period 1997-2001. Comparing the population growth rate to the physical growth rate of Accra, the annual physical growth of 10 sq. km (1985-1991) corresponded with the annual population growth rate of 2.78 percent for the 1986-1990 period. The physical growth of Accra increased dramatically to 25 sq. km for the period 1991-2002, which would correspond to annual population growth rate of 2.72 percent (1992-1996), a decline of 0.13 percent compared to growth rate for 1986-1990; and 2.38 percent (1997-2001), again, a decline of 0.14 percent. Thus, for the period 1992-2001, Ghana's population declined at an annual rate of about 0.13 compared to the growth rate for the period 1986-1990. However, around the same period (1991-2002) Accra's physical growth rate per annum was 25 sq. km, compared to the annual growth rate of 10 sq. km

for 1985-1991. In short, whereas Ghana's population growth rate declined at the rate of 0.14 percent per annum, Accra's urban extent grew at annual rate of 25 sq. km. With regard to population growth of urban Accra, specifically, it has been noted that:

Between 1985 and 2000, the city's population grew from 1.8 to 2.7 million, a 50 percent increase, while its urban land cover expanded from 13,000 to 33,000 hectares, a 153 percent increase. Urban land cover in Accra grew more than twice as fast as its population. (Angel et al., 2011: 39).

Clearly, Accra's built up area expansion rate outstripped population growth rate. It appears that in the case of Accra, population numbers (growth rate) might not have contributed much to the rapid physical expansion of the city in contemporary times since the population growth rates both for Accra and Ghana have not matched the physical growth of Accra within the same period. Hence, increase or decrease in population numbers alone would not adequately explain the rapid growth rate of Accra's physical extent. Nonetheless, it is tempting, superficially, to attribute such rapid physical growth to population growth because it makes sense: people need shelter; increase in population must induce increase in the number of shelters, increasing demand for housing and land. Consequently, the statistical evidence would seem to support this reasoning. Thus, the regression model estimated in Chapter 4 and implemented in IUSEEM, indicate that 1% increase in population induced 0.787% increase; 10 percent increase in population corresponded to about 7.9% increase in the built up area. This type of results is common in the literature (Angel et al., 2011, for example). However, it is important to look beyond these seemingly significant pieces of statistical evidence for this study area, since actual evidence based on historical data portray a different picture. It is possible that the population co-efficient in such models "mask" the influences of some more important land expansion driver (s). (This will be revisited

later). For now it would suffice to focus attention on the other most popular traditional urban land expansion driver, because population does not appear to be a major driver of land expansion in Accra.

Usually in rich countries, in such a situation whereby a city's physical growth rate does not match population growth, affluence (growth in income or wealth), which lead to changing lifestyles (housing tastes) are usually invoked to explain the rapid physical expansion (Burchtel et al., 2005; Zwick & Carr, 2007). Basically, as people become relatively rich they demand housing that requires more space, in and around the building, necessitating the need for relatively cheaper lands usually located in the urban periphery. As this type of demand increases, the urban extent expands spatially at a rapid rate (Burchell et al., 2005). Thus, for income to explain the rapid physical expansion of Accra, Ghana's GDP/GNP (per capita) must have experienced growth commensurate with the rate of physical expansion as usually pertains in advanced countries and in consonance with Accra's rate of physical expansion during the same period. If population does not seem to be a major driver of contemporary urban land expansion in Accra, placing Accra's rapid physical expansion in the context of Ghana's overall economic "success" for the same period may yield useful insights.

Is Income a Major Driver of Rapid Spatial Expansion in Accra?

Table 5-7 shows the GDP per capita for Ghana in 5-year periodic averages. For 1986-1990, the GDP per capita was US\$589.17, increased to US\$614.66 (1992-1996) and declined to US\$557.16 (1997-2001). Compared to the GDP per capita for 1986-1990, GDP per capita increased 0.25 percent (1992-2001), whereas Accra's physical extent grew at the rate of 25 sq. km per annum (1991-2002), from a previous growth rate per annum of 10 sq. km (1985-1991). Thus, domestically, Ghanaians in general did not see

appreciable increase in incomes during the period that Accra rapidly expanded its physical extent. This notwithstanding, the kind of quality housing units that have been put up in the peri-urban areas of Accra, which in many respects can be said to be the main contributor to the physical expansion of the city, would suggest that the owners and /or occupants are not low income earners (Aryeetey-Attoh, 2010). It is also important to note that mortgage financing is virtually absent in Accra's residential housing market and that more often individuals must save up on their own in order to own a house (Grant & Yankson, 2003; Gough & Yankson, 2000; Konadu-Agyemang, 2001). As has rightly been asserted by Karen Seto and colleagues, income seems to be more relevant to the explanation of urban land expansion in developed countries (Seto et al., 2011). Angel e al. (2011) came to similar conclusion in their study using a sample of over 3000 cities in a regression analysis and found that ,“A 10 percent increase in GNP per capita is associated with a 1.8 percent increase in urban land cover” (Angel et al., 2011:45). Similarly, the preliminary empirical analysis presented in Chapter 4 of this dissertation shows that 1% increase in per capita income corresponded to about .215% increase in the urban built up area. Important as these 'global' studies are, their application to local/regional level analysis may be misleading. It is important, therefore, that the source of economic sustenance - the main source of purchasing power to the people which enable them to buy the lands and real property in the first place must be recognized. FDI appears to be a good candidate because even though GDP per capita for Ghana as a whole might not have increased in any significant way, incomes for Accra's residents might have gone up in the wake of increasing FDI inflows (Chapter 2; Chapter 4 of this dissertation).

How likely is FDI a Major Driver of Rapid Spatial Expansion in Accra?

That Accra is rapidly globalizing is now reasonably established, at least to some extent (Grant, 2009; Grant & Yankson, 2003). It is common knowledge among researchers studying the urban form and function of Accra that the city has been attracting increased international attention following globalization and economic liberalization in the 1980s and 1990s to the present (Aryeetey-Attoh, 2010; Grant, 2009; Grant & Yankson, 2003; Yeboah, 2003). In particular, the Structural Adjustment Program (SAP) the country embarked on in the 1980s has had profound impact on FDI inflows to Ghana and Accra (GIPC, various years), even though Accra benefited from external economic inflows even in the colonial era when it served as the main port for the export of cocoa, and enjoyed the attention of both colonial and post- independence governments. FDI, as a form of spatial financial flow, has come to characterize the current era of globalization, with increasing importance, particularly to developing countries, with substantial concentrations in urban economies of recipient countries. Accra, largely by virtue of its primacy and its “superior” infrastructure and amenities compared to other cities in Ghana such as Kumasi and Sekondi-Takoradi, has attracted the bulk of FDI (Grant, 2009; Grant & Yankson, 2003; Konadu-Agyemang, 2000). Thus, if FDI inflows are used as a rough indicator of a liberalized economy, Ghana would be accounted as a success story among West African countries (Grant, 2009; 2007; 2001; GIPC, 2009), even though not the largest recipient. For example, according to the GIPC (2009), Ghana received a total of GH¢3.17 billion in FDI funds (about US\$3.5billion) in 2008. This amount is reported to be unprecedented and represented more than 160% increase over the total FDI the country received in 2007. Generally, FDI inflows to Ghana post SAP has been impressive to a large extent. Figure 5-8

shows that in 1993 FDI inflows to Ghana amounted to about US\$120 million, rising to about US\$230 million in 1994 and falling to about US\$110 million in 1995. Thus, it must be pointed out that throughout 1993-2005, Ghana's FDI inflows have been characterized by fluctuations. However, it can be seen that since 2006 FDI inflows into Ghana has been trending upwards. The upward trending of FDI is more explicitly shown in Figure 5.9; between 1992-1996 the average annual FDI inflows to Ghana amounted to about US\$130million, increasing to about US\$150million in 1997-2001 and finally increasing to about US\$230 million during 2002-2006.

A very important and desirable attribute of FDI inflow is that it creates or helps create jobs, thereby contributing to the reduction of unemployment and enhancing economic growth prospects of the recipient economies. For Ghana, this assertion holds some truth, according to GIPC statistics. From Figure 5-7, a total of 79 FDI projects were created in Jan-June of 2003. For the corresponding period in 2007, 150 projects were created, representing an increase of about 89.9% over the 2003 figure, with increments observed for the intermediate years over the previous estimate. As expected, FDI related projects have been providing jobs to increasing number of Ghanaians. Figure 5-8 shows that the percentage of Ghanaians employed in FDI related jobs in all sectors of the economy were high compared to employment offered to foreigners. In Figure 5-9, in terms of expected jobs to be created, Building and Construction came in 3rd behind manufacturing and services; surpassing agriculture and tourism. This means that the increasing FDI flows have also been reflected in the building and construction sector of Ghana's economy. In 2001, according to GIPC data, the building and construction sector registered a total of 10 projects, representing 85%

of all projects, with an estimated value of about US\$5.16million (5.3%). In 2010, 30 building and construction projects were registered, representing 7.98% of all projects, with an estimated value of US\$123 million, representing 9.69% of value of FDI funds. It is not too difficult to see that the building and construction sector of the Ghanaian economy has been booming with increasing FDI levels. Even though the foregoing cannot be considered an exhaustive analysis, it would be difficult not to recognize the importance of FDI in real estate development, with associated jobs increases in the building and construction sector.

It has been noted that the increased inflow of FDI into Ghana is highly skewed in favor of Accra, the capital city of Ghana, implying that Accra has attracted a more than proportionate share of FDI flows into its urban space. For example, according to GIPC data, out of the total of 95 FDI projects created in the 2nd quarter of 2007, 81 were created in the Greater Accra Region, representing about 85%, with urban Accra (GAMA), being the main destination for these projects. It follows that the unequal geographical distribution of FDI projects is even more revealing as shown in Table 5-8 for example, depicting the regional distribution of the FDI projects in the second quarter of 2007. Again, the pattern of over-concentration of FDI projects in the Greater Accra Region and the city of Accra has been sustained, if not enhanced in recent times (Figure 5-9). According to the GIPC (2011), the Greater Accra Region hosted a total of 105 projects, representing about 82% of all projects created for the 2nd quarter of 2011. The estimated value of 105 projects in the Greater Accra Region (majority of which are concentrated in the GAMA) was about US\$579 million. This is a rough indicator pointing to the fact that FDI inflows to Ghana continues to increase and that the Greater

Accra Region (and the city of Accra) have been disproportionately favored in terms of the geographical distribution of this all-important external funds. Again, in Accra, foreign building and construction companies are active participants in the local real estate development enterprises (Grant, 2009). In general, therefore, in the advent of increasing FDI inflows into Ghana, FDI related projects and employment have all been on the rise. A particularly important aspect of the FDI employment is that employment for expatriates, very important for the argument of this dissertation and the goal in this chapter is that even though small compared to Ghanaians employed in FDI related jobs, is increasing (Grant & Yankson, 2003). This is an important development which could impact the composition of residential housing demand in Accra since such expatriates are usually better paid and can therefore express effective demand for the new houses usually constructed in the urban periphery. This, in a way, gives some credence to the conceptual and theoretical analyses (Chapters 2; Chapter 4), consistent with the theoretical postulates.

The foregoing discussion is buttressed by the historical data on FDI presented in Table 5-7. The table displays five-year periodic averages for FDI (1980-2001). For the period 1986-1990, US\$8760000 flowed into Ghana annually, increasing to US\$121400000 for 1992-1996 and again increasing to US\$149620000 for the period 1997-2001. In comparative terms, average of annual inflow of FDI to Ghana for 1992-1996 represented an increase of about 1055 percent over the average annual FDI for the period 1986-1990. Similarly, the annual FDI inflow for the period 1997-2001 represented an increase of about 1608 percent over the average annual FDI flow for the period 1986-1990. It would be recalled that Accra's physical expansion was at the rate

of 10 sq. km per annum for the period 1985-1991 (Moller-Jensen et al., 2005; Table 5-1), corresponding to the FDI inflow to Ghana for the period 1986-1990. Incidentally, the dramatic increases in FDI inflow for the periods 1992-1996 and 1997-2001, roughly corresponded with the equally dramatic and rapid rate of increase in Accra's physical size for the period 1991-2002, 25 sq. km per annum, 150 percent increase over the annual physical growth rate for the previous period (1985-1991), at the rate of 10 sq. km per annum. According to these historical data, it appears that rapid rate of FDI inflow to Ghana during 1992-2001 roughly corresponded to an equally rapid physical expansion of Accra between 1991-2002. Whereas these alone may not prove conclusively that FDI was the significant cause of Accra's physical expansion at the time, it is important to note that FDI seems to be the only economic variable whose behavior around this period came close to the character of the physical expansion of Accra back then (compared to population and income growth). At the minimum, this is a good reason for further interrogation of the FDI-urban spatial expansion relationship in Accra, given the multiple pathways of FDI impact on urban land expansion and possible multiplier effects (Chapter 2; Chapter 4). Two important observations can be deduced from the analysis, documented published evidence and historical data presented above: (i) both FDI inflows to Ghana and physical expansion rate of Accra can experience dramatic increases in size/volume; and (ii) both can change in a very short period of time, resulting in a sort of coincidental rapid growth rates. Consequently, it would not be surprising for both FDI inflows to Ghana and the physical expansion of Accra to exhibit non-linear and exponential growth characteristics. And with the high concentration of FDI in Accra, compared to other urban areas in Ghana, it can be argued that FDI may

have more to do with the rapidity of physical expansion in Accra than population and income growth. The surge in FDI inflows have even been accentuated in recent times. For example, for the period 2000-2010, the average annual FDI inflows to Ghana topped US\$6million, even though with declines in some years (Table 5-7). Accordingly, it should be expected that FDI would help explain the rapidity of Accra's contemporary physical expansion if estimated with an appropriate method. Given the apparent potential importance of FDI in the urban economy of Accra and the multiple pathways that FDI may impact the urban expansion process, the FDI –urban land expansion relationship was modeled and estimated. The Integrated Urban Spatial Expansion Estimation Method (IUSEEM) was designed to help achieve the goal of quantifying the dynamic relationship between FDI concentration in Accra, with urban primacy status, and the rapid expansion of the urban extent over time.

To what extent is FDI a Major Driver of Urban Spatial Expansion in Accra: Interpreting the IUSEEM Results

Average growth rate.

USEEM results indicate that rapid rate of increase in FDI would correspond to rapid rate of physical growth of the urban area (Table 5-3 through to Table 5-6). This also resonates with the characteristic of FDI which responds to economic opportunities in the form of returns on capital, be it savings on labor or environmental quality rules and regulations. This ensures that FDI will flow into a particular location so long as operations would be profitable. It is also important to note that FDI originate from diverse sources cutting across developed and developing countries alike. For instance, with regard to FDI inflows to Ghana, the traditional sources had been the UK, USA, Netherlands and the likes (developed countries) but recent trends show increasing FDI

inflows from developing countries such as China, India, Malaysia, Libya and South Africa (GIPC, various years). With these diversified FDI flow sources, it would not be surprising if rate of increase in volume grows astronomically, given the relatively stable, democratic political environment as well as conducive investment climate in Ghana (GIPC, various years). In effect, the magnitude of FDI impact is further amplified when one reasons that in the discussion of socioeconomic induced urban land expansion modeling, much of FDI impulses may be masked by the use of population and GDP (or GNP) per capita as explanatory variables as pertains in current urban land expansion analysis. This study has suggested, in view of the unremarkable changes in these variables for Accra and Ghana during the 1991-2002, it is doubtful if they had any significant contribution to the rapidity of physical expansion that has been experienced by Accra during this period. However, population and income show up as strong and significant contributors of land cover expansion in the regression estimation in Chapter 4, possibly masking the true impact of FDI in urban land expansion, especially in the case of Accra. Consequently, these coefficients have been adjusted and implemented in IUSEEM with the results indicating a dramatic increase in the magnitude of the impact of the FDI-urban land expansion process (Table 5-3 through to Table 5-5).

It can be concluded that *in addition to the rapidity of urban physical expansion that can be brought on by rapid increases in the volume of FDI inflows, and the differential spatial impacts according to concentration levels, adjusting the population and GDP per capita coefficients would seem to better reflect the “true” impact of FDI on the urban spatial expansion process in Accra in contemporary times.* The adjustments have been based on the assumption that FDI might have increased incomes and contributed to the

kind of purchasing power necessary to afford the quality houses in peri-urban areas of Accra but the impact could have been masked by the use of population numbers and GDP per capita in regression estimation in this work and other related works such as Angel et al. (2011).

For Accra, something fundamental and enduring might have dramatically changed around this time, which may be more related to external economic influences than local ones. In this regard, it may be useful to consider remittances and FDI as potential drivers from “global” sources. Given that remittances affect the urban expansion process through multiple pathways (Chapters 2; Chapter 4), it is conceivable that remittances could have significant impact on the urban expansion process in Accra). For example, the quality housing units suggest people with high incomes, remittances from UK and USA with strong currency virtually have “windfall” as these foreign currencies are changed to the local currency equivalent. Also, the nature of housing units suggest affluence such as identified for urban sprawl in the USA for example, giving indications to the notion that some of the owners might be Ghanaians living abroad. Thus, the possible influence of remittances on the urban expansion process in Accra cannot be written off entirely. However, the measurement of remittances is fraught with numerous difficulties as discussed in Chapter 4 such as unrecorded transfers, definition issues, numerous non-reporting countries, among other things. These notwithstanding, it seems that remittances should show some positive correlation with urban spatial expansion. To the contrary, however, results obtained in Chapter 4 of this dissertation showed a negatively signed co-efficient but statistically significant at 95 percent confidence level. Consequently, even though there are strong

indications that remittances may influence urban spatial expansion the remittances coefficient obtained in Chapter 4 has not been considered in the analysis in Chapter 5. This is left for future empirical research.

Varying FDI concentration levels

From the foregoing, it is logical to expect that varying FDI concentration levels should influence the rate of FDI induced urban land expansion. Results from IUSEEM demonstrate this characteristic (Table 5.4; Table 5-6), using hypothetical FDI concentration levels for Accra, showing that low levels of FDI concentration (in percentage) corresponded to slow physical expansion rate and high FDI concentration levels corresponded to rapid rate of physical expansion. As foreign capital (FDI) enters the domestic economy of Ghana but over-concentrated in Accra, it is reasonable to suggest that average incomes in Accra will increase relative to incomes in other urban areas in Ghana, at least until in-migration smoothens this income peak. Consequently, demand for housing and land increases rapidly, translating into conversion of new lands in the absence of densification and effective land use controls, leading into rapid rate of physical expansion of the city. Thus, while demand for land in Accra receives a boost from external economic inflows, demand for land in urban areas in the rest of Ghana may be dictated by “actual” growth of the domestic economy, which according to available data, may not be as rapid as the inflow of FDI to be commensurate with the rapid rate of Accra’s physical growth. The broader geographical implication is that urban areas receiving large proportions of FDI are more likely to experience rapid rate of physical expansion, compared to urban areas receiving low to moderate amounts of FDI inflows. It is important to reiterate that all these tentative conclusions have been based on the estimation results using only the FDI coefficient as estimated in Chapter 4.

However, there are reasonable grounds to suggest that the use of the FDI coefficient alone may result in underestimation of the magnitude of FDI as explained above.

Consequently, for example, it could be misleading to attribute 0.215 coefficient in the estimated regression in Chapter 4 to GDP entirely. Similarly, the estimated population coefficient of 0.787 makes the variable overly important, contrary to the raw statistical evidence adduced already. Further, the rapidity of change in built up area does not match the rate of change in per capita income and population growth as has been noted above. Hence, the need to reconsider the apparent high values of these traditional urban land expansion drivers since they could be masking the potential economic influences of external forces such as FDI and remittances. In short, the GDP coefficient in the case of Accra may not be as significant as the estimated regression model suggests. The same can be said for the coefficient of population. However, GDP per capita and population coefficients may be adjusted to reflect the overarching importance of FDI in the urban economy of Accra. It is obvious that the magnitudes of impact for FDI and related activities become larger. Admittedly, the adjustment procedure is not a standardized one and therefore not proven to be robust (conclusive). However, it comes in handy and is also motivated by logical reasoning given Accra's circumstances whereby population and income appear to explain very little of the rapidity of the physical expansion. What may be particularly contentious is the use of the 80% FDI concentration level for adjusting the GDP per capita and population coefficients. Definitely, this is worth further investigation. The limitations of the adjustment procedure notwithstanding, it does not seem reasonable to attribute to

population and income the “entire” estimated coefficients as resulted from the regression modeling exercise.

One important characteristic of regression modeling is the provision for the random aspect of variation in a phenomenon, thereby allowing for the modeling of socioeconomic processes more appropriately. Thus, modelers are able to estimate the proportion of the variation in the response variable which could be explained by the estimated regression model. In the context of this dissertation, the regression model from which the coefficients were extracted for implementation in the IUSEEM explained 82% of the variation in built up area (Accra in this case). As a result, the IUSEEM results do not account fully for the variation in the urban built up area of Accra. Also, since IUSEEM purports to quantify the spatio-temporal dynamics of the FDI-urban land expansion relationship, errors may accumulate over time. It would therefore be desirable if the actual level of FDI-induced urban land expansion in Accra can be determined. Unfortunately, data available at this time would not allow for such analysis. However, a simple comparison of IUSEEM results with independent urban expansion data for Accra may yield useful insights in this regard.

The IUSEEM Results Compared to Independent Data

The IUSEEM results for the varying FDI concentration levels can be compared with data obtained from Moller-Jensen et al. (2005), based on the following simple calculation: It would be recalled that Accra’s physical expansion rate for the period 1985-1991 was 10sq.km per annum; and for 1991-2002, the rate of physical growth was 25sq.km per annum. Therefore, average annual increase in built up of Accra for the period 1985-2002 can be calculated as: $(10 \text{ sq. km} + 25 \text{ sq. km}) / 2 = 17.5 \text{ sq. km per annum}$. This average annual built up area expansion rate will be compared with the

average annual growth rate of Accra estimated with the IUSEEM using the combined adjusted coefficients comprising FDI, population and GDP per capita. With 80% FDI concentration level and firstly using IUSEEM average compared to Moller-Jensen et al. (2005). It would be recalled from above that the estimated annual average built up area for Accra between, 2001-2011 using FDI coefficient alone yielded 0.66sq.km, based on the IUSEEM. Compared to the calculated rate of annual growth rate of 17.5sq.km from Moller-Jensen et al. (2005), the IUSEEM average was found to be 3.75%. This would imply that given that about 18sq.km of land is converted to urban uses in Accra, 0.675sq.km could be attributable to FDI, if 80 percent of all FDI inflows for the period 2000-2010 were concentrated in Accra. This comparison of the IUSEEM estimated growth rate with actual, independent data does not seem significant enough. However, it has been suggested already above that using the estimated FDI coefficient alone could lead to underestimation of the actual impact of FDI on the built up area expansion process, hence the need to adjust for the population and GDP per capita for inclusion in order to reflect the full impact of FDI as has been demonstrated above. Therefore, to examine the full impact of FDI and related activities, the average estimated built up area within a year based on IUSEEM and using the sum of the adjusted coefficients can be compared with that of Moller-Jensen et al. (2005). Table 5-10 presents the comparison of IUSEEM estimation results at varying FDI concentration = Moller-Jensen et al. (2005), this time with the combined coefficients of FDI, population and GDP per capita. At assumed 80 percent FDI concentration level in Accra, the IUSEEM estimated annual average is found to be 54.31% against data from Moller-Jensen et al. (2005). This implies that, on the average, about 54 percent of land converted to urban uses in Accra

per annum for the period 2001-2011 may be attributed to FDI and other economic activities likely influenced by FDI. Thus, at least about half of all land converted to urban uses in Accra per annum during 2001-2011 could have been induced by FDI inflows to Ghana during 2000-2010, with assumed 80 percent concentration (based on GIPC publications) of funds in Accra. Thus, even though contribution of FDI to urban spatial expansion in Accra would vary from year to year depending on the fluctuations in FDI inflow volumes to Ghana, the external funds inflow appear to be making some significant contribution to urban expansion in Accra in contemporary times. Further insight may be gained when the *cumulative* built up area for Accra can also be used for comparison. Before comparing IUSEEM estimated built up area to that “projected” using the estimated annual average from Moller-Jensen et al. (2005), the minimum and maximum expected cumulative built up of Accra for 2011 estimated by IUSEEM is computed, using the confidence interval for the estimated coefficients for FDI, population and GDP per capita presented in Table 5-2. The results are shown in Table 5-11. The expected total built up area in 2011 estimated by IUSEEM (80 percent FDI concentration level) = 430.81 sq. km. The cumulative built area from the lower boundary is computed as follows: Summed all lower bound values for the 3 variables (Table 5-11 –*highlighted*) and implemented in IUSEEM, yielding 406.29 sq. km. The upper bound is computed in a similar manner, yielding 456.92 sq. km. This implies the lowest and highest cumulative built up area (expected) as induced by FDI up to 2011 (from 2001) would be 406.29 sq. km – 456.29 sq. km. On average, the FDI induced built up area would be between 7.12 sq. km-11.72 sq. km, implying that at least about 7sq. km and at most about 12 sq. km land expansion in Accra annually would be

attributable to FDI inflows; with the confidence level of 95%, since 2001. This outcome becomes more meaningful when compared with data by Moller-Jensen et al. (2005). Table 5-12 displays the comparison of cumulative estimated built up areas for 2011 “projected” using the computed annual averages for the IUSEEM, Moller-Jensen et al. (2005). (Adjusted coefficients have been combined).

The annual growth in built up area of Accra by Moller-Jensen et al. (2005) can be used to ‘project’ the built up area for 2011, yielding about 713 sq. km (from 555 sq. km in 2000 and growing at annual rate of 17.5sq.km). (Table 5-10). The corresponding estimation using IUSEEM is about 431sq. km (Table 5-10). In comparative terms, it can be calculated that the IUSEEM cumulative built up area comes up to 60% of the cumulative built up area obtained from the Moller-Jensen et al. (2005) calculation. This implies that some proportion of Accra’s built up area during 2001-2011 could be attributable to FDI inflows to Ghana directly and indirectly (through purchasing power enablement via population and income). The estimation using the confidence interval for IUSEEM comes to 57% (lower bound) and 64% (upper bound). Thus, when the cumulative estimated built up area estimated for Accra in 2011 from IUSEEM is compared to data obtained from Moller-Jensen et al. (2005), the share of built up area attributable to FDI would be in the neighborhood of 57% - 64%. (It is assumed that these data have acceptable quality and accuracy. It is also important to note that the regression model from which the coefficients were extracted to implement in IUSEEM explained 82% of the variation in urban land cover. Hence, the IUSEEM cannot account for the 18% of the variation in land expansion in Accra, but of reasonable explanatory power, given the accuracy of the processed remote sensing data implemented).

These notwithstanding, FDI and related economic activities seem to be making significant contribution to urban land expansion in Accra. This is not surprising considering the possible multiplier effects of FDI and the multiple pathways through which its influences may be transmitted into the urban landscape (Chapter 2; Chapter 4). This finding supports that of Seto (2005) for the Red River Delta in Vietnam and the Pearl River Delta in China, the only quantitative study of FDI caused urban land expansion known to this investigator. Consequently, in addition to adding to the literature on analysis of contemporary urban land expansion with the potential to affording a more comprehensive understanding, this study seems to be the first to have modeled and quantified explicitly, FDI induced urban built up area expansion over time for a specific city which can be replicated elsewhere in developing countries. It is also pertinent to point out that in both the single variable (FDI co-efficient alone) and combined variables (combined estimated coefficients: FDI, population and GDP per capita) cases, varying the FDI concentration levels resulted in marked differential impact on built up area expansion rates. This implies that the rate of urban spatial expansion may be influenced by the rate (FDI inflow volume per annum) of increase/decrease in the flow of FDI in the particular urban areas.

From the foregoing discussion, it may be difficult to dispute the fact that FDI may be contributing more to Accra's spatial expansion in recent times, especially given that population and income growth have been less than remarkable, compared to the physical growth rate of Accra during the era of intensifying globalization. Even though urban expansion researchers like Karen Seto make some attributions to FDI as a potentially important urban land expansion driver (Seto et al., 2011; Seto, 2005),

mainstream urban expansion theoretical works and modeling have largely neglected to incorporate FDI. But this preliminary work, which is the first detailed attempt to model and quantify such globally-induced urban land expansion, should help draw attention to FDI as an emerging potent urban land expansion driver, especially in fast globalizing primate cities in developing economies. Perhaps this will gain currency if it is demonstrated that FDI induced urban spatial expansion can be grounded in a standard urban economic theory such as the Thunen-Alonso theoretical framework.

FDI and the Thunen-Alonso Theoretical Framework

Basically, the Thunen-Alonso theoretical framework (outlined in Chapter 4 and in this chapter) is hinged principally on “land value” as relating to “accessibility” from the perspective of utility maximization; positing that land value would be determined by the economic benefits derived from the kind of usage to which the land is put. Typically, the Thunen-Alonso theoretical framework has emphasized transportation (improvement and cost), population, income and physical /geographical factors (which influence accessibility) as the main drivers of land values, particularly in the urban context, and therefore being implicated in the expansion of the urban extent (Angel et al., 2011; Seto et al., 2011; McDonald & McMillen, 2010; McGrath, 2005). For example, lands located in more accessible areas such as the CBD tend to be of high value attracting mostly commercial activities able to pay for the cost and leave room for profit for investors. Similarly, population growth puts pressure on demand for shelter and other infrastructure whose provision require the use of land. There is also interrelationships among these variables whereby, for example, improved transportation results in improved accessibility, thereby enhancing land values. However, it is arguable that even though these factors remain important in determining urban land values, their

effects have been mitigated in many respects, as a result of technological advancements and economic globalization. Technological advancements in transportation and communication have made it cheaper to live in the suburbs even though the cost of transportation per se may not have been reduced. Physical geographical factors, likewise, do not pose serious limitation on what piece of land is suitable for residential development as wetlands get filled and elevated grounds are leveled using modern technology. In short, traditional drivers of urban land values may not be entirely responsible for the dynamics of urban land demand in a given urban area since global economic forces may be exerting significant influences, which must be recognized and adequately represented in standard urban economic theorization, modeling and analysis. Essentially, external economic forces can drive urban land values in distant areas from their origination locations, as globalization and technological advancement continue to mitigate the magnitude of impact of the traditional factors influencing accessibility. At the same time people are being purchasing power-enabled by FDI, making domestic / national population and income growth less of enduring determinants of urban land values. Consequently, urban land values, especially in peri-urban areas, may appreciate significantly and rapidly even as domestic / national population and income do not experience any appreciable growth as shown above for the case of Accra and Ghana (Table 5-7). Thus, in discussing urban land value determinants in the era of increasing economic globalization, it may be useful to consider the fact that urban land values in a given location may start increasing as a result of events happening in similar urban areas and countries located far away. For instance, currency appreciation in European markets relative to the USA dollar, if

sustained for a considerable length of time, may trigger demand for housing and real estate in major urban areas in USA such as Manhattan in New York City (Sassen, 2006). Thus, deterioration in investment conditions in London could induce FDI inflows to New York City even though domestic economic conditions in the USA in general might not have changed in any significant way. In both cases, therefore, it is entirely possible for domestic urban land values to increase, not necessarily triggered by domestic economic conditions such as national economic growth, as urban land demand gets driven by external (global) economic stimuli. However, in the case of advanced urban economies, this may not necessarily lead to conversion of new lands, largely due to effective growth management policies which would help ensure densification- infilling, high rise apartment buildings and the likes. For example, London is a typical primate city receiving considerable amounts of financial resources from foreign sources, but the existence of the Greenbelt is believed to have helped restrict the growth of inner London. In other cases, a country like USA may have a good number of virtually equally competitive urban areas such as New York, Los Angeles, Chicago, among others, which are attractive for foreign direct investments. Thus, inflow of FDI may be more geographically diversified than concentrated which would help mitigate the spatial impact of the external funds inflow, other things being equal. It is therefore not the argument being advanced in this dissertation that those FDI inflows automatically would have positive influence on the urban spatial expansion process. The important point this dissertation advances is that FDI inflows would likely cause real estate property values, including land, to start appreciating in the domestic urban economy. In advanced countries with functioning and effective urban growth

management tools and systems, increases in land demand may be absorbed without necessarily causing a significant increase in the urban extent. However, in a primate city in a developing country, which usually lacks growth management policies, increased flow volumes of FDI may contribute significantly to rapid physical expansion of the receiving city, with the process likely to be characterized by sprawl in the face of gradually increasing opportunity cost of peri-urban lands. *More formally, inflows of external funds such as FDI, when significantly concentrated in a large urban location would serve as the external economic stimulus (or exogenous shock) to the urban land market, generating increase in demand for land (which could be described as an “autonomous shift” in the land demand curve).* (Chapter 2; Chapter 4). Agricultural land prices, however, remain relatively constant or decrease in real terms as peri-urban agricultural production is “outsourced” to the hinterlands and even to distant locations outside the country, thanks to international trade and technological advancement in transportation and communication. Consequently, indications are that FDI may be inducing urban spatial expansion in Accra, particularly accentuating the rate of physical expansion, and increasing in importance with intensification of economic globalization.

The foregoing analysis, to a large extent, is consistent with postulates of the Thunen-Alonso theoretical framework when viewed from urban land value perspective as induced by external economic force of FDI. It is the argument in this chapter that FDI's impact on the urban extent, as seems to have happened to Accra, can be explained within the context of the classical urban land use, land value theory (Alonso, 1964). More formally, the increased FDI- induced land demands will drive urban land values upwards (Figure 5-10), even as population and incomes grow at much slower

rates. In Figure 5-10A, (E_1) is the initial equilibrium for urban land use value and agricultural land use value, which is shown spatially in Figure 5.10B. However, this equilibrium cannot be stable in the face of stagnant or declining agricultural land values whereas urban land use values rise, induced largely by high volumes of FDI inflows into the urban space economy. It is expected that high levels of FDI concentration in the city increases demand for land for urban uses such as housing and infrastructure, which causes urban land use value to rise. This can be considered as a right shift (autonomous shift) of the urban land value curve, since FDI, which is the main stimulus in this case is externally generated and exogenous to the urban and national economies. In this regard, FDI inflow may be considered as an 'exogenous shock' to the urban land market, which makes it capable of inducing autonomous change in the urban land use value curve in Figure 5-10A. A new equilibrium (E_2) is established outward of E_1 . This is reflected in the movement of the "urban frontier" in Figure 5-10B. But since agricultural uses in the peri-urban areas is less profitable compared to urban land uses, this second equilibrium may not exist per se. Consequently, these lands may just be waiting to be converted to urban uses in the advent of the new "wave" of FDI inflows into the urban space. In a nutshell, the interactions of the urban land value curve and the agricultural land value curve results in the spatial ramification reflected in Figure 5.10B; whereby the "urban frontier" shifts outwards, virtually consuming all the peri-urban lands in its path. The reasoning behind the shift in the urban frontier is that in the peri-urban area of the city, the rise in urban land use value increases the opportunity cost of holding lands in natural and agricultural uses (Hanink, 1997). Peri-urban lands get converted to urban

uses since this is more profitable compared to farming, thereby increasing the urban extent.

Specifically, relating to Accra, it can be argued that agricultural land values in the peri-urban areas of the city have remained stagnant or even declined, (since farming is less profitable compared to urban uses) whereas urban land uses continue to receive 'impetus' from FDI concentration in Accra. Logically and theoretically, therefore, this may partly explain the documented sprawl development as per (Angel et al., 2011; 2005; Aryeetey-Attoh, 2010; Moller-Jensen et al., 2005), indicating urban density decline as argued elsewhere in this dissertation of being characteristic of *relative affluence* that can be linked to global economic influences. Indeed, decline in urban density in Accra has also been confirmed by some studies, including Angel et al. (2005). The authors note that in 1985 the average density (persons/sq.km) was 14,120.39. In 2000 this figure had reduced to 8,102.64, representing a decline of 3.66% per annum and implying that the average Accra resident was occupying more land in 2000 than he/she did in 1985. Generally, on the global scale, Angel and colleagues have asserted that

The projected rate of increase in urban land cover will be higher than the rates of increase of the urban population because urban population densities can be expected to decline. (Angel et al. 2011: 46).

This may be attributable to other factors but there are indications that FDI may be playing a significant role, substituting for country-specific economic growth increases required to sustain the observed affluence in the character of the new real estate development.

The important implication is that: *even though economic growth usually occurs in tandem with urbanization (including urban spatial expansion), the primate, globalizing*

city may undergo “unprecedented” physical growth in the face of slow growth in the national economy as well as low population growth. Based on the analysis presented in this dissertation, Accra may represent such a paradox, which can be resolved by appealing to external economic influences of globalization such as FDI.

More importantly, the situation can be grounded in a refined form of the standard economic theory of urban land use and land value as espoused by Von Thunen (1826, 1926) and Alonso (1964), particularly building on its current extensions (Angel et al., 2011; 2005; McGrath, 2005) that models the expansion of the urban extent as a function of relevant socioeconomic variables. More specifically, the ‘refined’ Thunen-Alonso theoretical framework, formally articulated in Chapter 4 of this dissertation may help explain how FDI might have contributed to the rapid spatial expansion of Accra. It is the cardinal argument in this regard that *in a developing country setting urban locations receiving disproportionate share of FDI will experience rapidly rising urban land values whereas agricultural land values remain constant or decline, thereby increasing the opportunity costs of holding lands in agricultural uses and natural fallow in the peri-urban areas of the city.* Consequently, rapid land conversion will follow “busts” of FDI inflows, other things being equal, as the calculations show in Table 5-3 above. Reinforcing tendencies may also be associated with FDI inflows whereby existing agglomerations attract more FDI and population who become purchasing power-enabled, demanding housing and infrastructure construction; the construction of which deepens the attractiveness of the urban location, generating further rounds of FDI attraction. Thus, once FDI starts concentrating disproportionately in an urban location, relative to other urban areas in the country, “domino” effect can be expected. From a

purely economic perspective the peri-urban spatial expansion appears to be a “win-win” situation for both peri-urban agricultural land holders and developers. For land holders, increasing peri-urban land values incur high opportunity cost if held in agricultural use; it would be more profitable to sell the land to developers or build on it (for renting, perhaps). For the developer, increasing urban land values exhibit spatial inequality in its distribution pattern, with higher land values close to inner locations in the city but expensive while peri-urban lands are of high value and cheaper. Hence, from both the peri-urban landowner and the developer perspectives, the land is put to highest value and best use by converting from agricultural uses to urban uses. To sum up, *FDI flows into geographically restricted urban space increase urban land values, increase opportunity costs of peri-urban agricultural lands, making land conversion to urban uses more profitable, especially in the peri-urban areas of the city.*

However, the Thunen-Alonso theoretical framework assumes the operation of free market in land. In the specific case of Accra, this would require the existence of a functioning peri-urban land market through which land can be exchanged based on supply and demand, for the postulates of the standard urban economic theory (the Thunen-Alonso theoretical framework) to be properly analyzed. However, the peri-urban land market in Accra and urban Africa in general, unlike urban markets in advanced economies, is fraught with difficulties, necessitating some further elaboration.

The Peri-Urban Land Market in Accra under Globalization

The discourse on the peri-urban in Africa is beset with vexing questions, according to urban researchers, bordering on definitions, laws as well as land markets. Theodore Trefon has asserted that

Peri-urban areas are fringe areas because they lie both at the edge of the city and at the limit of the rural hinterland. These worlds overlap and intermingle; making it difficult to establish where the city ends and where the rural place begins. (Trefon, 2009: 15).

Complexity has, therefore, bedeviled the precise/comprehensive definition for the peri-urban as well (Locatelli & Nugent, 2009). One simple definition for the peri-urban is: “ an area on the periphery of the urban area of the town and suburbs”. (Ciparisse, 2003: 52, quoted in Trefon, 2009: 19). This definition is focused solely on the “form” of the area, devoid of functionality. This can be complemented by a second definition, bordering on the composition of the peri-urban area.

The peri-urban zone can be broadly characterized as a mosaic of different land uses inhabited by communities of different economic status, in a state of rapid change with a lack of infrastructure and a deteriorating environment. (Birley & Lock, 1998, cited in Locatelli & Nugent, 2009: 19).

By this definition, the “hybrid” and the “dynamic” nature of the peri-urban area is made more explicit, implying an area undergoing continuous change. The explanation of the formation of the peri-urban has been based mainly on demographic factors and have often been carried out in developed countries (Trefon, 2009). However, Theodore Trefon has indicated that such studies could be drawn on to help understand peri-urbanization in the Central African context (Trefon, 2009:20) and by extension to the Ghanaian context.

Briefly, in an Australian case study, Tania Fischer has identified and conceptualized four main growth processes which could serve as a model to explain population growth in the peri-urban area:

(i) sub-urbanisation (in-migration from metro area to peri-urban locations adjacent to the metro boundary); (ii) counter urbanization (in-migration from throughout the metro area to peri-urban locations, both adjacent to the metro area and those more distant); (iii) population retention (increased period of residence and reduced rate of out-migration); and (iv) centripetal

migration (in-migration from outlying rural areas). (Fischer, 2003: 553, cited in Trefon, 2009: 20).

In effect, Theodore Trefon summarizes the situation thus

As housing plots and agricultural space within the city become rare and expensive, people move towards the city's outskirts. Likewise, new migrants hailing from rural areas also tend to occupy land in these areas for the same reasons. (Trefon, 2009: 20).

It is obvious from the foregoing that the focus is on internal dynamics within the country and within the urban area. But when this is applied to the case of Accra, it would suggest that population and income growth in the country enabled people to own the quality residential property widely held to be responsible for the rapid growth in the consumption of peri-urban lands. However, this is doubtful as the arguments and discussions advanced so far in this dissertation show. It is therefore imperative that the influences of external economic forces originating outside the national system are considered in the discourse, given the almost seamless transmission of global "impulses" into local urban spaces.

Even though cities have been in existence for hundreds of years in Africa (Rakodi, 2007), widespread urbanism (urban lifestyles) can be considered to be largely a recent phenomenon on the continent, largely occurring in tandem with increasing economic globalization (Kasanga & Woodman, 2004). Essentially, therefore, urbanization and globalization forces have combined to contribute to the complexity of land ownership and land markets in Africa, subjecting urban spaces in Africa to competing claims as (Locatelli & Nugent, 2009; Rakodi, 2007) would put it, even in the absence of smooth operation of free market mechanism in land. According to A. Trefon:

The complexities of land tenure in Africa have been studied in-depth by the interdisciplinary network of social scientists: AFREFA (Association pour la Promotion des Recherches et des Etudes Foncières en Afrique) (Le Bris

et al. 1991). They suggest a model of land tenure which suits the peri-urban context relatively well. In their view, the totality of social relations is based on land and space. These social relations are primarily conditioned by politics, economics, institutions and the nature of infrastructure, making land tenure a *total social fact*. (Trefon, 2009: 20-21).

For most parts of Africa, during the pre-colonial times, land ownership operated under customary laws, whereby communities, families and stools (chieftaincy) had vested interest in the land and could only be used and transferred but not sold outright (Rakodi, 2007; Gough and Yankson, 2000). Also, most land acquisition had had to do with the cultivation of the land for food or some cash crops (Payne, 1997, cited in Gough & Yankson, 2000). To acquire a piece of land for such an operation, the interested party presents customary “drinks” to the chief or head of the family owning the land; and in the presence of witnesses, the land is then “leased” to the individual for use (Gough & Yankson, 2000). In short, according to customary land tenure system in pre-colonial Africa, land was not considered a commodity to be sold for individual (private) ownership (Rakodi, 2007). The advent of the Europeans on the African continent did not do much to change the customary land tenure system since according to Mabogunje (1992, cited in Gough & Yankson, 2000)

It suited the colonial administration to strengthen the myth of all land being under communal ownership, as this enabled them to increase the power of the local chiefs through whom they could rule indirectly. (p. 2486).

Alongside the customary land tenure system, however, with the advent of colonization, European based land acquisition systems had been introduced in several parts of Africa, creating a dual system of land tenure (Mabogunje, 1992, cited in Gough & Yankson, 2000). The most relevant aspect for the discussion presently is the assertion that “this dual system evolved as a result of the colonial powers refusing to allow the operation of the free market economy in land for Africans who migrated to the cities”

(Mabogunje, 1992, cited in Gough & Yankson, 2000: 2486). Thus, free market economy in land in Africa in general, and Africa's urban areas in particular, have not been encouraged until recently. Concerns with the inefficacy of the traditional land "access" rules in Africa has led some to argue that the customary system of land tenure might have served the needs of rural communities well but found wanting as people began to migrate to cities to eke out a living and wishing to acquire lands in their name (Mabogunje, 1992). This points to a dissatisfaction with the customary land tenure as it exists, with efforts aimed at some reforms. Again, increasing globalization and democratic dispensation which have allowed for private owning of real estate property have contributed to freeing lands for urban development. Consequently, in addition to responding to pressures of urbanization, most land markets in Africa are now opening up to more market forces alien to the land (Africa), especially during the era of intensifying economic globalization, however discrete the transfers may be.

As a specific example for Ghana, even beyond the capital city of Accra, Kasanga and Woodman have asserted that the peri-urban land market in Kumasi, the second largest city of Ghana, has been influenced by global economic forces in the forms of remittances and FDI, indicating that demand for land for residential purposes have been boosted by these external funds inflow (Kasanga & Woodman, 2004). The case of peri-urban land market in Kumasi being influenced by "external" economic forces is not different from that of Accra, however. Thus, peri-urban lands in Accra are no longer 'restricted'; by and large, these lands have become commoditized, privatized to some extent, allowing for individual ownership (Gough & Yankson, 2000). As a result, Accra's peri-urban land demand is increasingly being influenced by external economic forces

including FDI and remittances. Consequently, unlike most urban land markets in some countries in central Africa, where economic globalization does not appear to be the major force directly driving urban land demand, the major urban land demand in Ghana, and in Accra in particular, are being significantly influenced by forces of economic globalization. Indeed, it has been documented that foreign private companies are beginning to participate in real estate development in urban Accra (Grant, 2009; 2007; 2001), indicating the opportunity for private ownership of lands in Accra, even though the acquisition procedures may be fraught with difficulties. By and large, then, there seem to be some form of peri-urban land market in Accra where lands can be freely bought and / or sold, even though it may not be what one would expect in developed countries. It appears, therefore, that the requisite for the existence of free market in land as a requirement for the Thunen-Alonso theoretical framework can be found in peri-urban Accra, to some extent. Trade in land does seem to exist.

However, in popular explanation of urbanization in Ghana in general, analysts have ignored the potential influences of foreign economic influences. For example, Farvacque-Vitkovic and colleagues have noted that

What is evident in the Ghanaian context is that urbanization has led to rapid increase in consumption of land in the past two decades. The factors that have influenced the increase of land values are a combination of the following: population growth, inefficient town planning, activities of the Central Government, and the monopoly of land –holdings. (Farvacque-Vitkovic et al., 2008: 12).

The problem with this assertion is that impact of foreign economic forces on domestic land markets are masked and not given any role in the urbanization process (and in the urban spatial expansion process, by extension). Recognizing global economic influences is especially important in the situation where the peri-urban spatial expansion

has been characterized by “quality residential sprawl” as in the case of Accra (Yeboah, 2003). For Accra, therefore, even though in-migrants from rural hinterlands have contributed to the expansion process (from a demographic perspective), this aspect may not be as significant as the demand driven from forces like FDI (from the perspective of spatial expansion).

To help draw attention and encourage research in order to address this situation, FDI induced urban spatial expansion in Accra has been theorized via the Thunen-Alonso theoretical framework and quantified using an integrated method-IUSEEM-formulated by this author. Tentatively, it can be concluded that Accra’s contemporary rapid physical expansion has been induced, in part, by high volumes and sustained concentration of FDI, following intensifying economic globalization and economic liberalization (SAPs). Two main deductions may be advanced:

- If a globalizing primate city in a developing country experiences rapid rate of physical growth within a short time but population and income growth both remain low, FDI inflows might be contributing significantly to the urban land expansion process such as is happening in Accra.
- Rapid increases in the volume of FDI inflow into the urban economy of Accra is manifested in equally rapid physical expansion of the city. Thus, the rate of urban spatial expansion seems to “mimic” the flow characteristics of FDI.

Therefore, based on the presentation so far in this dissertation and this chapter in particular, a theory of *FDI induced urban spatial expansion* is proposed thus:

In a globalizing primate city located in a developing country, the rate of physical expansion of the city is a function of the volume of annual FDI inflows; during the expansion process, peri-urban land is put to its highest value and best use by converting from agricultural to urban use, thereby accelerating the rate of urban spatial expansion as FDI inflows increase over time.

In effect, this theory would argue that the rapid rate of physical growth experienced by a fast globalizing city, located in a developing country, has more to do with increasing

volumes of FDI and its unequal geographical distribution favoring urban agglomerations, than resulting from population and income growth which have been consistently identified as the most important urban expansion drivers.

Underlying assumptions

- Absence of growth management and land use controls
- Low growth rate (GDP/GNP per capita growth lags physical growth rate)
- Low to moderate population growth rate (lags physical growth rate)
- Unequal distribution of FDI within the country's urban system

It is important to put on record that the theory being proposed aims to build on the classical Thunen-Alonso theoretical framework, in an attempt to incorporate influences of economic globalization on urban land values and urban spatial expansion, from a geographical perspective. This theoretical extension will be particularly useful for the analysis and for a more comprehensive understanding of contemporary urban spatial expansion in fast globalizing primate cities in developing countries.

Given the above, therefore, it can be argued that this study lays out both the theoretical foundations and methodological framework specifically suitable for theorizing and quantifying the emerging phenomenon of FDI induced urban spatial expansion which should, hopefully, help draw more attention to it. A full articulation of the proposed hypothesis would require a better understanding of the geographical concepts and themes of *spatial differentiation*, *movement* and *human-environment interaction*, as discussed above. This would require integration of concepts, themes and theory across economic geography, urban geography and urban economics as demonstrated in the literature reviewed above. In particular, the geographical fundamental theme of human-environment interaction provides a framework to embed FDI induced urban spatial expansion firmly in the broader context of human-induced environmental change which

is widely recognized to be one of the formidable challenges faced by society (UN, 2005; IHDP, 2005).

FDI and Human-Induced Environmental Change

FDI induced urban spatial expansion can be viewed as an instance of human-induced environmental change playing out in the urban setting. Already, urbanization is increasingly being identified as one of the formidable aspects of global environmental change, posing one of the greatest challenges of the twenty-first century (IHDP, 2005) and is projected to rise. For example, it has been projected that by the year 2030 about 60% of the world's 8 billion inhabitants will dwell in urban areas, majority of which will be expected to live in urban areas of the developing world (UN, 2003). It goes almost without saying, therefore, that if the greater proportion of the world's inhabitants is becoming urban dwellers then it is important that adequate attention is paid to the biophysical environments that would contain such human populations and their settlements as well as the increased demand for environmental resources. Importantly, the loss of vegetation cover associated with urbanization (spatial expansion) affects the microclimate via alterations in ecological functions and integrity of the biophysical environment, among other things, which would feed into global environmental change, via land cover change and land degradation. It is widely acknowledged that economic growth is inextricably tied to the environment since the environment serves as the natural capital (input) as well as the global sink for wastes from the production processes and consumption (Munasingh, 2002; England, 2000; Costanza et al., 1997, for example), in addition to its life-supporting functions such as ensuring ecosystems health and functions. Costanza and colleagues have rightly asserted that regardless of the sophisticated nature of technological advancement, basic raw environmental

resources serve as inputs for numerous productive activities, not to mention the critical life-support functions the environment provides such as air purification, pollination, and carbon dioxide sequestration and the likes (Costanza et al., 1997). However, economic growth continues to put these invaluable natural assets under stress. For example, in a cross-country empirical study, using species diversity and income per capita as proxies for biodiversity and economic growth, Asafu-Adjaye (2003), found that economic growth generally had adverse effect on biodiversity. Of particular importance to this work is the loss of pristine and agricultural lands to urbanization and the development process in general at the expense of land conservation; and the case of Florida, even in an advanced country will serve to illustrate more. According to Zwick and Carr (2006), economic growth and urbanization, coupled with population growth, could have lasting negative impacts on conservation lands in Florida. More specifically, the study projects Florida's population of about 18 million (2006) to grow to about 36 million by the year 2060; correspondingly, urban development level occupy 5,998,523 acres of land and is projected to increase to about 112,951,787 acres during the same period (Zwick & Carr, 2006: 1). However, land conservation is not projected to increase and rather the attendant urban expansion would occur at the expense of pristine and agricultural lands (Zwick & Carr, 2006: 1). Located in a highly advanced country, this Florida study provides a valuable food for thought, adding to the doubts raised against the Environmental Kuznet Hypothesis, since increasing economic growth hardly translates into enhanced environmental protection (land conservation in this case). If rich countries cannot hold onto their pristine and agricultural lands in the face of increasing economic growth and urbanization, one can safely assume that it would be doubly

difficult for developing countries, often lacking growth management policies and effective environmental quality controls. In the developing world, therefore, urbanization and urban spatial change have often resulted in environmental degradation, feeding into the larger problem of human-induced environmental degradation. Human-induced environmental change (degradation) is becoming widespread around the globe and the processes involved are complex. The United Nations International Strategy for Disaster Reduction (UNISDR) acknowledges that

The types of human-induced degradation are varied and include land misuse, soil erosion and loss, desertification, wild land fires, loss of biodiversity, deforestation, mangrove destruction, land, water and air pollution, climate change, sea level rise and ozone depletion” (<http://www.unisdr.org/we/inform/terminology>) .

In many respects, therefore, environmental degradation can be viewed as a broad term which can be simply described as the decline in environmental quality to the extent that environmental resources contained therein may not be usable by humans and animals. Examples include excess carbon dioxide in the atmosphere, air pollution, soil contamination as well as land degradation in general whereby land and its resources are rendered unsuitable for use by humans and animals. From this perspective, therefore, land degradation can be considered a component of environmental degradation.

The problems associated with environmental degradation appear to be further compounded by globalization; economic globalization to be more specific, with its tendency to drive increasing levels of economic activities and economic growth across the surface of the earth. Rightly so, it has been observed that high rates of economic growth, which inevitably drives increasing levels of urbanization, could put enormous strain on the ecological resources of the earth including urban lands and its biological

resources (Wackernagel, 2006; Costanza et al., 1997). Even though many analysts would agree with Jennifer Clapp and Peter Dauvergne that “Globalization is partly an extension of processes began long ago, including modernization and colonization” (Clapp & Dauvergne, 2005: 20), it is equally valid that the intensification of economic globalization in recent times have been unparalleled (Dickens, 2003), and could contribute in no small measure to global environmental change (Clapp & Dauvergne, 2005). Indeed, in the opinion of many commentators and researchers, economic globalization is still picking up steam, despite the economic downturn in 2008 (UNCTAD, 2010); and FDI is likely to continue to be attracted into urban agglomerations, such as primate cities in developing countries. Sustainable development and sustainability Science do have appealing aspirations that promise to help solve the social-economic-environmental problems but still lacks a core theory of sustainability which would aid rational and consistent explanation, not to mention the fact that intensifying economic globalization continues to “muddy” the waters.

From the foregoing, it is not too difficult to see that urban spatial expansion which almost invariably removes the vegetation cover entirely, if uncontrolled, could result in land degradation and feed into environmental degradation. Consequently, if FDI is proven to be a potent driver of contemporary urban land expansion, it would have wider implications for environmental degradation and could be considered a “new” dimension of human –induced environmental change in urban areas. However, such FDI induced environmental impacts would be spatially differentiated, since FDI flows generally exhibit unequal geographical distribution among countries as well as within a country. For instance, among developing countries, China is noted to receive a greater chunk of

the FDI “pie” (Chapter 1; Chapter 2). Similarly, within a country, FDI distribution pattern usually favor urbanized areas with existing agglomerations, making primate, urbanizing and globalizing cities such as Accra, attractive for FDI inflows; and meriting theorizing and quantifying for a better understanding. Consequently, insights in this chapter, even though from a case study, could have broader implications for research on human-induced environmental change necessitating the replication and testing of the proposed theory elsewhere, especially in the developing world. Obviously, the importance of geographical research in this regard cannot be overemphasized.

Summary

So, can FDI be implicated in the rapid rate of Accra’s physical expansion especially during 1991-2011? The answer seems to be “yes”. Essentially, Chapter 5 has focused on understanding how Accra’s spatial size has expanded over time in response to increasing inflows of FDI; theorizing FDI induced urban spatial expansion and contextualizing the phenomenon in the broader human-induced environmental change discourse. In pursuant of these, reasonable arguments were advanced as to whether or not FDI could be implicated in the rapid physical expansion of Accra, particularly, increasing consumption of peri-urban lands. Rapid urban land expansion (usually characterized as sprawl) such as what is happening in Accra have been explained using population and income as explanatory variables. However, indications so far are that these variables may not adequately explain the rapidity of the spatial expansion that has occurred in Accra, especially, during 1991-2011. Consequently, FDI induced urban spatial expansion theoretical argument was advanced, drawing heavily on current extensions of the Alonso theory in which the expansion of the urban extent is modeled as a function of socioeconomic variables. Initial hypotheses developed were

tested using the Integrated Urban Spatial Expansion Estimation Method. The IUSEEM is simply an allometric based model integrating regression and exponential growth modeling, to quantify the urban built up area over time as induced by FDI inflows. Essentially, the IUSEEM results show that increasing volumes of FDI inflows to Ghana (with 80 percent concentration in Accra) corresponded closely with the rapidity of rate of physical expansion of Accra during 1991-2011. It is estimated that for 2001-2011, FDI induced average annual increase in the built up area of Accra was about 9 sq. km, assuming 80 percent of all annual FDI inflows to Ghana during 2000-2010 concentrated in Accra. Comparison with results of another study (Moller-Jensen et al., 2005), showed that for the period 2001-2011 the IUSEEM estimated average annual built up area increase constituted about 54% of the total estimated by these authors. In terms of the cumulative built up area in 2011 alone, the comparison showed that FDI induced built up area might have accounted for about 60 percent of the total “projected” land expansion (based on Moller-Jensen et al., 2005). Tentatively, therefore, it can be argued that FDI induced urban spatial expansion may be taking place in Accra. The IUSEEM results further showed that varying the FDI concentration levels resulted in differential rates of Accra’s urban extent expansion over time. The important, broader implication of this is that unequal geographical distribution of FDI in a country’s urban system may help explain, in part, differential spatial expansion rates in different urban locations. Specifically, urban locations within the country receiving high volumes of FDI inflow are likely to experience rapid physical growth rate in their urban extent.

Based on the outcomes above, an initial FDI induced urban spatial expansion theory has been proposed as an extension to the Thunen-Alonso theoretical framework:

In a globalizing primate city located in a developing country, the rate of physical expansion of the city is a function of the volume of annual FDI inflows; during the expansion process, peri-urban land is put to its highest value and best use by converting from agricultural to urban use, thereby accelerating the rate of urban spatial expansion as FDI inflows increase over time.

The basic argument of the proposed theory or general hypothesis is that the rapid rate of physical growth experienced by a fast globalizing primate city like Accra, located in a developing country, has more to do with increasing volumes of FDI and its unequal geographical distribution which favor urban agglomerations, than resulting from population and income growth which have been consistently identified as the most important urban land expansion drivers (Angel et al., 2011; 2005; Seto et al., 2011). FDI inflows increase demand for land (resulting from purchasing power enablement from FDI and related activities), increase urban land values; with peri-urban lands in agricultural use incurring rising opportunity cost. It makes economic sense for the land holder to convert to urban use. At the same time, even though peri-urban land values are rising, the lands are cheaper than those in inner city locations hence developers will find it more profitable to build in the peri-urban area. Thus, from purely economic perspective, both developers and landlords are better off converting peri-urban agricultural lands to urban uses: utility in both instances are maximized and economic efficiency would have been achieved since the peri-urban land is put to its highest value and best use. This, according to the proposed FDI induced urban spatial expansion, would explain why the primate globalizing city will keep expanding rapidly (spatially) into peri-urban areas in response to increasing volumes of FDI inflows, even as population growth has been slow and economic growth similarly sluggish. In general, the theory suggests that urban researchers, particularly those interested in urban land expansion

will do well to begin paying attention to FDI as a potent urban land expansion driver, beyond numbers and statistical correlations linking population and income to urban land expansion. Consequently, a cogent argument is advanced to the effect that urban land expansion theory and models should seek to incorporate economic influences flowing from global sources to better reflect current realities of economic globalization.

In view of the increasing importance of FDI with intensifying globalization, and its potential repercussions on the biophysical environment, the research theme pursued in this chapter will likely assume increasing societal and scientific importance, and this chapter in particular and the dissertation, in general, would serve as a pioneering effort. Importantly, it can be argued that the theoretical foundation and methodological framework for a systematic study of FDI induced urban spatial expansion have been laid out in this chapter of the dissertation. This should help draw attention from urban geographers, economic geographers and urban economists as well as urban planners, to develop and test hypotheses from the proposed theory aimed at testing the theory in other locations to increase understanding. Moreover, since FDI induced urban spatial expansion can be put in the broader context of human-induced environmental change and associated problems such as land degradation; increased understanding in this area would be a welcoming development for researchers interested in understanding the socioeconomic aspects of global environmental change in general. The importance of increased understanding in this area of research has been underscored (NRA, 2010). However, the economy –environment relationship dynamics are complex, eliciting different views from different quarters who have suggested disparate worldviews. Complexity notwithstanding, sustainable development as a concept seems to capture

many of the concerns from the various camps. Sustainability science as an “umbrella” discipline has been noted to have burgeoned since the formalization of the concept of sustainable development by the World Commission on Environment and Development (WCED), otherwise known as the *Brundtland Report* in 1987 (Bettencourt & Kaur, 2011), attesting to the increasing societal concern for effective solutions that will balance the social, economic and environmental imperatives. Land Change Science researchers can be considered one of the “new” integrative disciplines under Sustainability Science, which arguably is directly concerned with the study of land use change causes and consequences (including urban expansion). However, a core theory has not emerged as yet. Of particular note is that the focus in land change science has usually been on “bottom-up” processes which undoubtedly help in understanding, but generally fail to incorporate “global” scale processes such as FDI influences, in the urban setting. The economy-environment relationship problems appear to be further complicated by intensifying economic globalization, especially in primate cities of developing countries. In view of this the efforts in this chapter which seek to integrate geographical concepts and fundamental themes with urban economic theory to help better understand the spatial imprints of economic globalization in the urban landscape can potentially contribute to Sustainability Science in general and Land Change Science in particular.

In addition to the potential contribution to scientific enquiry, the results above and the foregoing discussion, if empirically supported in other urban areas, may have important policy implications for urban policy, urban planning and urban environmental conservation. For urban policy in general, policy makers may be focusing on population

numbers, which may flock into the city from within the country whereas the main underlying 'causal' agent might have originated thousands of miles away, largely beyond the control of these policy makers. In effect, even though population influx into Accra may be controlled, this would likely do little to stop the sprawling of Accra and the associated loss of peri-urban lands to urban development since the underlying land conversion driver may be more related to FDI than anything else. Insights in this chapter may encourage urban policy makers to look beyond the urban and national systems.

Secondly, land conversion from agricultural to urban uses give rise to increasing loss of vegetation and declining urban green spaces. Since vegetation cover forms a fundamental basis of species habitats (Wackernagel, 2006; Defries et al., 2004; McKinney, 2002) it would not be too far-fetched to imagine how the loss of peri-urban lands could have negative impact on species habitats and ecosystems, resulting in a general decline of urban terrestrial biodiversity which should be a concern for the urban environmental conservationist. Thus, an important implication of particular interest to this writer is the potential negative impact that unbridled FDI inflows could have on urban environmental conservation efforts.

Finally, urban planners are concerned with all aspects of the city, making sustainable development the central theme of contemporary urban planners (Campbell, 2003). Increasing volumes of FDI inflows would complicate the traditional concerns with transportation, housing and the likes, making it worthwhile for urban planners to pay attention to increasing FDI inflows into the urban economy. Further elaboration on these practical implications has been provided in Chapter 6.

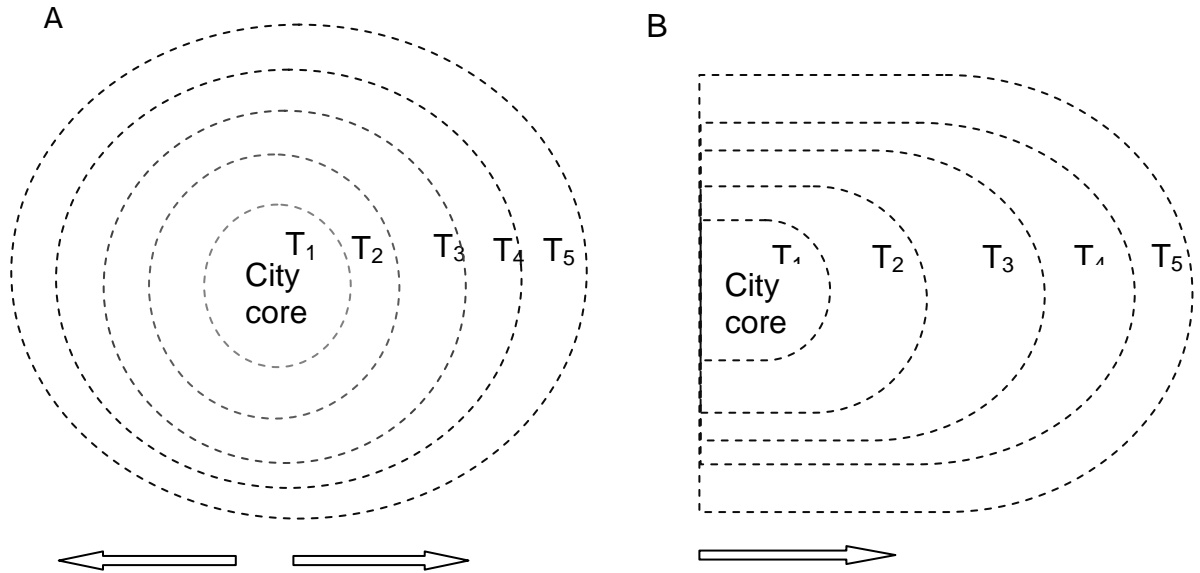


Figure 5-1. Spatio-temporal growth of the city as a spatial /geographical system. (A) City expands in all directions, unconstrained. (B) City expansion is constrained. Source: Author's construct based on Coffey (1981).

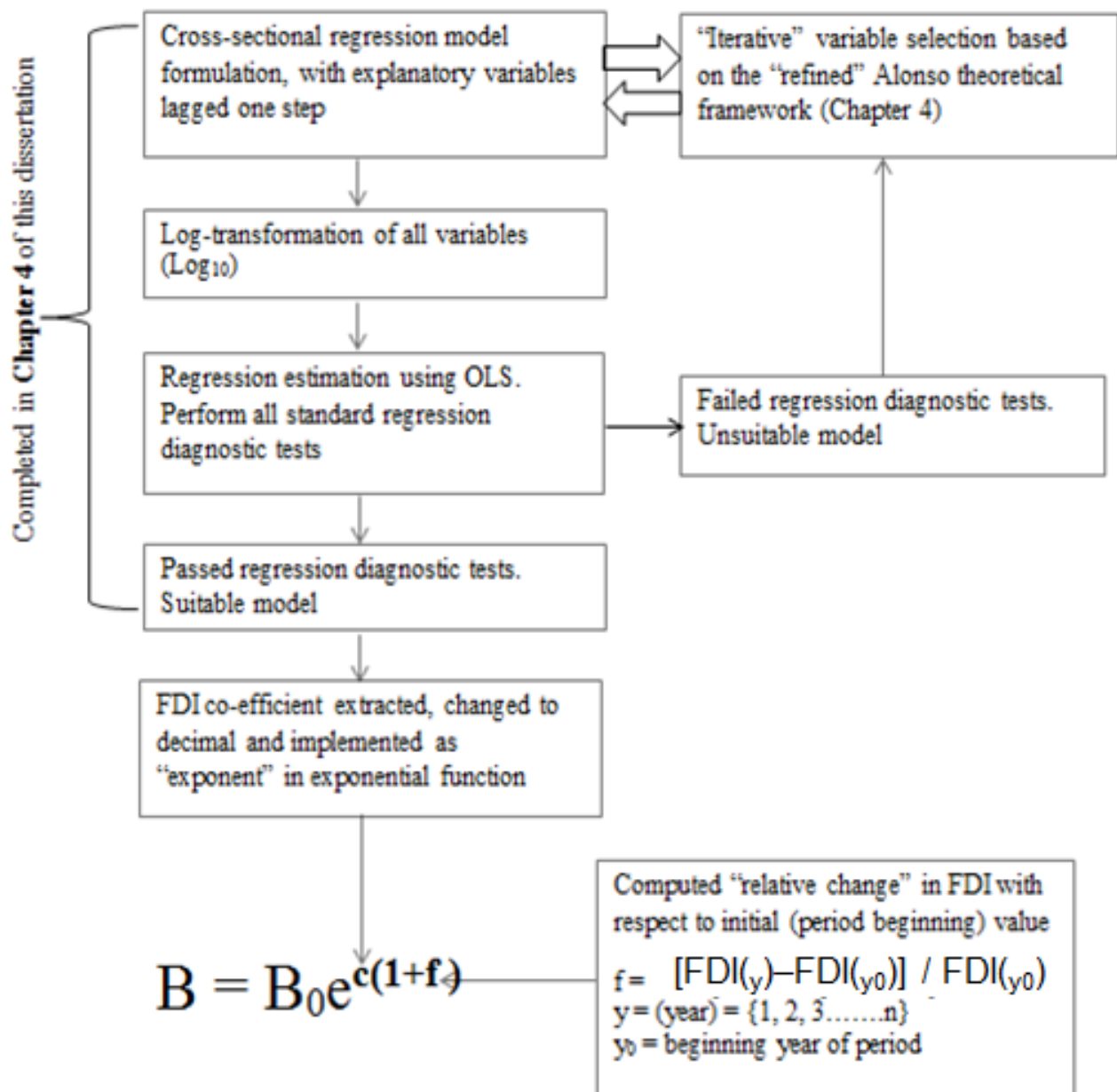


Figure 5-2. Steps in formulating the Integrated Urban Spatial Expansion Estimation Method (IUSEEM). Source: Author’s construct.

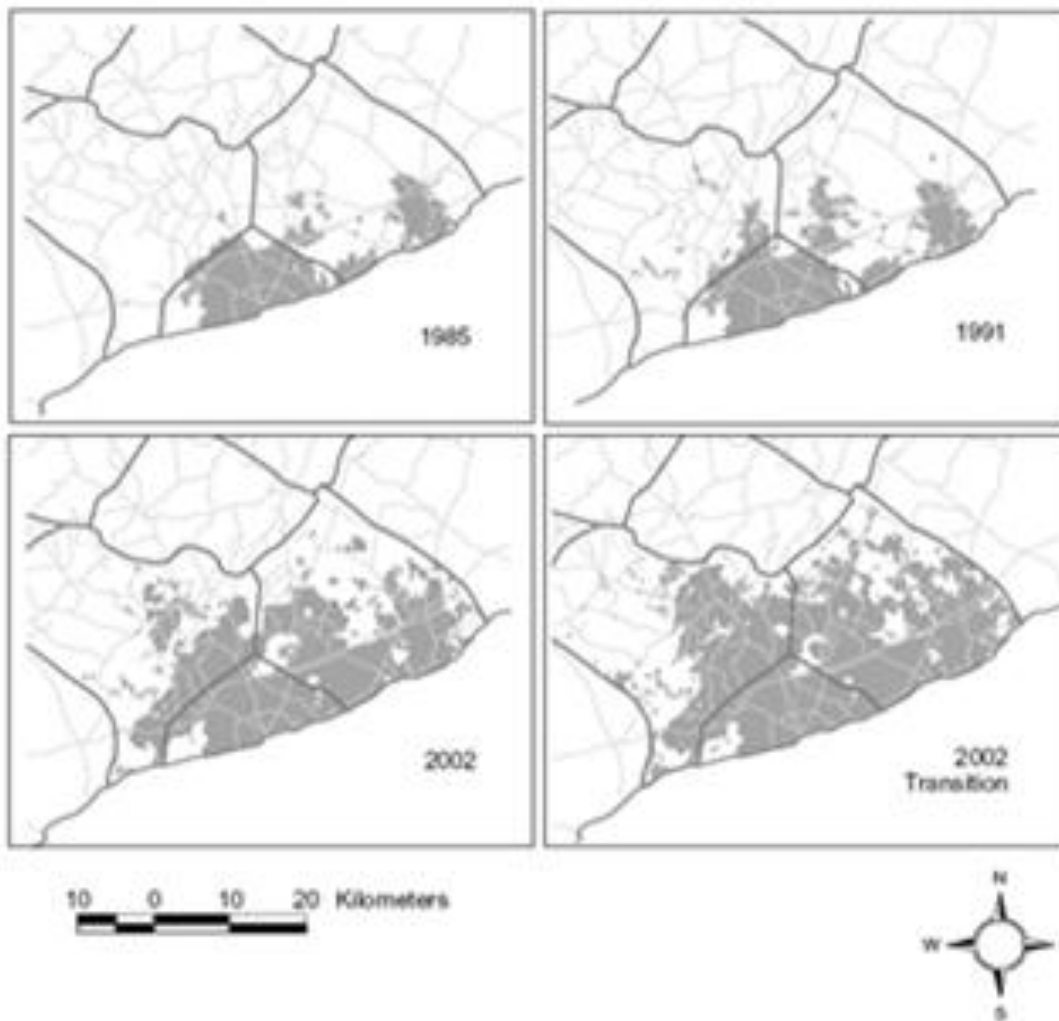


Figure 5-3. Spatial expansion of Accra: 1985 -2002. Source: Moller-Jensen et al. (2005).

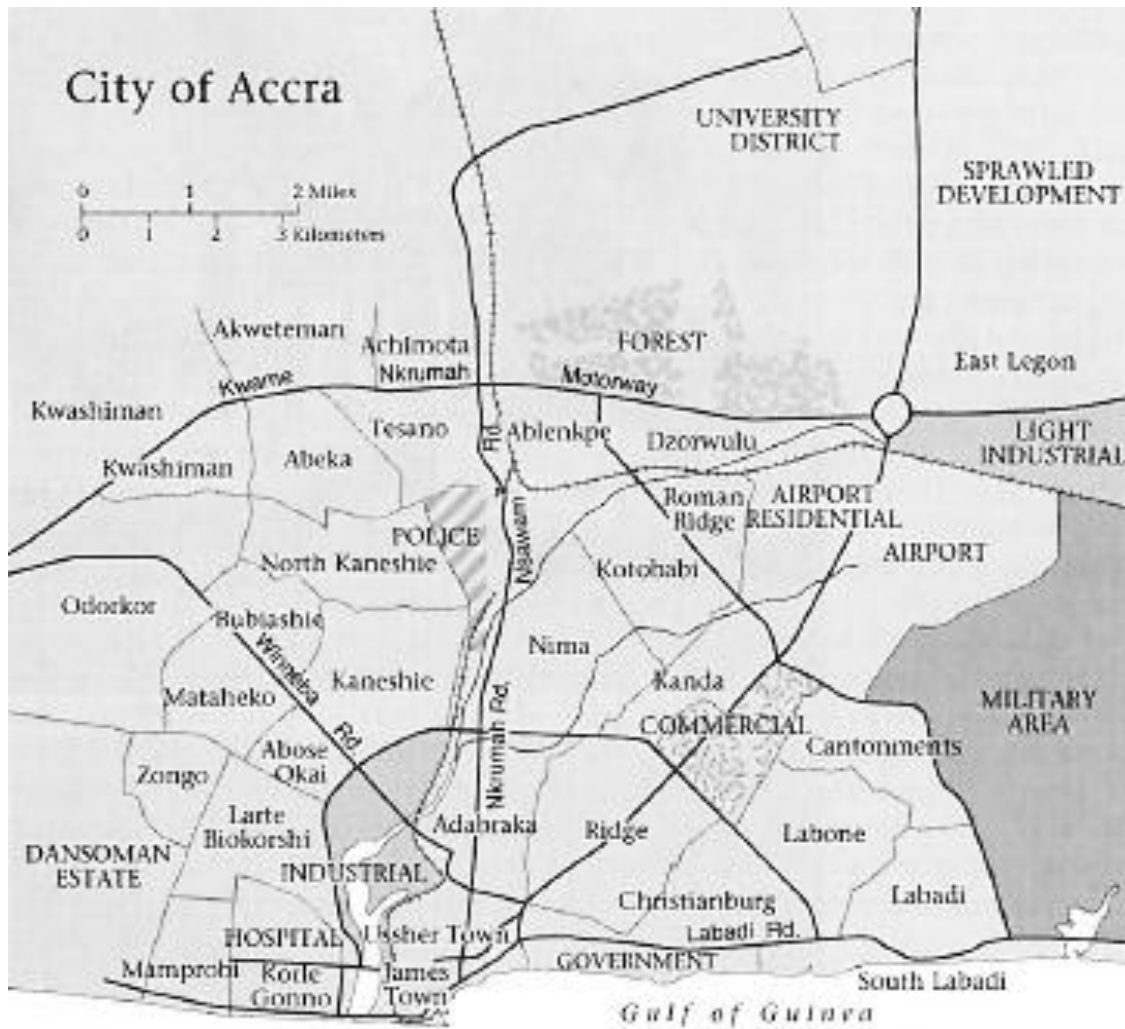


Figure 5-4. A section of Accra and a simplified diagrammatic scheme of recent internal structure. Source: Aryeetey-Attoh (2010).

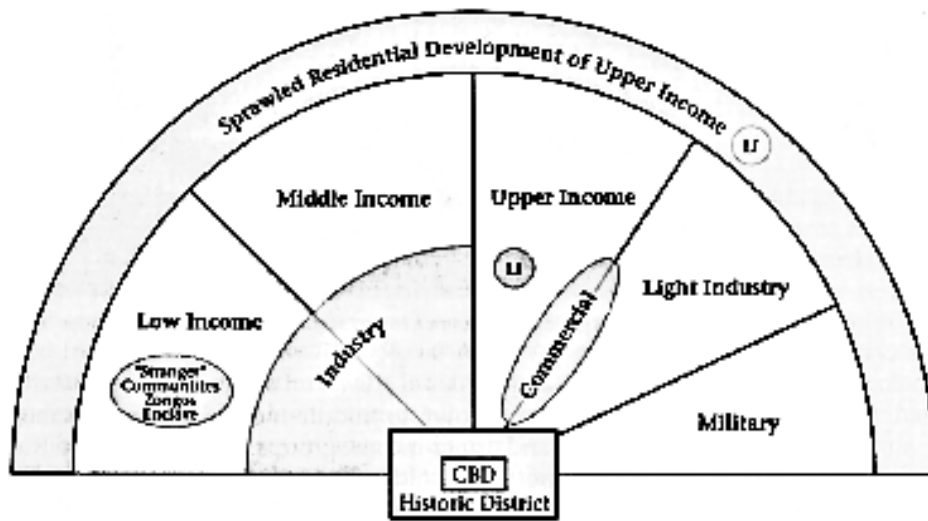


Figure 5-5. Sprawled residential developments in the peri-urban areas of Accra, Ghana. Source: Aryeetey-Attoh (2010).

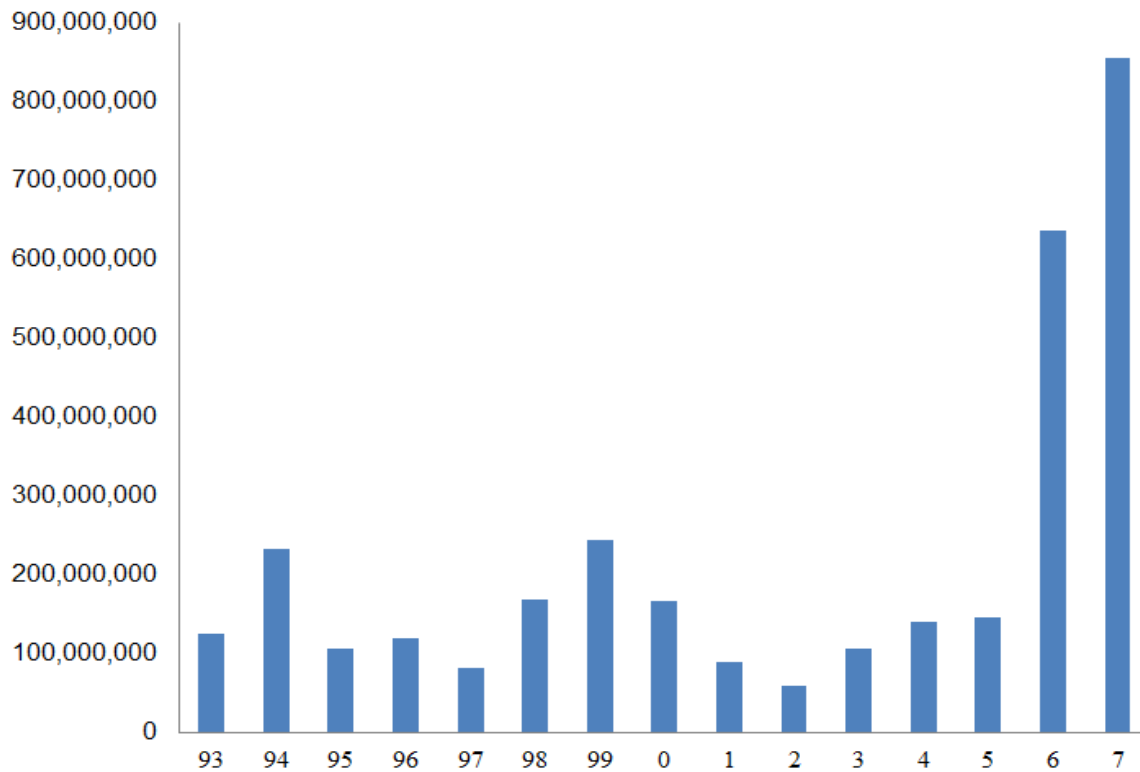


Figure 5-6. Trends in FDI inflows to Ghana (US\$). 1993 – 2007. Source: Author's construct based on UN (2012) data.

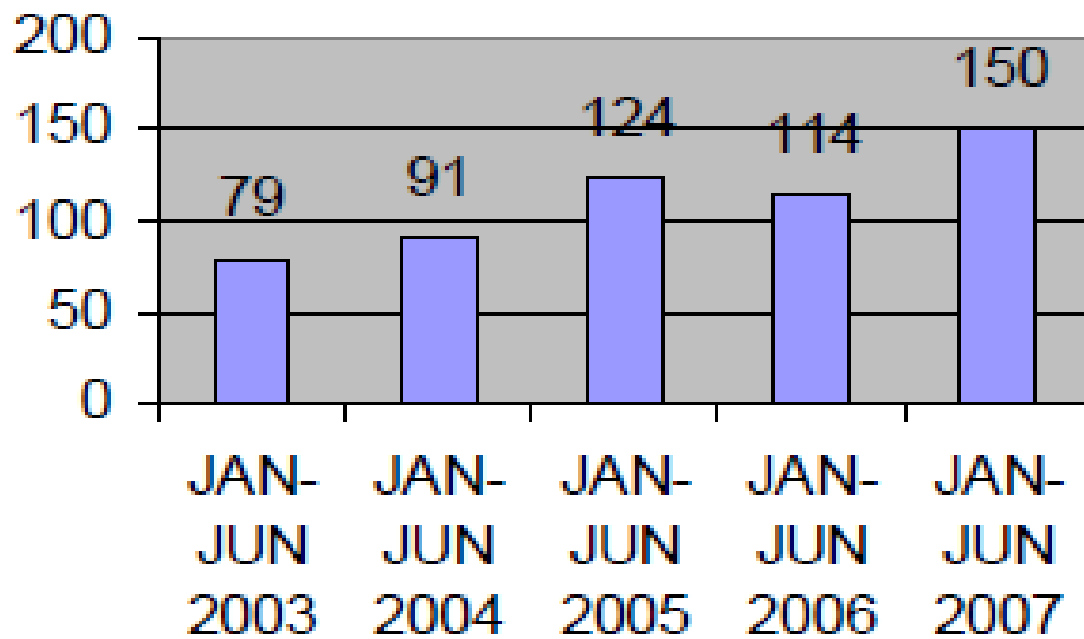


Figure 5-7. Growth in FDI projects in Ghana, (first half year), 2003-2007. Source: Adapted from GIPC (2008).

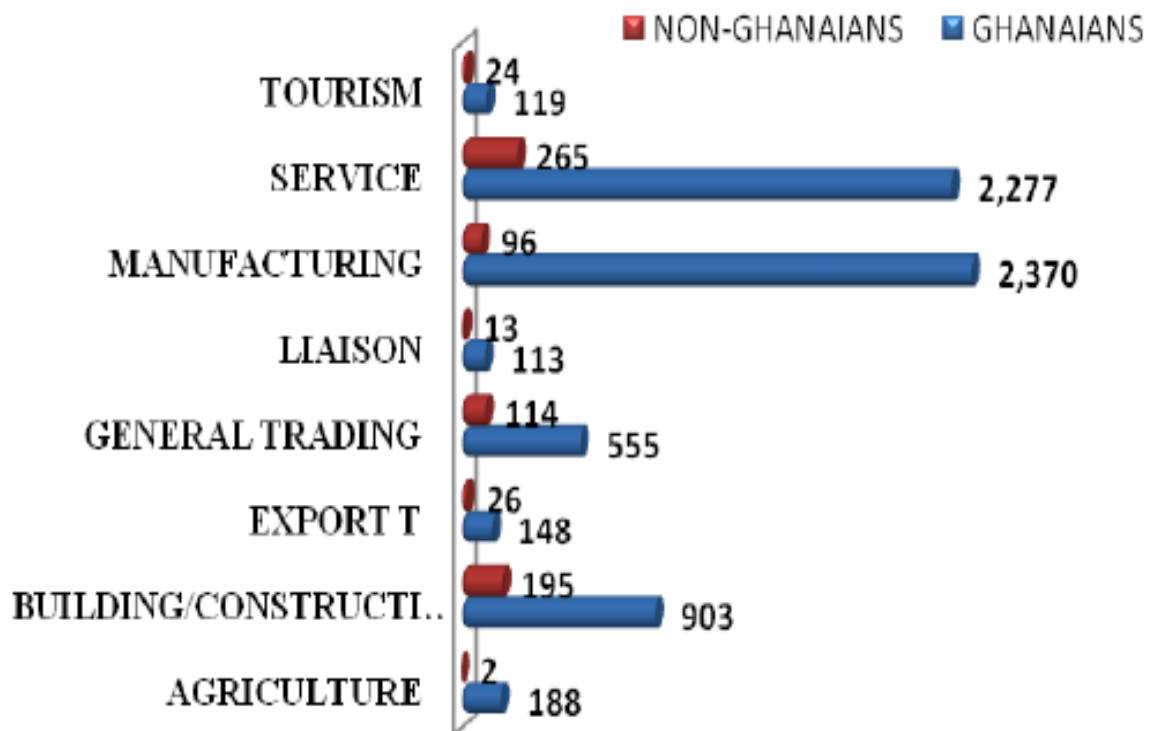


Figure 5-8. Sectorial distribution of employment to be generated by FDI inflow in the 2nd quarter of 2011 (1st April – 30th June, 2011). Source: Adapted from GIPC (2011).

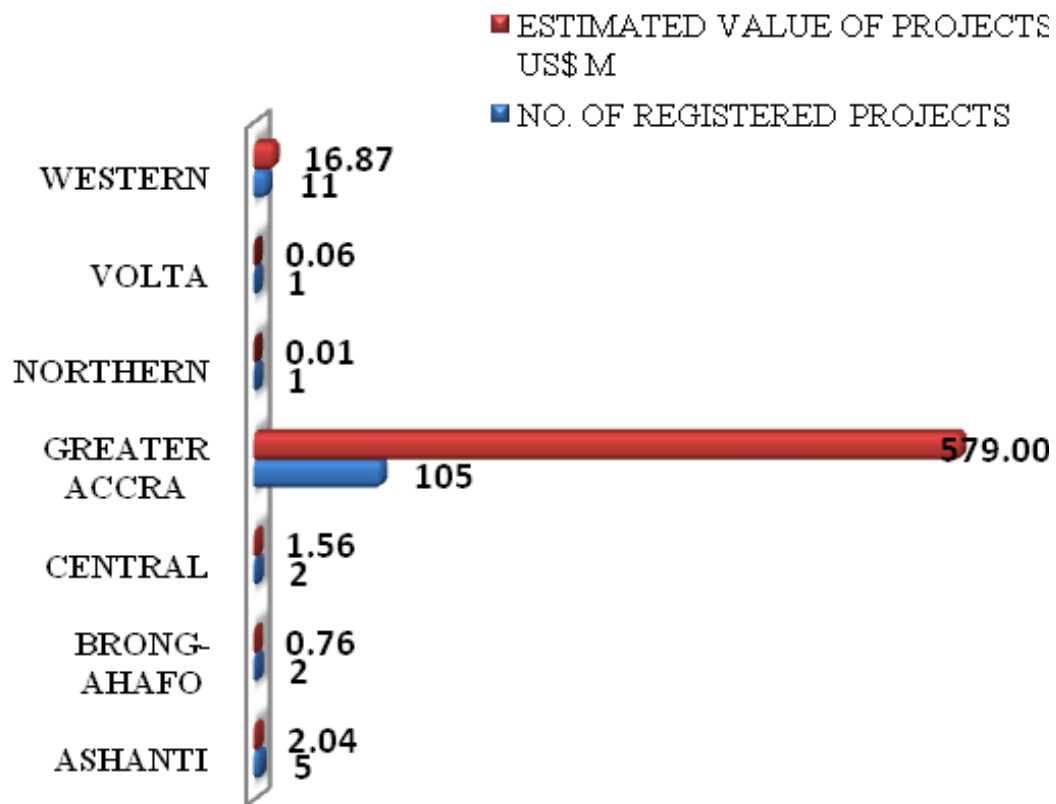


Figure 5-9. Geographical distribution of FDI projects among the regions of Ghana, 2nd quarter 2011. Source: GIPC (2011).

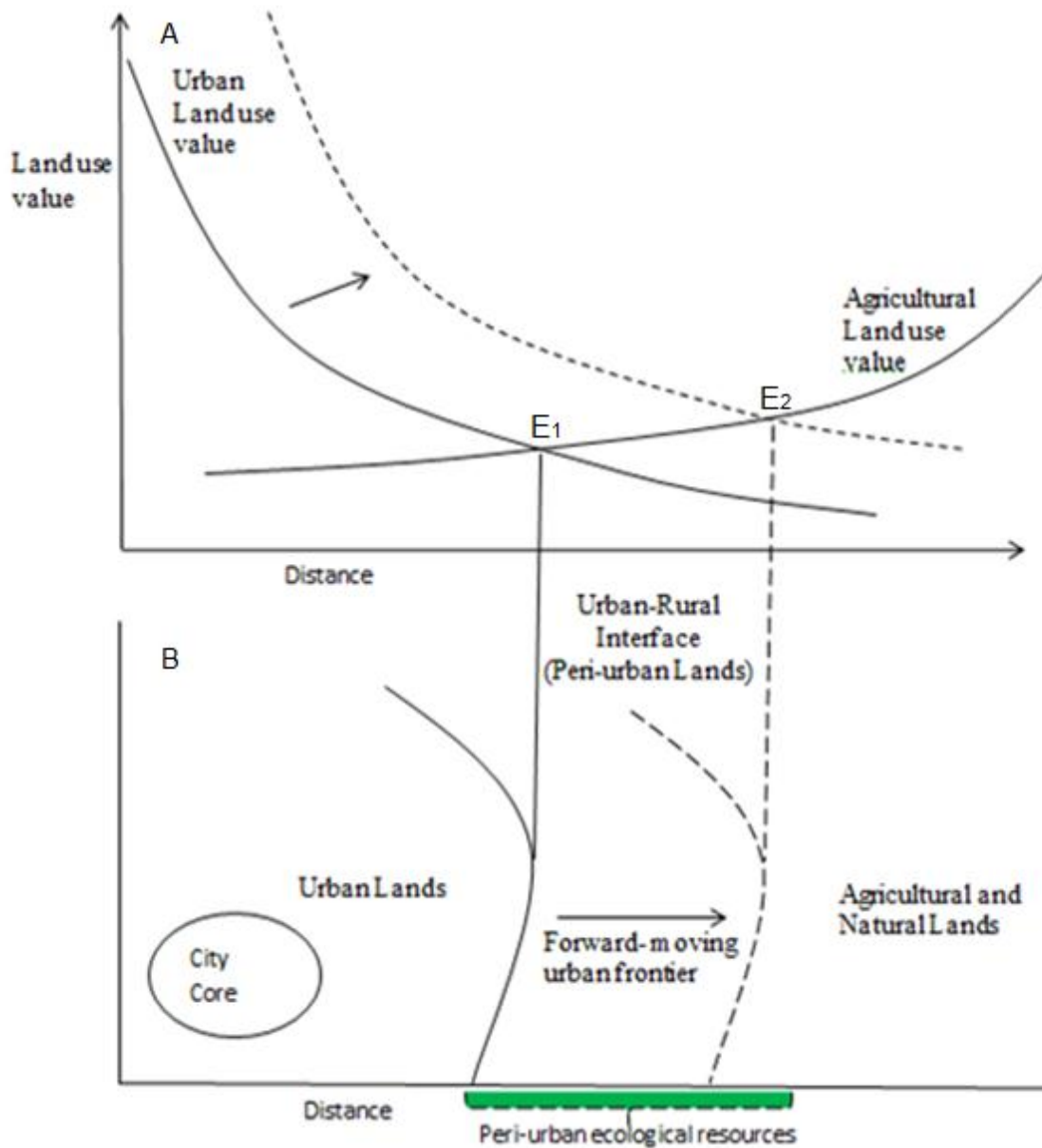


Figure 5-10. FDI induced peri-urban land conversion and loss of peri-urban ecological resources in a 'globalizing' (hypothetical) city. (A) Depicts the dynamics of urban and agricultural land use values in the face of increasing FDI inflows into the urban space economy. (B) Shows the translation of land use value dynamics into peri-urban land consumption in 'globalizing' city. Source: Author's construct.

Table 5-1. Spatial expansion of Accra and annual growth rate, 1985-2002.

| Label | Year | Total area | Growth in period | Yearly growth in period |
|-------|------|------------|------------------|-------------------------|
| Urban | 1985 | 216 | - | - |
| Urban | 1991 | 276 | 60 | 10 |
| Urban | 2002 | 555 | 279 | 25 |

Data source: Author's construct based on data from Moller-Jensen et al. (2005)

Table 5-2. Portions of regression estimation results in Chapter 4.

| Variable | Co-eff | S.E | t | Significance | Confidence interval | |
|------------------------------|--------------|-------------|---------------|--------------|---------------------|--------------|
| | | | | | Lower B | Upper B |
| CityPOP ₂₀₀₀ | .787 | .040 | 19.458 | .000 | .707 | .867 |
| GDP ₁₉₉₉ | .215 | .046 | 4.645 | .000 | .123 | .307 |
| FDI ₁₉₉₉ | .087 | .032 | 2.763 | .007 | .025 | .150 |
| <i>REMIT</i> ₁₉₉₉ | <i>-.134</i> | <i>.041</i> | <i>-3.245</i> | <i>.002</i> | <i>-.217</i> | <i>-.052</i> |
| <i>constant</i> | <i>-.959</i> | <i>.417</i> | <i>-2.301</i> | <i>.023</i> | <i>-1.786</i> | <i>-.132</i> |

N=107 F=121 (.000) R² = 820 S.E =.238 Durbin-Watson = 2.096

Note: Italicized variables and corresponding values were not implemented in IUSEEM.

Source: Author's construct.

Table 5-3. IUSEEM estimated built up area of Accra (2001-2011): FDI coefficient alone with 80 percent FDI concentration.

| Year | Annual FDI flow (current US\$) | Relative Change in FDI flow (f) | Adjusted FDI Co-eff (c) | c(1+ f) = exponent (ĝ) | Input (B ₀) | Estimated Built area (B). (km ²) | Annual change (km ²) |
|--------------------------|--------------------------------|---------------------------------|-------------------------|------------------------|-------------------------|--|----------------------------------|
| 1999 | 243700000 ¹ | | | | | | |
| 2000 | 165900000 | | | | | | |
| 2001 | 89300000 | -0.319245 | 0.000696 | 0.000474 | 328.00 | 328.16 | 0.16 |
| 2002 | 58900000 | -0.63357 | 0.000696 | 0.000255 | 328.16 | 328.24 | 0.08 |
| 2003 | 105400000 | -0.75831 | 0.000696 | 0.000168 | 328.24 | 328.29 | 0.06 |
| 2004 | 139270000 | -0.5675 | 0.000696 | 0.000301 | 328.29 | 328.39 | 0.10 |
| 2005 | 144970000 | -0.42852 | 0.000696 | 0.000398 | 328.39 | 328.52 | 0.13 |
| 2006 | 636000000 | -0.40513 | 0.000696 | 0.000414 | 328.52 | 328.66 | 0.14 |
| 2007 | 855400000 | 1.609766 | 0.000696 | 0.001816 | 328.66 | 329.26 | 0.60 |
| 2008 | 1220400000 | 2.510053 | 0.000696 | 0.002443 | 329.26 | 330.06 | 0.81 |
| 2009 | 1684740000 | 4.007796 | 0.000696 | 0.003485 | 330.06 | 331.21 | 1.15 |
| 2010 | 2527350000 | 5.913172 | 0.000696 | 0.004812 | 331.21 | 332.81 | 1.60 |
| 2011 | - | 9.370743 | 0.000696 | 0.007218 | 332.81 | 335.22 | 2.41 |
| Total change (2001-2011) | | | | | | | 7.22 |
| Ave change | | | | | | | 0.66 |

FDI coefficient = 0.087 (80% = 0.0696). 1. This value will remain the base year (point of reference) for all IUSEEM computations in Chapter 5. Source: Author's construct.

Table 5-4 IUSEEM sensitivity to varying FDI concentrations (FDI co-efficient only): 2001-2011.

| FDI Concentration Level (%) | Cumulative Built up Area (km ²) | Total Built up Area (km ²) | Average Built up Area (km ²) |
|-----------------------------|---|--|--|
| 100 | 337.05 | 9.05 | 0.82 |
| 90 | 336.14 | 8.14 | 0.74 |
| 80 | 335.22 | 7.22 | 0.66 |
| 70 | 334.31 | 6.31 | 0.57 |
| 60 | 333.40 | 5.40 | 0.49 |
| 50 | 332.50 | 4.50 | 0.41 |
| 40 | 331.59 | 3.59 | 0.33 |
| 30 | 330.69 | 2.69 | 0.24 |
| 20 | 329.79 | 1.79 | 0.16 |
| 10 | 328.89 | 0.89 | 0.08 |

Source: Author's construct.

Table 5-5 IUSEEM estimated built up area of Accra (2001-2011): FDI, GDP per capita and population coefficients with 80 percent FDI concentration.

| Year | Annual FDI flow (current US\$) | Relative Change in FDI flow (f) | Adjusted Sum of Co-eff. (c) | c*(1+f) = exponent (g) | Input (B ₀) | Estimated Built area (B). (km ²) | Annual change (km ²) |
|--------------------------|--------------------------------|---------------------------------|-----------------------------|------------------------|-------------------------|--|----------------------------------|
| 1999 | 243700000 ¹ | | | | | | |
| 2000 | 165900000 | | | | | | |
| 2001 | 89300000 | -0.319245 | 0.008712 | 0.005931 | 328.00 | 329.95 | 1.95 |
| 2002 | 58900000 | -0.63357 | 0.008712 | 0.003192 | 329.95 | 331.01 | 1.05 |
| 2003 | 105400000 | -0.75831 | 0.008712 | 0.002106 | 331.01 | 331.70 | 0.70 |
| 2004 | 139270000 | -0.5675 | 0.008712 | 0.003768 | 331.70 | 332.96 | 1.25 |
| 2005 | 144970000 | -0.42852 | 0.008712 | 0.004979 | 332.96 | 334.62 | 1.66 |
| 2006 | 636000000 | -0.40513 | 0.008712 | 0.005183 | 334.62 | 336.36 | 1.74 |
| 2007 | 855400000 | 1.609766 | 0.008712 | 0.022736 | 336.36 | 344.09 | 7.73 |
| 2008 | 1220400000 | 2.510053 | 0.008712 | 0.03058 | 344.09 | 354.77 | 10.68 |
| 2009 | 1684740000 | 4.007796 | 0.008712 | 0.043628 | 354.77 | 370.59 | 15.82 |
| 2010 | 2527350000 | 5.913172 | 0.008712 | 0.060228 | 370.59 | 393.60 | 23.00 |
| 2011 | - | 9.370743 | 0.008712 | 0.09035 | 393.60 | 430.81 | 37.21 |
| Total change (2001-2011) | | | | | | | 102.81 |
| Ave change | | | | | | | 9.35 |

Coefficients: FDI = 0.087, Population = 0.787, GDP = 0.215. 1 = reference value.

Source: Author's construct.

Table 5-6. IUSEEM results sensitivity to varying FDI concentrations (all coefficients) 2001-2011.

| FDI Concentration Level (%) | Cumulative Built up Area (km ²) | Total Built up Area (km ²) | Average Built up Area (km ²) |
|-----------------------------|---|--|--|
| 100 | 461.20 | 133.20 | 12.11 |
| 90 | 445.74 | 117.74 | 10.70 |
| 80 | 430.81 | 102.81 | 9.35 |
| 70 | 416.37 | 88.37 | 8.03 |
| 60 | 402.42 | 74.42 | 6.77 |
| 50 | 388.94 | 60.94 | 5.54 |
| 40 | 375.91 | 47.91 | 4.36 |
| 30 | 363.31 | 35.31 | 3.21 |
| 20 | 351.14 | 23.14 | 2.14 |
| 10 | 339.37 | 11.37 | 1.03 |

Source: Author's construct.

Table 5-7. Five-year averages for the regression explanatory variables.

| <i>2007-2003</i> | <i>2001-1997</i> | <i>1996-1992</i> | <i>1990-1986</i> | <i>1984-1980</i> |
|------------------|---------------------------------------|------------------|------------------|------------------|
| 855380000 | 89300000 | 120000000 | 14800000 | 2000000 |
| 636010000 | 165900000 | 106500000 | 15000000 | 2400000 |
| 144970000 | 243700000 | 233000000 | 5000000 | 16300000 |
| 139270000 | 167400000 | 125000000 | 4700000 | 16263752 |
| 136750000 | 81800000 | 22500000 | 4300000 | 15600000 |
| 382476000 | 149620000 | 121400000 | 8760000 | 10512750 |
| | 16.07990* | 10.54788* | | |
| | Ghana's GDP Per Capita (current US\$) | | | |
| 1090.05 | 433.85 | 637.49 | 674.81 | 486.81 |
| 920.61 | 416.65 | 609.57 | 584.76 | 447.01 |
| 794.76 | 660.88 | 527.25 | 594.53 | 466.65 |
| 673.91 | 655.88 | 593.99 | 558.90 | 488.48 |
| 593.47 | 618.53 | 705.01 | 532.85 | 476.49 |
| 814.56 | 557.16 | 614.66 | 589.17 | 473.09 |
| | -0.05* | 0.30* | | |
| | Ghana's population Growth Rate | | | |
| 2.41 | 2.41 | 2.51 | 2.75 | 3.45 |
| 2.42 | 2.37 | 2.64 | 2.69 | 3.51 |
| 2.43 | 2.35 | 2.75 | 2.69 | 3.31 |
| 2.44 | 2.36 | 2.83 | 2.80 | 2.92 |
| 2.44 | 2.42 | 2.85 | 2.98 | 2.39 |
| 2.43 | 2.38 | 2.72 | 2.78 | 3.12 |
| | -0.14* | -0.13* | | |

Notes: Italicized values = period averages. * is the relative change with reference to average values in column 4 (1990-1986).

Table 5-8. Geographical distribution of FDI projects among the regions of Ghana, 2nd quarter of 2007.

| <i>Region</i> | <i>No. of Projects</i> | <i>Percent of Total</i> |
|---------------|------------------------|-------------------------|
| Ashanti | 4 | 4.21 |
| Brong Ahafo | 1 | 1.05 |
| Central | 3 | 3.15 |
| Eastern | 4 | 4.21 |
| Greater Accra | 81 | 85.26 |
| Northern | 1 | 1.05 |
| Volta | 3 | 3.15 |
| Western | 2 | 2.10 |
| Total | 95 | 100.00 |

Source: Author's construct based on GIPC (2008) data.

Table 5-9. Comparing IUSEEM results with Angel et al. and Moller-Jensen et al. (FDI coefficient alone)-varying FDI concentration levels.

| FDI Con- centration Level (%) | IUSEEM | Average built up area | | IUSEEM Angel et al. (2011) | Average as percent Moller-Jensen et al. (2005) |
|-------------------------------------|--------|-------------------------|---------------------------------|----------------------------------|--|
| | | Angel et al. (2011)* | Moller-Jensen et al. (2005)* | | |
| 100 | 0.82 | 13.30 | 17.5 | 6.20 | 4.70 |
| 90 | 0.74 | 13.30 | 17.5 | 5.58 | 4.23 |
| 80 | 0.66 | 13.30 | 17.5 | 4.95 | 3.75 |
| 70 | 0.57 | 13.30 | 17.5 | 4.32 | 3.28 |
| 60 | 0.49 | 13.30 | 17.5 | 3.70 | 2.81 |
| 50 | 0.41 | 13.30 | 17.5 | 3.08 | 2.34 |
| 40 | 0.33 | 13.30 | 17.5 | 2.46 | 1.87 |
| 30 | 0.24 | 13.30 | 17.5 | 1.84 | 1.40 |
| 20 | 0.16 | 13.30 | 17.5 | 1.23 | 0.93 |
| 10 | 0.08 | 13.30 | 17.5 | 0.61 | 0.46 |

Source: Author's construct.

Table 5-10. Comparing IUSEEM results with Angel et al. and Moller-Jensen et al. (all estimated coefficients)-varying FDI concentration levels.

| FDI Con- centration Level (%) | Average built up area | | | IUSEEM | Average as percent |
|-------------------------------------|-----------------------|------------------------|---------------------------------|------------------------|--------------------------------|
| | IUSEEM | Angel et al.(2011)* | Moller-Jensen et al. (2005)* | Angel et al. (2011) | Moller-Jensen et al. (2005) |
| 100 | 12.11 | 13.30 | 17.5 | 92.86 | 70.40 |
| 90 | 10.70 | 13.30 | 17.5 | 82.06 | 62.21 |
| 80 | 9.35 | 13.30 | 17.5 | 71.63 | 54.31 |
| 70 | 8.03 | 13.30 | 17.5 | 61.56 | 46.67 |
| 60 | 6.77 | 13.30 | 17.5 | 51.83 | 39.29 |
| 50 | 5.54 | 13.30 | 17.5 | 42.43 | 32.16 |
| 40 | 4.36 | 13.30 | 17.5 | 33.34 | 25.28 |
| 30 | 3.21 | 13.30 | 17.5 | 24.57 | 18.63 |
| 20 | 2.14 | 13.30 | 17.5 | 16.10 | 12.20 |
| 10 | 1.03 | 13.30 | 17.5 | 7.91 | 6.00 |

Source: Author's construct.

Table 5-11. Confidence interval for IUSEEM at the 80% FDI concentration: 2001-2011

| Variable | Confidence interval | |
|----------------------|---------------------|------------------|
| | Lower Bound | Upper Bound |
| Pop | 0.707 | 0.867 |
| GDP | 0.123 | 0.307 |
| FDI | 0.025 | 0.15 |
| Sum | 0.855 | 1.324 |
| 80% of sum | 0.684 | 1.0592 |
| <i>Decimal</i> | <i>0.00684*</i> | <i>0.010592*</i> |
| Cumulative estimated | 406.29 | 456.92 |
| Average estimated | 7.12 | 11.72 |

Notes: *These values are used as the exponent in the IUSEEM to compute the lowest and highest expected cumulative as well as the average annual growth rate in built up area for 2001-2011. Source: Author's construct.

Table 5-12. IUSEEM results compared to independent data.

| Year | IUSEEM 80% FDI con- centration | Moller-Jensen et al. (2005) | Angel et al. (2011; 2005)* |
|---------------------------|--------------------------------------|--------------------------------|-------------------------------|
| 1985 | | 216 | 129 |
| 1991 | | 276 | |
| 2000 | 337.35 | | 328 |
| 2001 | | | |
| 2002 | | 555 | |
| 2011 | 430.81 | 712.50 | 473.93 |
| Annual growth | 9.35 | 17.50 | 13.27 |
| IUSEEM results as percent | | | |
| <i>Cumulative</i> | | 60.46 ¹ | 90.90 |
| Upper Bound | | 64.13 | 96.41 |
| Lower Bound | | 57.02 | 85.73 |
| <i>Average</i> | | 53.41 ² | 70.45 |
| Upper Bound | | 66.97 | 88.34 |
| Lower Bound | | 40.67 | 53.65 |

Notes: *This column is provided for further information only. The built up area for 2011 from Moller-Jensen et al.(2005) was calculated based on estimated annual average growth of 17.50sq.km [(10sq.km+25sq.km)/2] since 2002. 1 = 430.81/712.50*100
2 = 9.35/17.50*100. Source: Author's construct.

CHAPTER 6 GENERAL CONCLUSIONS

Summary

This dissertation research set out to explore the theoretical underpinnings and methodological approach to understanding and quantifying the linkages between FDI and remittances on the one hand, and rapid land conversion in the peri-urban areas of Accra, Ghana. The major outcomes are three-fold: (1) The study proposes the *FDI induced urban spatial expansion theory* as an extension to the Thunen-Alonso theoretical framework from a geographical perspective; aimed at explaining rapid rate of land conversion in the peri-urban areas of primate, globalizing cities in developing countries as well as to help better account for realities of economic globalization in urban expansion theorizing and modeling; (2) The integrated Urban Spatial Expansion Estimation Method (IUSEEM) is proposed as an appropriate method for quantifying FDI induced urban spatial expansion; and (3) The study shows that articulating FDI induced urban spatial expansion through integration of geographical concepts and themes and economic theory helps place the phenomenon in the broader context of human-induced environmental change, an increasingly important societal concern. By these outcomes this dissertation has sought to lay down the conceptual and theoretical foundations, as well as the methodological framework for analyzing contemporary urban land expansion as induced by FDI, facilitates a theoretically grounded geographical analysis of urban land expansion induced by FDI; with implications for urban planning, policy and environmental conservation planning.

The premises upon which the dissertation is based are as follows. Globalization related economic forces (FDI and remittances) are assuming increasing importance,

impacting expansion of built up areas, especially in primate cities in developing countries where these funds show tendencies to over-concentrate. However, for the most part global economic forces are inadequately represented in urban land use theorizing and urban expansion modeling approaches, indicating a less than fuller understanding. Even though urban built up areas occupy only about 2% of the earth's land, the potential negative consequences on urban ecological resources of rapid and uncontrolled urban land conversion has been underscored by many researchers. For example, Karen Seto and colleagues have stated in no uncertain terms that

The conversion of Earth's land surface to urban uses is one of the most irreversible human impacts on the global biosphere. It drives the loss of farmland, affects local climate, fragments habitats, and threatens biodiversity. (Seto et al., 2011: 1).

Since urban land conversion responds to global capital flows into urban spaces, it is imperative that a more comprehensive understanding is sought in order to ensure sustainable urban development. In this regard, the overall goal of this dissertation has some resonance with the NRC's strategic direction question number 7: How is the movement of people, goods, and ideas transforming the world? (NRC, 2010: 75).

FDI and remittances were formally "inserted" in the standard economic theory of urban land use (Alonso, 1964). Propositions developed were tested using log transformed multiple regression approach (OLS regression estimation method), for a sample of 107 cities. FDI and remittances; together with city population and GDP per capita explained 82 percent of the variation in urban built up area. More importantly, FDI was found to be positively correlated with urban built up area and statistically significant at the 95 percent confidence level; a 10 percent increase in FDI corresponded to almost 1 percent (0.087%) increase in the urban built up area.

Apparently small in size, this FDI co-efficient is non-trivial considering that FDI can multiply dramatically within a very short period of time; and that FDI affects urban expansion through multiple pathways. Surprisingly, however, the coefficient for remittance was negatively signed, contrary to the conceptual and theoretical postulates in this work as well as evidence from the literature. Consequently, remittance was excluded in the subsequent analysis.

To better understand the spatio-temporal dynamics of the FDI –urban land conversion relationship, the Integrated Urban Spatial Expansion Estimation Method / Model (IUSEEM), was formulated to estimate the extent of FDI induced urban spatial expansion in Accra during 2001-2011. The IUSEEM draws on the Allometric growth principle (or the Allometric Law) and integrates regression analysis with exponential growth modeling. Formulated as an exponential function, the Allometric law can be used to ‘track’ growth in a system or subsystem over time, thereby mathematically linking function to form; and in this case linking economic functions to urban form through time. IUSEEM was implemented using processed remote sensing data for Accra; with preliminary results indicating that the method could be useful for estimating the “quantum” of urban land conversion as induced by FDI. In particular, IUSEEM results, compared to data obtained from Moller-Jensen et al. (2005), seem to confirm that FDI induced urban expansion exhibited non-linear and exponential characteristics. According to the preliminary results, about 54 percent of the annual average growth in built up area of Accra during 2001-2011 could have been induced by FDI inflows to Ghana (with 80% concentration in Accra). For 2011 alone, IUSEEM results represent about 60% of the “projected” built up area of Accra based on data from Moller-Jensen et

al. (2005). In all, FDI may account for at least 50% of the built up area increase of Accra during 2001-2011.

Even though effort in this dissertation research may be modest, the author envisages contributions in the areas of geographical theory construction, urban spatial expansion modeling and estimation methodological development as well as trans-disciplinary research; designed to better understand human-induced urban environmental change in general. Moreover, by seeking to draw attention to the increasing importance of FDI as a potent driver of urban land conversion in an era of unprecedented global economic integration, insights from this dissertation research may have practical implications for urban planning and policy and could aid urban environmental conservation planning.

Contributions of this Dissertation

The major contributions of this dissertation are in the areas of theory construction, model building and methodological development.

Integrated Geographical Theory Construction

Clarion calls on geographers to focus on theory development have been numerous especially after the so called quantitative revolution in geography. So important was geographical theorizing to Harvey that he wrote

Without theory we cannot hope for controlled, consistent, and rational explanation of events . . . It seems to me, therefore, that theory construction on a broad and imaginative scale must be our first priority in the coming decade (Harvey, 1969: 486).

Indeed Harvey concluded his classical book *Explanation in Geography* by saying:

“Perhaps the slogan we should pin up upon our study walls for the 1970s ought to read:

‘By our theories you shall know us’” (Harvey, 1969: 486). This, to a very large extent,

has been the motivational message for this dissertation research; attempting to link processes of economic globalization to peri-urban environmental / land degradation through loss of natural areas in the peri-urban areas of a rapidly globalizing primate city in a developing country setting. A formal theory in this area of increasing societal importance as have been noted by researchers (for example, Seto et al., 2011; NRC, 2010) will increase our understanding about human-induced environmental change in general.

The advent of economic globalization with attendant almost seamless flow of financial resources across locations, is contributing to the profound changes Planet Earth is going through. The complexity of the issues cannot be overemphasized. However, human geographical research, particularly in the sub-disciplines of economic and urban geography, with its integrative nature, is well situated to contribute to solving some of these problems, especially those that border on the interface between the socio-economic subsystem and the biophysical system. In seeking to contribute to this course it is important that one does not need to re-invent the wheel, neither should one adhere to rigid disciplinary boundaries, hence the decision to build on the latest extensions of Alonso (1964) economic theory of urban land use as well as adopting an empirical law from biological sciences as the basis for the urban spatial expansion model proposed in this study. While being fully aware about the dangers of this “academic walk-about” this dissertation research tried to focus on the salient aspects of theories and concepts relevant to the view advanced in the work. Indeed, throughout, the author has sought to explain that the “integrative” approach advanced in this dissertation is not new to geography. With reference to the use of economic concepts

and theories for developing geographical theories, for example, geographers have had many luminary advocates (Harvey, 1969; Burton, 1963; cited in Harvey, 1969, just to mention a few). According to Harvey (1969):

Central-place theory provides just one example out of many to demonstrate how geographical theory may be derived from the basic postulates of economics. The existence of such postulates was undoubtedly an important necessary condition for the emergence of a theoretical human geography. (p. 119).

Burton was even more emphatic when he suggested that “one role of an economic geographer is to refine and adapt available economic theory” (Burton, 1963: 159; cited in Harvey, 1969: 119). It is the fervent hope of this investigator that further refinement of the globalization relevant theoretical framework presented in this dissertation research will aid the geographically motivated theorization of contemporary spatial expansion in cities where external funds may be over concentrated, since the emergence of globally – induced urban expansion can longer be ignored.

Consequently, the study has proposed the theory of FDI induced urban spatial expansion: *In a globalizing primate city located in a developing country, the rate of physical expansion of the city is a function of the volume of annual FDI inflows; during the expansion process, peri-urban land is put to its highest value and best use by converting from agricultural to urban use, thereby accelerating the rate of urban spatial expansion as FDI inflows increase over time.*

Urban Spatial Expansion Modeling and Estimation Methodology

Most modern spatially explicit urban expansion modeling approaches use very complex methods which are usually computationally intensive, and may place them beyond the means of the average curious mind that has an interest in modeling urban growth. Furthermore, many of these models are not linked to any particular economic

theory which could afford a deeper understanding of the underlying economic drivers which usually are the most important factors influencing activities and decisions of urban residents (Pacione, 2009). In arguing for the adoption of modern approaches such as Cellular Automata for modeling urban spatial expansion, advocates have often cited the inadequacy of traditional models including being static, linear and unrealistic assumptions (Batty, 2005), for example. However, these so called modern models are yet to deliver on a lot of the promises. It is argued in this study that urban spatial expansion can be modeled analytically, thereby simplifying the modeling process. Therefore, the methodological approach suggested in this work -the IUSEEM) - appears to have the potential to contribute to making urban spatial expansion modeling simple, analytically tractable, dynamic and non-linear. Moreover, the IUSEEM is firmly grounded in the Thunen-Alonso theoretical framework which is a positive development; given that most modern urban modeling approaches lack standard economic theoretical grounding. The building of this model, it is hoped, would have demonstrated that with the ability to connect concepts and ideas across disciplines one does not necessarily have to limit his/her scope in developing spatially explicit urban expansion models to only computationally intensive and methodologically complex simulation methods. In short, the IUSEEM has attempted to lay the foundations for building a more realistic, simple and theoretically informed model for monitoring the impact of FDI on peri-urban natural areas over time, potentially useful for studying contemporary urban spatial expansion in 'primate' cities of the developing world such as Accra in Ghana. More importantly, however, it is hoped that the urban spatial expansion method/ model (IUSEEM) developed in this dissertation would be coupled with GIS to contribute to

efforts aimed at making GIS analyses more dynamic and policy relevant. The need for dynamic GIS has been underscored by researchers. In particular, Kavouras (2001) has lamented that

Most GIS are restricted to static snapshots of spatial data and have difficulties with the management of time series . . . People are interested in change but current GIS remain unable to analyze changing data. Future GIS must be able to store, retrieve, analyze and present time-varying spatial data. (Kavouras, 2001).

Commendable efforts are on-going but the approach advanced in this dissertation research may help simplify and may speed up the process as well, largely due to its simplicity; with specific application in FDI induced urban spatial expansion analysis. An added advantage is that it would be grounded in standard economic theory of urban land use/ land value.

Thinking Across Geographical Scales and Disciplines

Linking global economic ‘impulses’ to local / regional spatial and environmental changes as well as synthesizing ideas and concepts across disciplines seem to offer a more relevant approach to studying contemporary urban land expansion, with the potential to helping better understand changes in the coupled socioeconomic-biophysical environments such as FDI induced environmental degradation.

Geographers, in particular, have emphasized the need for such skills for contemporary problem-solving especially in the area of human-induced environmental change as global economic impulses impact local places (AAG, 2003). This study has sought to utilize ideas, concepts and theories from urban geography, economic geography; and urban economics; and to some extent, ecological economics as well as principles from biological science, to conceptualize, theorize and model and quantify contemporary urban spatial expansion as influenced by external economic forces –FDI, specifically.

Conceptualizing, theorizing, modeling and quantifying the urban spatial impacts resulting from global scale economic forces such as FDI flows necessitated the capability of thinking across geographical scales. This ability has, hopefully been demonstrated throughout the pages of this dissertation. Interdisciplinary research is widely recognized as an effective approach to solving societal problems especially those that result from human-environment interactions. Consequently, geographers skilled in the integrative way of thinking demonstrated in this dissertation will be equipped to contribute to the broad academic community, to the specific discipline of geography as well as engaging in policy relevant research on issues bordering on human-environment relationships.

In addition to the above contributions, it is hoped that insights contained within the pages of this dissertation would help inform policy in the practical realm, especially in the area of urban planning and policy as well as urban environmental conservation planning.

Implications of this Dissertation Research

Urban Planning and Policy

Just as the case with geography, an all-encompassing definition has so far eluded urban planning, at least to an extent (Bayer et al., 2010; Hall & Tewdr-Jones, 2010; Campbell & Fainstein, 2003). However, elusive definition notwithstanding, many urban planners will share the assertion by Bayer and colleagues that

One of the distinguishing characteristics of urban planners, no matter what their approach to planning, is their focus on the future . . . No one can predict what the future will bring. But planners are in the business of attempting to anticipate and recommend strategies to help cities thrive as the future unfolds. (Bayer et al., 2010: 13).

Michael Pacione even puts the task a little more succinctly when he stated that “Urban Planning and urban policy are concerned with the management of urban change” (Pacione, 2009: 164)). It is precisely the focus of urban planning on the ‘future’ and ‘change’ that it is anticipated that research findings and arguments advanced in this work could be of some use to urban planners and urban policy makers who are concerned with the proper land use and environmental planning of the ever changing urban system. From a very simplified perspective, the main subject matter of this dissertation can be described as urban spatial expansion as induced by economic forces, usually operating at a larger scale but producing spatial change in localities in the urban setting. This work reveals that the focus on “traditional” factors of urban expansion such as population and incomes (say, GDP per capita) - which have been identified consistently by researchers as contributing significantly to urban land expansion (for example, Seto et al., 2011; Angel et al., 2011); may be masking underlying economic factors which are not too obvious and most likely induced by global economic forces such as FDI. In this regard, the conceptual framework (Chapter 2; Chapter 3) revealed that FDI and remittances, through job creation, may be a major source of the purchasing power afforded to city residents to enable them express “effective” demand for housing and land in the city. In short, increasing demand for housing and land, in the absence of densification, will translate into conversion of new agricultural/natural lands usually in the peri-urban areas of the city. Thus, the conceptual and theoretical analyses in this study should help draw attention to the “masking” tendencies of population increase and GDP growth, which may prompt urban land use planners and environmental managers to look beyond the population numbers

and GDP statistics; and to focus more attention on external economic forces like FDI, which can multiply so fast in a very short time as has been shown in the pages of this dissertation. In advanced countries, changing taste (affluence) for housing consumption may be a major factor of increasing urban land expansion - sprawl (Carr & Zwick, 2007; Burchtel et al., 2005), with the affluence usually resulting from economic growth of the country. But the same argument may not be valid for a primate city in developing country such as Accra, with consistent concentration of about 80% of all FDI funds inflow to Ghana; the spatial ramifications can be profound. In this regard FDI may well be the single most important source of increasing purchasing power to influence land demand for urban uses. Consequently, if economic globalization generates forces that appear to impact urban change in these primate cities urban planners and urban policy makers would be better served if they paid heed to this emerging phenomenon of externally induced urban spatial expansion and its characteristic tendency to cause loss of natural areas in the peri-urban areas.

A formidable challenge urban planners may face in a rapidly globalizing primate city is the dilemma posed by market forces and national/urban policy. Liberalization and Free market dictates would seek to enforce the operation of market forces , perhaps at the expense of urban policy, which has been described as “state activities that seek to influence the distribution and operation of investment and consumption processes in cities for the common good” (Pacione, 2009: 164). The conflicting goals are not too difficult to see. Thus, it may not be easy to put policy to practice. Hence, the need for policy to be informed by verifiable research findings like this dissertation has sought to do. In a nutshell, it is suggested that urban planners and urban policy makers of rapidly

globalizing cities in developing countries, especially in Sub-Saharan Africa should watch trends of FDI inflows into their country and how much of it goes to the city they are planning and seeking to make sustainable. After all, “all communities are concerned about the future and faced with decisions that will shape that future” (Bayer et al., 2010: 17). The earlier those entrusted with this task start looking beyond the national boundaries, the better for the city residents. For, in a rapidly globalizing world, with seamless flow of global financial resources into geographically restricted urban spaces, urban land expansion can be pretty quick, even though the overall economic health of the country may not be all that impressive. One way for urban planners and policy makers to be able to monitor the external influences on the urban land expansion process is to implement the IUSEEM, formally developed in Chapter 5 of this dissertation, which will give the estimate of urban land cover in any given year to afford a good indication regarding the “moving” boundary of the city in response to FDI inflows. IUSEEM will be easy to implement and provide analytically tractable results, as well as steeped in urban economic theory.

A related suggestion is that urban land use planners must begin to pay adequate attention to external economic influences in the advent of globalization. More specifically, and with particular relevance to primate cities in developing country setting; policy interventions that target urban population control / management in lieu of urban expansion should be augmented with effective FDI management policy, otherwise the triggers associated with FDI as explained in this dissertation will likely undermine their efforts. In view of the foregoing, this dissertation research suggests a comprehensive FDI management in order to ensure a more geographically diversified FDI distribution

into smaller but economically viable urban centers. Of course, such an approach may come at the expense of benefits of economic agglomerations, perhaps; but this makes it even more imperative that a more complete understanding in this area of research is sought for which several questions may be raised. For example, what levels of FDI can be accommodated by the “primate” city without the potential negative impacts on peri-urban lands, likely associated with FDI overconcentration? What proportion of land demand can be attributed to FDI-related activities? How best can FDI be managed to ensure a more geographically diversified distribution among urban centers without undermining the benefits of agglomeration and economic linkages? In short, for those cities which are “blessed” to be enjoying increasingly high volumes of FDI inflows into the urban economy, it may be worthwhile to consider these questions.

In addition to the foregoing, FDI induced urban land expansion; especially the appropriation of peri-urban natural lands into urban uses may pose a formidable challenge for urban environmental conservation planning.

Urban Environmental Conservation

So far in this dissertation, it appears that rapidly increasing levels of FDI inflows, when significantly concentrated in an urban location, drive urban land values up, increases the opportunity cost of holding lands in agricultural and natural uses in peri-urban areas; thereby boosting rapid land conversion to urban uses. Consequently, FDI inflows into urban agglomeration ‘enclaves’ in developing countries, with the tendency to cause urban land values to rise, thereby causing agricultural and natural lands to incur increasing opportunity costs; may not bode well for urban environmental conservation. Certainly, the debate about economic growth and development in relation to environmental degradation is still on-going, gathering momentum as our knowledge

advances. However, there appear to be a general consensus among researchers and conservationists alike that land conservation is one effective means through which the environment could be preserved, underscoring the need for protected areas, even in the city.

The International Union for the Conservation of Nature (IUCN) defines a protected area as

A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. (Dudley, 2008: 8)

Thus, strictly speaking, the key function of a protected area would be to conserve a piece of land and whatever resources found therein, regardless of whether they are of immediate utility to humans or not. However, the basic economic fact of life is that resources are limited relative to needs to be satisfied, making choice inevitable. In this regard, any society or community that sets the land apart to conserve nature would have to be content with foregoing an alternative preference which could have been satisfied if the land had been put to some other usage. This is the basic underlying concept of what economists call opportunity cost – an alternative foregone as a result of choosing to use one's means to satisfy some other ends. It seems logical and imperative, therefore, for members of the society to demand to know, directly or indirectly, the "value" to them of a conservation effort, which one way or the other would deny them some form of benefits. Consequently, protected areas elsewhere have been called upon, directly or indirectly through perceived efficient allocation of resources, to account for their existence in terms of their economic (usually in monetary terms)

benefits to society and to justify continued financial support for their maintenance and operations.

Whereas the foregoing would hold true for all protected areas in general, those in and around fast “globalizing” cities in developing countries such as Accra in Ghana may be particularly vulnerable to increasing inflows of FDI since these funds accentuate the urban land conversion process as has been demonstrated in the pages of this dissertation. The important lesson that can be drawn from this insight is that conserving urban lands would aid environmental quality and enhance societal well-being, broadly defined. However, such urban environmental conservation efforts will more likely be associated with higher opportunity costs to society (Chapter 5). It is in this regard that the finding in this research – likelihood of FDI induced increasing urban land values - would suggest that urban environmental conservation efforts are more likely to be successful if the high opportunity costs of urban lands can be offset in some way. Hence, this dissertation suggests that urban environmental conservation planners be cognizant of the fact that even though FDI would bring numerous benefits to the city, it may also undermine conservation efforts as market dictates would favor the conversion of natural lands to urban uses. In the light of this, it is suggested that urban conservation planners concerned with rapidly globalizing primate cities in developing countries such as Accra, who may have to deal with FDI imperatives, may want to look into adopting methods of mixed uses for urban protected areas as opposed to the “pristine” land mentality advocated by some ecologists.

Planning urban parks and protected areas for mixed uses would likely yield enormous benefits to society both in terms of ecosystems services provision; and

pecuniary incentives such as revenues, including enhanced real estate value, recreation, sports, special events hosting, among others. Perhaps, this is one secret for the 'survival' of the New York Central Park, located within an area of extremely high land values? For example, the amenity values of parks to urban residential areas have been well documented (Cho et al., 2008; Geoghegan, 2002; Irwin, 2002; Bolitzer & Netusil, 2000). This could be generally interpreted as contentment among residents of areas near urban parks hence their willingness to pay more for the adjacent real estate property. In the case of the New York Central Park, for example, real estate property values adjacent to the park are considerably higher than areas not in close proximity to the park (Central Park Conservancy, 2006). It is heartening to note, therefore, that urban residents are not averse to natural areas preservation after all, with urban conservation efforts presumably rooted in history. According to Christensen and colleagues

Cities have historically been the dynamic engines of conservation, as well as the engines of economic growth and innovation. Some of the best environmental history in recent years has focused on urban environments, including Matthew Gandy's *Concrete and Clay: Reworking Nature in New York City* (MIT Press, 2002), Jared Orsi's *Hazardous Metropolis: Flooding and Urban Ecology in Los Angeles* (University of California Press, 2004), Matthew Klinge's *Emerald City: An Environmental History of Seattle* (Yale University Press, 2007), and Michael Rawson's *Eden on the Charles: The Making of Boston* (Harvard University Press, 2010). (Christensen et al., 2012).

Indeed, the concern for conservation of lands in and around urban centers seems to be gaining renewed vigor. For instance, Peter Kareiva, the Chief scientist for Nature Conservancy, is recently reported to have issued a warning to the members, thus:

Conservation is facing a crisis of irrelevance—it is an enterprise that is not urgent to most people. If conservation is to build the support it needs, it must energize young urban dwellers, who now make up most of the world. The best way to get city people to care about conservation is to do

conservation where they live, so that nature is seen as relevant and connected to modern life. (Christensen et al., 2012).

To put it bluntly, conservation of nature in the city is not a favor to some ‘uncivilized’ biological entities but for our own good (so called modern human society).

To sum up, FDI will more likely continue to flow into urban agglomerations, increasing urban land values, with the tendency to make urban environmental conservation economically unattractive. Thus, realities of economic globalization and free market tendencies cannot be ignored; neither can they be stopped. But it seems a “middle” ground pathway between economic expediencies and natural areas conservation, especially, for ecosystems services and sustenance of biological diversity, can be towed. After all, as the saying goes: “half a loaf is better than none”. Hopefully, urban environmental conservation – minded people will find something insightful in the pages of this dissertation.

Suggestions for Further Research

FDI, Remittances and Cost of Low Income Housing in Accra

Household income characteristics and spatial mobility of city residents result in what has been described as the “filtering” of houses. Essentially, the filtering –of housing concept suggests that as a housing unit ages and deteriorates its relative price will decrease, and it will become available to lower-income families (Johnston, 1979). From a spatial mobility perspective, this has often entailed the movement of high income households from the inner areas of the city to the peri-urban areas where new houses and subdivisions are often created. Middle income earners then move into houses previously occupied by the high income city residents. Theoretically, the end result of this process is that affordable houses of reasonable quality are made available

to lower income households near the center of the city (Johnston, 1979). One potential problem that may stop this filtering process would be that if the composition of housing demand shows a significant proportion related to external forces such as FDI and remittances, thereby placing the newly constructed housing units above the means of the average worker, residing and earning incomes in the local economy. The average Ghanaian (resident in Ghana and earning income locally) may not be able to afford the type of “quality houses” being put up in the peri-urban areas of Accra. And many researchers have pointed out the fact that most of these houses are owned by Ghanaian migrants or resident Ghanaians who have some “outside” business connections or earn supplementary incomes from oversea (subject to possible positive currency effect). This has contributed to the high cost and low quality of low income housing in Accra compared to similar cities in Africa has been confirmed by (Konadu-Agyemang, 2001). In short it is widely acknowledged that the ordinary low income Ghanaian household in Accra may not be positively affected by the recent boom in residential housing development in the city. The conceptual and theoretical analyses presented in this dissertation seem to suggest that a significant share of the housing and land demand in Accra are related to FDI and remittances. With the new houses being put up mainly in the peri-urban areas, at least indirectly, it seems the external economic forces of FDI and remittances may be blocking the house filtering process, thereby contributing to rising cost of housing but poor quality of housing for low income residents. Many factors have been identified as contributing to this situation, with one cited as the increasing housing demand by expatriates (Grant & Yankson, 2003), largely resonating with the conceptual and theoretical analyses in this dissertation. However,

there is more to this since according to the conceptual and theoretical analyses, expatriates housing demand is only one of the many pathways through which FDI influence the housing and land demand. Further research will add to our understanding in this area. One question that readily comes to mind is: in what specific ways is FDI affecting housing cost and quality for low income residents of Accra? And: what is the rate of change of housing demand in Accra in response to inflows of FDI? Answers to these questions, hopefully, will add to our understanding of the potential impact of FDI on housing of low income households, which could inform housing policy formulation.

IUSEEM, GIS and Empirical Research

Another area of this dissertation research where further investigations could yield enormous benefits to the urban modeling community and GIS researchers and practitioners is that further refinement of the IUSEEM (Chapter 5) will be useful. Specifically, interested researchers may want to put IUSEEM to test in other similar cities like Accra in Ghana. It would also be interesting if the analytical model developed in this dissertation would be coupled with GIS to formulate the (IUSEEM-GIS), to help make GIS analysis of urban expansion and modeling more dynamic, theoretically informed and analytically simple. Particularly, if the formula can be programmed into GIS and results simultaneously displayed spatially, it will be a good step towards the development of dynamic GIS for urban expansion modeling which is grounded in the standard urban land use theory. Unlike simulation methods, the modeler can incorporate external economic variables directly into the model to examine the responsiveness of urban spatial expansion to “impulses” of global economic forces. The importance to urban planners in primate cities of the developing countries, of knowing the external economic influences on urban spatial expansion cannot be over-

emphasized in the light of increasing globalization as these cities are “bombarded” by globalization forces. Thus, from a practical point of view, IUSEEM-GIS may be useful for urban land use planning and conservation of urban nature once one can monitor the rates at which socio-economic drivers impact the process of urban spatial expansion, as the IUSEEM advocated in this dissertation purports to do.

Expanding the Scope of this Research-Modeling

Related to the foregoing is the potential for the expansion of the modeling exercise undertaken in this dissertation in order to enhance its policy relevance. In particular, probability modeling capable of predicting differential expansion rates in different localities in Accra will be useful when policy makers are attempting to protect sensitive ecological areas in and around Accra. In this regard, it seems combining IUSEEM, Markov chain modeling and Cellular Automata (CA) will likely yield an integrated model of high practical relevance. As has been demonstrated in this work, the IUSEEM is able to conduct FDI as a “global” variable into the urban landscape but fails to predict the transition of parcels of land from agricultural to urban. This shortfall can be remedied by the Markov chain model. But Markov chain models do not detail the spatial change process in a spatially explicit manner (Lambin, 1997 cited in Adhikari, 2011). This can be best handled by spatially explicit dynamic models such as CA (Adhikari, 2011). Thus, if successful, the integration of IUSEEM, Markov chain model and CA should yield a more realistic model of urban spatial expansion as induced by FDI, with due consideration given to external economic drivers of urban spatial change which are likely to assume increasing importance should current globalization rates be sustained into the future. More importantly, from policy perspective, such an approach is likely able to help protect ecologically sensitive areas but based on a scientific approach that

will help avoid the enactment of “one-size-fits-all” bylaws where they may not be necessary. Thus, policy will be targeted towards specific localities that can be identified using this integrated modeling approach, without unnecessarily restricting development in less ecologically sensitive peri-urban areas.

Scale of Data Capture

This dissertation calls for research into appropriate data for urban expansion modeling since the scales at which the traditional variables (population and income (GDP per capita) are measured may not adequately capture the potential influences of FDI on urban spatial expansion (as revealed by the conceptual and theoretical analyses presented in this work). On the one hand, the high significance attributed to population change as land use change driver may be over-bloated, given the fact that the purchasing power enablement is not considered. On the other hand, GDP per capita measured at the national level would not capture increased incomes enjoyed by city residents, via the creation of FDI related jobs attracted by the city. The combined implication of these measurement discrepancies may explain in part, why FDI’s coefficient (resulting from the regression estimation in Chapter 4 of this dissertation research) is small compared to population and GDP per capita. Further research into how to capture the data that will help adequately reflect the influences of FDI on urban spatial expansion in primate cities of developing countries, undergoing rapid globalization is likely to be useful.

Remittances and Urban Spatial Expansion

Anecdotal evidence, literature review as well as theoretical and conceptual analyses in this dissertation all pointed to a positive correlation between remittances and urban land expansion. Surprisingly, however, remittance was found to be

negatively correlated with increase in the urban extent and not statistically significant at the 95% confidence level. What is even more puzzling is that when remittance is included with city population, GDP per capita growth rate and FDI in the log transformed regression, the overall explanatory power of the model improved slightly, but remittance co-efficient continued to be negative and not statistically significant. When urban built area was regressed on FDI and remittances, the R^2 for this model was 0.13, the same as for the model in which urban built area was regressed on FDI alone. For the co-efficients, remittance remained negative, not statistically significant at the 95% but FDI co-efficient remained positive and statistically significant at the 95% confidence level. Further research on the remittances-urban spatial expansion relationship, especially, employing larger samples, may confirm (or yield results consistent with) the literature and the conceptual and theoretical postulates advanced in this dissertation thereby aiding understanding.

Some Limitations of this Research

Data

Data for this research were obtained from secondary sources which are deemed reliable and relevant for our work. However, use of secondary data entails many challenges and difficulties, with the potential for inaccuracy. As such the validity and accuracy of the numerical results presented in this dissertation are subject to validity and accuracy of the source documents and databases. In future work, the author intends collecting primary data to be implemented in the regression models constructed in this work which can then be compared with the results obtained using the secondary data. Having said this, it should be noted that using secondary data did not have any adverse consequences on the logical reasoning presented in this dissertation. Thus, for

a large measure, this work is of substance to the research community and would potentially contribute to the literature.

Scale of Data Capture

The FDI, remittances and GDP (explanatory variables) data used for the regression estimation and analysis were captured at the national level, whereas the urban built up area (respondent variable) data were captured at the city / urban level. In other words, the magnitude of the independent variables measured for the whole country were attributed to the selected cities in the sample. Thus, with the three explanatory variables are captured at the national (country) scale whereas the response variable is captured at the “local” (urban) scale, it can be argued that this could result in “inflating” the importance of these variables in relation to the spatial expansion of the cities in question. It should be noted, however, that since by nature regression analysis is about “averages” this should not invalidate the results obtained in this dissertation. Also, in regard to Accra, there is documented evidence that the bulk of annual FDI funds inflow to Ghana get concentrated in this capital city of Ghana, with estimates ranging between 75% - 80%. Thus, the contribution of FDI to Accra’s contemporary spatial expansion as asserted in this dissertation research may not be entirely out of place. But further investigation is warranted.

Scope

The scope for this research is limited to large /primate cities in developing countries that are receiving disproportionately large amounts of external funds. Additionally, these cities usually lack effective urban land use planning and environmental policies, thereby failing to control urban development, especially in housing / residential development. Particularly, the model, IUSEEM is not intended for

modeling spatial expansion in cities in developed countries where external funds inflow are likely to be more geographically diversified. In this case, enough demand “pressure” may not be exerted on any single city in order to contribute significantly to the urban expansion process. For example, FDI inflows to the USA is more likely to be geographically diversified by virtue of the existence of considerably large number of “competitive” cities which could attract FDI in equal measure, compared to Accra, Ghana where such funds have consistently flowed disproportionately into its urban space.

IMPORTANT NOTE: This study does not purport to tow any ideological line of thinking. For example, Marxist theorists have sought to blame capitalism for urbanization and attendant crises. However, valid this may be, this author does not necessarily share this approach, and neither is capitalism endorsed. The aim is to analyze the emerging phenomenon of FDI induced urban spatial expansion, utilizing the theories and methods deemed appropriate and effective should they come from Marxists or Capitalists. I aim neither to condemn globalization nor endorse it. It is simply not the call of my dissertation.

APPENDIX A
DATA USED FOR REGRESSION ANALYSIS

Table A-1. Extracted Data for the Sample of 120 cities and urban areas.

| City | Country | T2 | Built-Up T2 (Ha) | City Pop T2 |
|----------------|-------------|------|------------------|-------------|
| Accra | Ghana | 2000 | 32834 | 2693371 |
| Addis Ababa | Ethiopia | 2000 | 11865 | 2510904 |
| Ahvaz | Iran | 2000 | 21945 | 1258713 |
| Akashi | Japan | 2001 | 3572 | 294657 |
| Alexandria | Egypt | 1999 | 18780 | 3378392 |
| Algiers | Algeria | 2000 | 22913 | 3627912 |
| Anqing | China | 1999 | 3552 | 578216 |
| Ansan | Korea, R | 2001 | 8864 | 993560 |
| Astrakhan | Russian F | 1999 | 16153 | 594015 |
| Aswan | Egypt | 2000 | 1579 | 310069 |
| Bacolod | Philippines | 2000 | 3294 | 510321 |
| Baku | Azerbaijan | 1999 | 9015 | 2067017 |
| Bamako | Mali | 1999 | 12992 | 1239935 |
| Bandung | Indonesia | 2001 | 15382 | 3671064 |
| Bangkok | Thailand | 2002 | 102593 | 9761697 |
| Banjul | Gambia | 2000 | 4949 | 447985 |
| Beijing | China | 1999 | 157638 | 11866221 |
| Budapest | Hungary | 2000 | 36977 | 2052781 |
| Buenos Aires | Argentina | 2000 | 135722 | 11915543 |
| Cairo | Egypt | 2000 | 56917 | 13083621 |
| Caracas | Venezuela | 2001 | 15673 | 1308279 |
| Casablanca | Morocco | 2001 | 11431 | 3004505 |
| Castellon | Spain | 2000 | 8203 | 268712 |
| Cebu | Philippines | 2002 | 6365 | 1524080 |
| Changzhi | China | 2000 | 11500 | 928518 |
| Chicago | USA | 2001 | 425126 | 8590032 |
| Chinju | Korea, R | 2000 | 5208 | 342454 |
| Chonan | Korea, R | 2000 | 5898 | 424046 |
| Cincinnati | USA | 1999 | 77225 | 1517716 |
| Coimbatore | India | 1999 | 10479 | 1399225 |
| Dhaka | Bangladesh | 1999 | 16563 | 9196964 |
| Fukuoka | Japan | 2001 | 37203 | 2598370 |
| Gorgan | Iran | 2001 | 10711 | 455061 |
| Guadalajara | Mexico | 1999 | 40518 | 3669578 |
| Guangzhou | China | 2000 | 64106 | 7156071 |
| Guaruja | Brazil | 2002 | 3664 | 277993 |
| Guatemala City | Guatemala | 2000 | 18903 | 1766093 |

Table A-1 (Continued)

| City | Country | T2 | Built-Up T2 (Ha) | City PopT2 |
|------------------|-------------|------|------------------|------------|
| Harare | Zimbabwe | 2000 | 24310 | 889421 |
| Ho Chi Minh City | Vietnam | 1999 | 21033 | 4309449 |
| Hong Kong | China | 2001 | 9763 | 5179089 |
| Houston | USA | 1999 | 182374 | 3656247 |
| Hyderabad | India | 2001 | 31754 | 5707677 |
| Ibadan | Nigeria | 2000 | 29996 | 2421369 |
| Ilheus | Brazil | 2001 | 4970 | 151509 |
| Ipoh | Malaysia | 2001 | 21906 | 655200 |
| Istanbul | Turkey | 2000 | 53269 | 8826758 |
| Jaipur | India | 2000 | 14084 | 2779119 |
| Jalna | India | 2000 | 1952 | 24304 |
| Jequeie | Brazil | 2001 | 3655 | 138216 |
| Johannesburg | S. Africa | 2000 | 99279 | 4695165 |
| Kampala | Uganda | 2001 | 20169 | 1761733 |
| Kanpur | India | 2000 | 17668 | 2674116 |
| Kigali | Rwanda | 1999 | 4502 | 354273 |
| Kingston | Jamaica | 2002 | 11945 | 875605 |
| Kolkata | India | 2000 | 48344 | 13170280 |
| Kuala Lumpur | Malaysia | 2001 | 80529 | 5389624 |
| Le Mans | France | 1999 | 7444 | 212064 |
| Leipzig | Germany | 1999 | 19580 | 664696 |
| Leshan | China | 2001 | 9944 | 966091 |
| London | UK | 2000 | 185551 | 10028978 |
| Los Angeles | USA | 2000 | 385089 | 13218754 |
| Madrid | Spain | 2000 | 36979 | 4588170 |
| Malatya | Turkey | 2000 | 13747 | 852864 |
| Manila | Philippines | 2002 | 63317 | 17335085 |
| Marrakech | Morocco | 2000 | 16475 | 1722999 |
| Medan | Indonesia | 2001 | 14559 | 2239596 |
| Mexico City | Mexico | 2000 | 105853 | 17224096 |
| Milano | Italy | 2001 | 63517 | 3708980 |
| Minneapolis | USA | 2001 | 109971 | 2167795 |
| Modesto | USA | 2000 | 16892 | 344540 |
| Montevideo | Uruguay | 2000 | 35725 | 1838801 |
| Moscow | Russian F | 2002 | 104632 | 9144624 |
| Mumbai | India | 2001 | 37090 | 16161758 |
| Ndola | Zambia | 2002 | 5390 | 326119 |
| Oktyabrsky | Russian F | 2001 | 9786 | 228371 |
| Ouagadougou | Burkinafaso | 2001 | 13746 | 874623 |
| Palembang | Indonesia | 2001 | 17504 | 1616527 |
| Palermo | Italy | 2001 | 8087 | 833992 |
| Paris | France | 2000 | 148208 | 9519527 |
| Philadelphia | USA | 1999 | 233491 | 5238892 |

Table A-1 (Continued)

| City | Country | T2 | Built-UpT2 (Ha) | City PopT2 |
|----------------|-------------|------|-----------------|------------|
| Pittsburgh | USA | 1999 | 47213 | 1185877 |
| Port Sudan | Sudan | 2001 | 4104 | 209154 |
| Pretoria | S. Africa | 2000 | 17004 | 659834 |
| Puna | India | 1999 | 19149 | 4041868 |
| Pusan | Korea, R | 2000 | 19686 | 3485359 |
| Rajshahi | Bangladesh | 2000 | 2026 | 599525 |
| Ribeirao Preto | Brazil | 2001 | 10034 | 512239 |
| Saidpur | Bangladesh | 2001 | 759 | 233478 |
| San Salvador | El Salvador | 1999 | 12862 | 2022047 |
| Sanaa | Yemen | 2000 | 15528 | 1474635 |
| Santiago | Chile | 2000 | 43851 | 5337512 |
| Sao Paulo | Brazil | 2000 | 155418 | 15481476 |
| Seoul | Korea, R | 2001 | 70614 | 14546082 |
| Shanghai | China | 2001 | 116186 | 14133931 |
| Sheffield | UK | 2002 | 15880 | 764213 |
| Shimkent | Kazakhstan | 2000 | 14565 | 577753 |
| Songkhla | Thailand | 2001 | 1899 | 244403 |
| Springfield | USA | 2002 | 23770 | 427126 |
| Sydney | Australia | 2002 | 75951 | 2754486 |
| Tacoma | USA | 2000 | 44526 | 697104 |
| Tebessa | Algeria | 2001 | 7537 | 457364 |
| Teheran | Iran | 2000 | 47170 | 7803538 |
| Tel Aviv | Israel | 2000 | 34022 | 2610373 |
| Thessaloniki | Greece | 2001 | 7144 | 857935 |
| Tijuana | Mexico | 2000 | 20808 | 1174193 |
| Tokyo | Japan | 2001 | 256425 | 29615263 |
| Ulan Bator | Mongolia | 2001 | 12857 | 776538 |
| Valledupar | Colombia | 2001 | 2704 | 288448 |
| Victoria | Canada | 2000 | 10735 | 255055 |
| Vijayawada | India | 2000 | 6234 | 1117042 |
| Warsaw | Poland | 2002 | 33217 | 2002178 |
| Wien | Austria | 2001 | 39450 | 2118871 |
| Yerevan | Armenia | 2000 | 41569 | 2063290 |
| Yiyang | China | 1999 | 9562 | 1207164 |
| Yulin | China | 2000 | 25001 | 3387078 |
| Zhengzhou | China | 2001 | 78954 | 5133266 |
| Zugdidi | Georgia | 2000 | 4134 | 157008 |

Source: Angel, S., Parent, J., Civco, D. L. and Blei, A. M. (2010). Atlas of Urban Expansion, Cambridge MA: Lincoln Institute of Land Policy. Available at: <http://www.lincolninst.edu/subcenters/atlas-urban-expansion/urban-national-data-tables.aspx> . Last accessed: December 14, 2011. The data were extracted from "Table 1: Spatial Metrics Data for the 1990 Global Sample of 120 Urban Areas".

Table A-2. Socio-economic dataset used for regression estimation.

| Country | GDP99 ^a | FDI99 ^b | Remit99 ^b | FDI99 ^b Ave* | Remit99 ^b Ave* |
|-------------|--------------------|--------------------|----------------------|-------------------------|---------------------------|
| Ghana | 405 | 243700000 | 31000000 | 243700000 | 31000000 |
| Ethiopia | 116 | 69980000 | 34000000 | 69980000 | 34000000 |
| Iran | 1659 | 35000000 | 508000000 | 11666667 | 169333333 |
| Japan | 34535 | 12308393000 | 1109000000 | 4102797816 | 369666667 |
| Egypt | 1389 | 1065300000 | 3235000000 | 355100000 | 1078333333 |
| Algeria | 1617 | 291700000 | 790000000 | 145850000 | 395000000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| Korea, R | 10015 | 9333400000 | 666000000 | 933340000 | 666000000 |
| Russian F | 1331 | 3309430000 | 1292000000 | 1103143333 | 430666667 |
| Egypt | 1389 | 1065300000 | 3235000000 | 355100000 | 1078333333 |
| Philippines | 1000 | 1247000000 | 6918000000 | 415666667 | 2306000000 |
| Azerbaijan | 568 | 510317000 | 54000000 | 510317000 | 54000000 |
| Mali | 285 | 2178012 | 86000000 | 2178012 | 86000000 |
| Thailand | 1983 | 6102677500 | 1460000000 | 3051338836 | 730000000 |
| Gambia | 648 | 49480000 | 7000000 | 49480000 | 7000000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| Hungary | 4792 | 3307673090 | 213000000 | 3307673094 | 213000000 |
| Argentina | 7764 | 23987695600 | 64000000 | 23987696390 | 64000000 |
| Egypt | 1389 | 1065300000 | 3235000000 | 355100000 | 355100000 |
| Venezuela | 4056 | 2890000000 | 17000000 | 2890000000 | 17000000 |
| Morocco | 1395 | 2651866 | 1938000000 | 1325933 | 969000000 |
| Spain | 15468 | 18523396100 | 4313000000 | 2058155051 | 479222222 |
| Philippines | 1000 | 1247000000 | 6918000000 | 415666667 | 2306000000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Korea, Rep | 10015 | 9333400000 | 666000000 | 933340000 | 666000000 |
| Korea, Rep | 10015 | 9333400000 | 666000000 | 933340000 | 666000000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Bangladesh | 324 | 179662976 | 1807000000 | 59887657 | 602333333 |
| Japan | 34535 | 12308393000 | 1109000000 | 4102797816 | 369666667 |
| Iran | 1659 | 35000000 | 508000000 | 11666667 | 169333333 |
| Mexico | 5371 | 13696200000 | 6649000000 | 3424050000 | 1662250000 |
| China | 893 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| Brazil | 3420 | 28576000000 | 1862000000 | 5715200000 | 372400000 |
| Guatamala | 1489 | 1546000000 | 466000000 | 154600000 | 466000000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Nigeria | 294 | 1004916740 | 1301000000 | 1004916719 | 1301000000 |
| Brazil | 3420 | 28576000000 | 1862000000 | 5715200000 | 372400000 |
| Malaysia | 3612 | 3895263230 | 1042000000 | 1947631579 | 521000000 |

Table A-2 (Continued)

| Country | GDP99 ^a | FDI99 ^b | Remit99 ^b | FDI99 ^b Ave* | Remit99 ^b Ave* |
|-------------|--------------------|--------------------|----------------------|-------------------------|---------------------------|
| Turkey | 3817 | 783000000 | 4529000000 | 391500000 | 2264500000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Brazil | 3420 | 28576000000 | 1862000000 | 5715200000 | 372400000 |
| S. Africa | 3012 | 1503332480 | 327000000 | 751666227 | 163500000 |
| Uganda | 281 | 140200000 | 233000000 | 140200000 | 233000000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Rwanda | 258 | 1725717 | 5000000 | 1725717 | 5000000 |
| Jamaica | 3467 | 523700000 | 790000000 | 523700000 | 790000000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Malaysia | 3612 | 3895263230 | 1042000000 | 1947631579 | 521000000 |
| Germany | 26131 | 55906673000 | 4329000000 | 55906671344 | 4329000000 |
| France | 24080 | 45986861000 | 9301000000 | 22993429694 | 4650500000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| UK | 25598 | 89337012000 | 3400000000 | 44668505172 | 1700000000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Spain | 15468 | 18523396100 | 4313000000 | 2058155051 | 479222222 |
| Turkey | 3817 | 783000000 | 4529000000 | 391500000 | 2264500000 |
| Philippines | 1000 | 1247000000 | 6918000000 | 415666667 | 2306000000 |
| Morocco | 1395 | 2651866 | 1938000000 | 1325933 | 969000000 |
| Mexico | 5371 | 13696200000 | 6649000000 | 3424050000 | 1662250000 |
| Italy | 21055 | 6942860300 | 1999000000 | 3471430178 | 999500000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Russian F | 1331 | 3309430000 | 1292000000 | 1103143333 | 430666667 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Russian F | 1331 | 3309430000 | 1292000000 | 1103143333 | 430666667 |
| Burkinafaso | 263 | 7925951 | 80000000 | 7925951 | 80000000 |
| Italy | 21055 | 6942860300 | 1999000000 | 3471430178 | 999500000 |
| France | 24080 | 45986861000 | 9301000000 | 22993429694 | 4650500000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Sudan | 314 | 370800000 | 665000000 | 370800000 | 665000000 |
| S. Africa | 3012 | 1503332480 | 327000000 | 751666227 | 163500000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Korea, R | 10015 | 9333400000 | 666000000 | 933340000 | 666000000 |
| Bangladesh | 324 | 179662976 | 1807000000 | 59887657 | 602333333 |
| Brazil | 3420 | 28576000000 | 1862000000 | 5715200000 | 372400000 |
| Bangladesh | 324 | 179662976 | 1807000000 | 59887657 | 602333333 |
| Brazil | 3420 | 28576000000 | 1862000000 | 5715200000 | 372400000 |
| El Salvador | 2108 | 215900000 | 1387000000 | 215900000 | 1387000000 |
| Korea, R | 10015 | 9333400000 | 666000000 | 933340000 | 666000000 |

Table A-2 (Continued)

| Country | GDP99 ^a | FDI99 ^b | Remit99 ^b | FDI99 ^b Ave* | Remit99 ^b Ave* |
|------------|--------------------|--------------------|----------------------|-------------------------|---------------------------|
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| UK | 25598 | 89337012000 | 3400000000 | 44668505172 | 1700000000 |
| Kazakhstan | 1119 | 1587000000 | 64000000 | 1587000000 | 64000000 |
| Thailand | 1984 | 6102677500 | 1460000000 | 3051338836 | 730000000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Australia | 22607 | 3311038460 | 2029000000 | 3311038586 | 2029000000 |
| USA | 32689 | 289443000000 | 2748000000 | 28944300000 | 274800000 |
| Algeria | 1617 | 291700000 | 790000000 | 145850000 | 395000000 |
| Iran | 1659 | 35000000 | 508000000 | 11666667 | 169333333 |
| Israel | 18607 | 3210900000 | 424000000 | 3210900000 | 424000000 |
| Greece | 12897 | 567300000 | 2284000000 | 567300000 | 2284000000 |
| Mexico | 5371 | 13696200000 | 6649000000 | 3424050000 | 1662250000 |
| Japan | 34535 | 12308393000 | 1109000000 | 4102797816 | 369666667 |
| Mongolia | 442 | 30400000 | 7000000 | 30400000 | 7000000 |
| Colombia | 2478 | 1507907070 | 1312000000 | 1507907130 | 1312000000 |
| India | 442 | 2168591100 | 11124000000 | 240954562 | 1236000000 |
| Poland | 4360 | 7270000000 | 825000000 | 7270000000 | 825000000 |
| Austria | 26416 | 3009014270 | 1526000000 | 3009014242 | 1526000000 |
| Armenia | 597 | 122040000 | 95000000 | 122040000 | 95000000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |
| China | 892 | 38753000000 | 4796100000 | 3875300000 | 479610000 |

a. GDP per capita. "Per capita GDP at current prices - US\$, 1999". Available at: <http://data.un.org/Search.aspx?q=gdp+per+capita>. GDP per capita is rounded up to the nearest whole number. b. FDI. Foreign direct investment, net inflows (BoP, current prices-US\$, 1999). Available at: <http://data.un.org/Search.aspx?q=foreign+direct+investment>. Remittances: Workers' remittances and compensation of employees, received (current US\$ - 1999). Available at: <http://data.un.org/Search.aspx?q=remittances> *Ave = Values for FDI and remittances were averaged based on the number of cities within a country that are captured in the sample of 107 cities.

Definitions: GDP per capita, FDI and remittances are as defined by the World Bank. *Source:* World Bank (2010) “World Development Indicators – Table Notes”.

Available at: http://data.un.org/_Docs/WDI%20definitions.pdf

The *Undata* is essentially an internet search engine which allows the user to access databases stored and managed by the United Nations by performing queries.

The original sample of 120 cities (covering 58 countries) in Table A1 was reduced to 107 cities (covering 51 countries) which were used in the regression estimation in Chapter 4. Thus, 13 cities were not included. The reason is that FDI and / or remittances data for the countries in which the cities were located were not available. It must be noted, for example, that some countries do not report remittances flow into their countries. The 13 cities removed from the original sample of cities are: St Catharines and Victoria (Canada), Singapore (Singapore), Santiago (Chile), Ho Chi Minh City (Vietnam); Ndola and Harare (Zimbabwe); Montevideo (Uruguay); Kuwait City (Kuwait); Bandung, Medan and Palembang (Indonesia); and Sanaa (Yemen).

“*The Built-Up Area* is the area occupied by built-up pixels within the set of administrative boundaries defining the city”.

(<http://www.lincolinst.edu/subcenters/atlas-urban-expansion/area-metrics.aspx>)

APPENDIX B
SUPPLEMENTARY MAPS

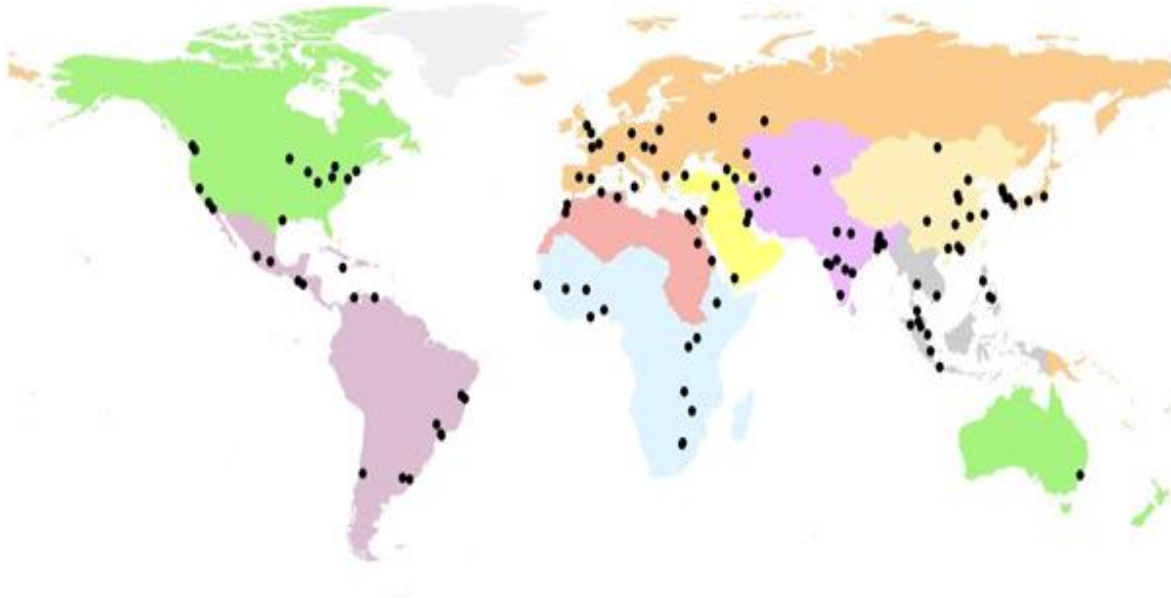


Figure B-1. Location Map of the sample of 120 cities. Source: Angel, S., Parent, J., Civco, D. L. and Blei, A. M. (2010). *Atlas of Urban Expansion*, Cambridge MA: Lincoln Institute of Land Policy. Available at: <http://www.lincolninst.edu/subcenters/atlas-urban-expansion/global-sample-cities.aspx> Last accessed on December 14, 2011.

Note: This map is provided to give an indication of the geographical distribution of the sample of the 120 cities upon which the regression analysis in this dissertation is based. Of particular importance to this research is the wide regional coverage of the dataset – spreading across all the continents.

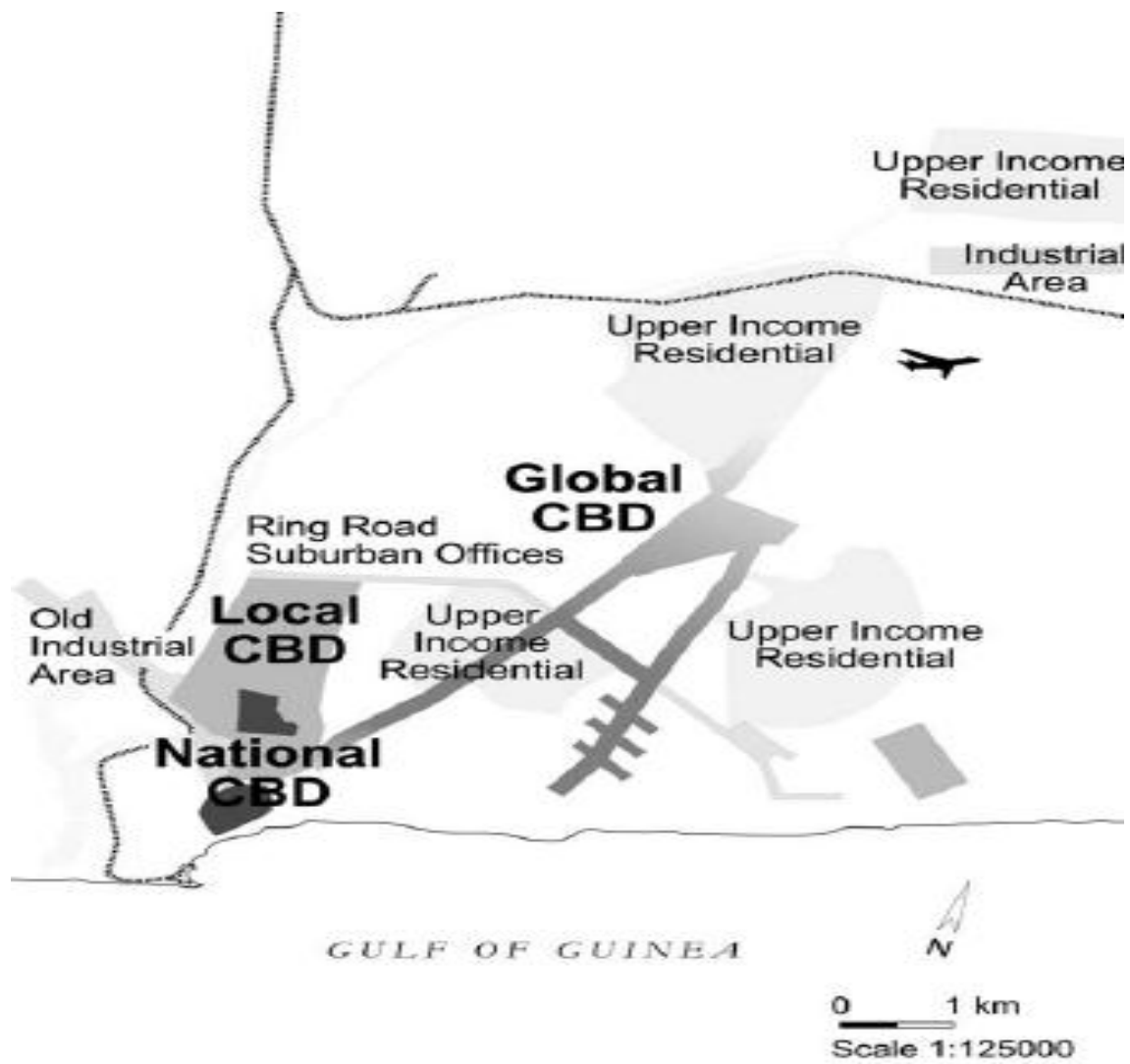


Figure B-2. Map of Accra, Ghana, showing main Central Business Districts (CBDs).
 Source: Adapted from Grant & Yankson (2003).

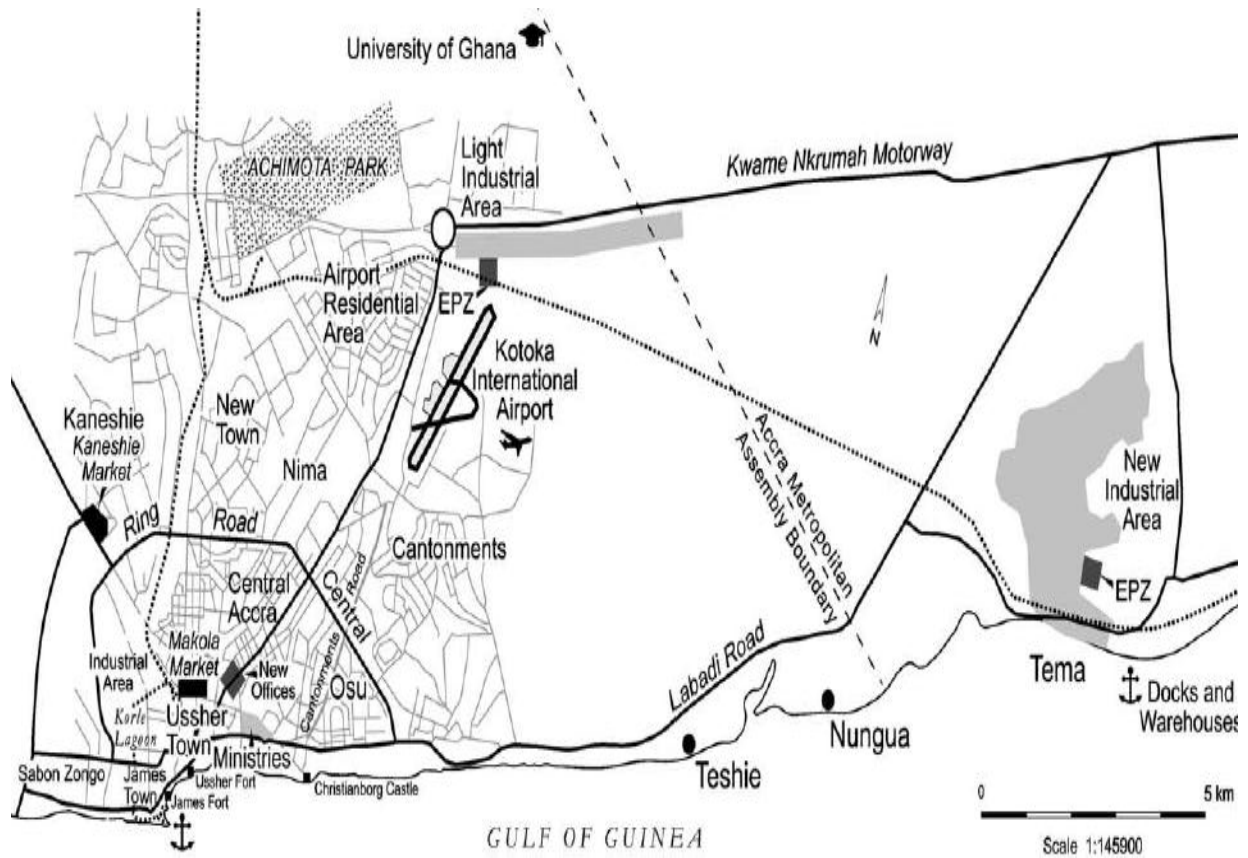


Figure B-3. Map of Accra (and part of GAMA) showing points of interest, including the only international airport and the Export Processing Zone (EPZ). Source: Adapted from Grant & Yankson (2003).

APPENDIX C GENERAL NOTES ON DATA SUITABILITY

Two main issues are discussed briefly below, i. e. the nature of remote sensing land cover change data; and the use of secondary statistical data in this dissertation.

Firstly, urban land cover change data derived from satellite remote sensing are essentially categorical, based on some classification scheme. According to Donnay and Unwin (2001) “classified land cover/ land use data constitute qualitative and spatially discrete geographical information” (p. 206). Thus, the nominal scale of measurement would appear to make such data not amenable to manipulation by many statistical and mathematical methods, especially in urban modeling, since according to Donnay and Unwin:

Urban modeling frequently supposes the existence of quantitative variables that are spatially continuous while planning makes use of discretization of space into zones which are very different from those given by image pixels. (Donnay & Unwin, 2001: 206).

However, the data are usually transformed to suit such purposes. Indeed some authors have claimed that the classification of satellite remote sensing is largely motivated by the possibility of data transformation for further analyses. For example, Donnay and Unwin (2001) assert that:

A primary aim of classifications of land use/ land cover data derived from satellite remote sensing is to provide data for a large range of urban models by a transformation which changes their measurement scale from nominal categories into ratio/interval scales (p. 207).

One way to quantify such data has been suggested as grouping pixels according to attributes and computing the area(s) of polygon (s) corresponding to each attribute (Donnay & Unwin, 2001). By so doing the discrete and nominal land cover change data are transformed into spatially continuous and interval data which are useful for most

urban modeling (Donnay & Unwin, 2001). Thus, the use of processed remote sensing land cover change data in Chapter 4 and Chapter 5 of this dissertation is consistent with accepted urban modeling practices as evidenced in the literature.

Secondly, use of secondary data in research could pose formidable challenges, especially bordering on 'misalignment' of original objectives of those who collect the primary data and those who use such data, often for purposes other than the originally intended. In view of this the decision to use secondary data in this dissertation was carefully considered, particularly examining the aims and objectives for which the data were collected and what they could be used for. In this regard, it is gratifying to note that the authors have asserted that:

The main thrust of our work has been a concentrated effort to *measure* different aspects of the spatial structure of a large number of urban areas the world over in a rigorous and consistent manner, in a way that can make it possible - for us as well as for others - to study them across time and space. (Angel et al., 2010: *online*).

With this statement, it seems reasonable to expect that the land cover change data used in this dissertation have been sourced from reliable and authoritative source. Indeed, the authors encourage the use of their data by stating that:

"The Atlas of Urban Expansion provides the geographic and quantitative dimensions of urban expansion and its key attributes in cities the world over. The data and images are available for free downloading, for scholars, public officials, and planners, those engaged in international development, and concerned citizens. The global empirical evidence presented here is critical for an intelligent discussion of plans and policies to manage urban expansion everywhere". (Angel et al., 2010, online).

With this coming from researchers associated with the Lincoln Institute of Land Policy, a well-known reputable organization, one can be reasonably confident about the

validity of the secondary data. In a nutshell, the goals for which the land cover change data were collected are in alignment with those of this dissertation as discussed in the text. It must also be noted that the only additional dataset on GDP per capita, FDI and remittances were sourced from United Nations databases for similar arguments as the preceding apply.

In addition to the above, this writer has extensive background knowledge of Accra, the study area, having been born and lived in Ghana all his adult life and watched the spatio-temporal evolution of Accra first hand. It is with this background knowledge that the writer became curious about the rapidity of urban land conversion in recent times and suspected that external economic forces of globalization, FDI in particular, may be implicated. Having observed the “flagship” city of Ghana expand spatially with time, and armed with a deep understanding of our cultural and traditional practices as well as the socio-economic processes in Ghana, the author believes he is well-equipped to be able to analyze and discuss the results and issues pertaining to this dissertation in their appropriate socio-cultural and environmental contexts.

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BIOGRAPHICAL SKETCH

Kofi Adu-Brempong was in Kumasi, Ghana, and currently married with two children. He is a broadly trained human geographer with interests in urban and economic geography. His doctoral research is designed to contribute to understanding the complex linkages among economic globalization, urbanization and environmental change in less developed countries, with special reference to Accra, Ghana. His research approach, broadly contextualized in the human-environment interactions geographical tradition draws extensively on classical economic / geographical theories and models which he attempts to 'refine' to reflect contemporary realities of economic globalization.

Kofi received the MA degree in Geography from the University of Toledo, Ohio (2007). His master's degree work focused principally on developing spatial analytical skills (GIS and quantitative geographical methods) and their applications to socioeconomic phenomena. He earned the BA (Honors) degree in Economics and Geography from KNUST, Kumasi, Ghana in (1999), after which he taught Economics at Konongo-Odumasi Secondary School, Ghana (1999-2000); and Geography at the Toase Secondary School, Ghana (2000-2003). Kofi served as a graduate teaching assistant (TA) in geography at both the University of Toledo (2003-2005) and the University of Florida (2005-2010); and is looking forward to teaching and research career in higher education.