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Working Paper

Divergence and convergence: Paul Samuelson on economic development

CHOPE Working Paper, No. 2019-07

Provided in Cooperation with:

Center for the History of Political Economy at Duke University

Suggested Citation: Boianovsky, Mauro (2019) : Divergence and convergence: Paul Samuelson on economic development, CHOPE Working Paper, No. 2019-07, Duke University, Center for the History of Political Economy (CHOPE), Durham, NC

This Version is available at:

<http://hdl.handle.net/10419/196164>

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DIVERGENCE AND CONVERGENCE: PAUL SAMUELSON ON
ECONOMIC DEVELOPMENT

BY MAURO BOIANOVSKY

CHOPE Working Paper No. 2019-07

April 2019



Divergence and Convergence: Paul Samuelson on Economic Development

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Forthcoming in *Paul Samuelson: Master of Modern Economics*, edited by R. Anderson, W. Barnett and R. Cord. Palgrave Macmillan, London, 2019

Abstract

The theory of economic development was an exception to Paul Samuelson's claim of being a "generalist" in economics. It was a hard subject to tackle analytically because of the intrinsic difficulty of some of the concepts involved, such as increasing returns and long-term economic evolution. Nevertheless, Samuelson was aware of the utmost practical relevance of the topic, and discussed at length, sometimes critically, the empirics of development and the theories and policies put forward by development economists, particularly in connection with market failures that could help to explain underdevelopment phenomena. Moreover, he paid more attention than most development economists to the Malthusian demographic dimension of poverty. On the other hand, development planners made use of Samuelson's turnpike theorems of growth theory, and reacted, mostly critically, to his factor price equalization (FPE) theorem of international trade and its apparent conflict with income divergence between developed and underdeveloped economies.

Keywords

Samuelson; economic development; divergence; convergence; increasing returns

1. Two Worlds?¹

Paul A. Samuelson (1986: 62) was proud of his position as the “last generalist” in economics. “My finger has been in every pie,” he claimed, with a very broad range encompassing significant contributions to virtually every field in economics – “in talking about modern economics I am talking about me.” William Baumol (2007) called him the “Generalists’ Generalisimo” and suggested that his hugely successful textbook *Economics: An Introductory Analysis* – published for the first time in 1948 and regularly revised until 1980, with new editions with co-author William Nordhaus from 1985 to 2010 – was a “revolutionary” work that only a “very capable generalist” could have carried out alone. However, development economics was an exception to Samuelson’s claim. He acknowledged its relevance in the face of the problem of underdeveloped economies, “one of the most challenging problems of the next quarter century” (Samuelson 1961: 775), but would regret that “precisely because the theory of economic development has been so hard to perfect, this is a field that will appeal to the venturesome” (Samuelson 1978: 8). It was the inherent complexity of the phenomena that lay behind economic development that rendered them not “tractable” (ibid.) and beyond the limits of economic science as a modeling endeavor (see also Boianovsky 2019a).

Nevertheless, that did not prevent Samuelson from paying close attention to the economic features of underdeveloped economies and to debates about development theory and policy, especially throughout the several editions of his *Economics*. In the

¹ I would like to thank G.C. Harcourt for his helpful comments. Research support from CNPq is gratefully acknowledged.

third edition, Samuelson (1955) introduced a new chapter 36 on “Problems of Economic Growth and Development,” as part of the new part 6 on “Current Economic Problems.” As he put it in the Introduction, “the new chapter on underdeveloped countries...provides important applications of economic tools (preliminary experience suggests that students will find it among the most interesting of all chapters)” (ibid.: vi). On the same page, Samuelson famously announced his new concept of the “neoclassical synthesis,” which argued that the “classical” theory of the efficient allocation of resources would come into its own once modern (mostly Keynesian) aggregate demand management eliminated involuntary unemployment and inflation. The neoclassical synthesis was relevant for industrialized developed economies like the United States, but not for underdeveloped countries, with their own problems of poverty and “disguised” unemployment which could not be alleviated by macroeconomic stabilization policies. The “paradox of thrift,” for instance, a main feature of *Economics* since its first edition, did not apply to underdeveloped economies:

Until we learned how to prevent mass unemployment, many economists worried about *oversaving* in *advanced* countries. But for *underdeveloped* countries the problem is often the classical one of *undersaving*: more precisely, the problem is underinvestment in productive instruments capable of increasing the nation’s rate of economic progress ... The Prime Minister [of an underdeveloped country] sometimes gets a little impatient with students who have studied depression economics abroad and do not seem alert to the different set of realities at home – in particular to the crucial need for *more* personal saving (Samuelson 1961: 785, 794; italics in original).

The relevance of the neoclassical synthesis for underdeveloped countries came from the

notion that the ability to control domestic purchasing power had made obsolete the neo-Marxian view, that full employment and growth in industrialized countries is impossible without imperialist exploitation of colonial nations through international trade (ibid.: 781; (1971) [1972]: 706).

Samuelson's remarks about the limits of Keynesian economics in dealing with economic development echoed similar claims by prominent development economists such as Arthur Lewis (1954). The 1955 new chapter in *Economics* appeared when the economic development of less-developed countries was turning into a major focus of economic policy and theory, partly because of the political backdrop of the Cold War. The 1950s was the time when a set of ideas put forward by a relatively small group of economists – including Lewis, Rosenstein-Rodan, Myrdal, Prebisch, Rostow, Gerschenkron, Nurkse, Balogh, Schultz, Hirschman, Singer, Bauer, Furtado, among others – established development economics as a new field (see Alacevich and Boianovsky 2018). Those were the years of “high development theory,” as put by Krugman (1993). In his 1949 Inaugural Address, President Truman announced his “Point Four,” a turning point in international economic development policy, hailed by Samuelson (1951: 689-690) as a “bold new program” for making the benefits of American “scientific advances and industrial progress” available to underdeveloped areas. As Samuelson (1961: 775) argued, “for conscience's sake, we are impelled to help”, not just through foreign aid but also by applying the tools of economic theory to the study of the determinants of and obstacles to economic development. Moreover, “history teaches that men do not always starve quietly” (ibid).

The post-war period was also the time when growth economics – in the sense of the

investigation of the formal properties of dynamic steady states and the long-term performance of industrialized economies – attracted significant attention from model builders (including Harrod, Domar, von Neumann (originally from 1937), Solow, Swan, Robinson, Kaldor, and many others). Samuelson, sometimes in collaborative work with Robert Solow, further elaborated von Neumann’s ([1937] 1945-1946) model in order to examine balanced growth paths and derive the well-known turnpike theorems about optimal growth trajectories (Samuelson and Solow 1953; see also chapter 12 of Dorfman et al. 1958, Samuelson 1965 and Niehans 1990: 438-439 and the references cited therein). This became influential in the application of optimal control theory to development planning (see, for example, Chakravarty 1969). Even if somewhat indirectly and unexpectedly, the turnpike theorems (discussed further below) represented a significant contribution to a particular branch of development economics – this being to Samuelson’s (1969a) satisfaction. Clearly, they were the work of a growth theorist, not a development economist.

It was only in the sixth edition of *Economics* that Samuelson (1964: chapter 35) introduced a chapter on the “Theory of Growth.” By then, Solow and Samuelson had turned the Department of Economics at the Massachusetts Institute of Technology (MIT) into the foremost center of research on economic growth. Moreover, since 1951, MIT had been home to the Center for International Studies (CENIS), which gathered together influential development economists such as Rostow, Rosenstein-Rodan, and Eckaus. Methodological differences between growth and development economists at MIT and elsewhere made co-existence sometimes problematic (see Boianovsky and Hoover 2014). Samuelson (1964: vi; italics in original) announced the “new chapter on the *theory* of growth.” While acknowledging that “development problems are all the

rage these days among economists,” he stressed the need to “bring economic analysis to bear” instead of boring students with “dated anecdotes and statistics” about different countries.

Samuelson’s (1964) new chapter 35 provided one of the first textbook discussions ever of growth theory, covering the classical “magnificent dynamics” of Malthus and Ricardo, Solow’s neoclassical model (the focus of the chapter), and, in an appendix, topics such as Schumpeterian innovation, the Harrod-Domar Keynesian growth model, the von Neumann general equilibrium growth model and the Cambridge approach of Kaldor and Robinson. Sometimes he used the words “growth” and “development” interchangeably, but the context made the meaning clear. Chapter 35 provided the “*principles* of economic theory to the process of growth and development,” in preparation for the next chapter’s “application” of those ideas to underdeveloped economies (ibid.: 721). Development economics was perceived as essentially an applied field, not a distinct part of economic theory, despite efforts by development economists to give it a proper identity. While development economists “have developed no unified theory that differs from the basic growth model introduced in the last chapter, they have added to that some special features” (ibid.: 760).

The distinctive elements of development economics, as compared to neoclassical growth theory, were Rosenstein-Rodan’s (1943, 1961) emphasis on external economies and increasing returns and Lewis’s (1954) concept of perfectly elastic labor supply and its associated notion of disguised unemployment in economies with a surplus of labor. From Samuelson’s neoclassical perspective, these were the features that could bring some analytical distinctiveness to development economics (see Arrow 1988 for a

similar take on the theory of economic development). However, whether the assumption of labor surplus (under the double influence of von Neumann and Lewis) would be formally incorporated into growth and development planning models, as attempted at MIT in the 1960s (see, for example, Chakravarty 1969), increasing returns proved to be more difficult to tackle. It was only in the late 1980s and early 1990s, with the development of endogenous models of technical progress in New Growth Theory by Paul Romer and others, that increasing returns became integrated into growth and development modeling (see Samuelson 2001; Krugman 1993).

Samuelson did not go as far as John Hicks (1965: 3), who claimed that there was no real connection between growth theory and the economics of underdevelopment. But he came close. Hicks regarded development economics as a “vastly important subject,” but denied that it was a “formal or theoretical subject.” According to Hicks (*ibid.*), it was a “practical subject which must expect to call upon any branch of theory...which has any relevance to it. If there is any branch of economic theory which is especially relevant to it, it is the Theory of International Trade.” Samuelson, the generalist, liked trade theory better than any other topic in economics: “Our subject puts its best foot forward when it speaks out on international trade” (Samuelson 1969b: 9). His main contribution to trade theory – the seminal factor price equalization (FPE) theorem – had vast implications for the study of economic divergence and convergence in the international economy (see Samuelson 1948a, 1949). That formal proposition (further discussed below) appeared around the same time as the first edition of *Economics* and the emergence of development economics as a new field.

It was no coincidence, argued Albert Hirschman ((1977) [1981]: 60), that development

economics emerged in the same period as Samuelson's pivotal articles on the pure theory of international trade. According to Hirschman, Samuelson's FPE theorem was constructed just as awareness of the persistent and increasing international income divergence was becoming sharp in the post-war period. From that perspective, maintained Hirschman (ibid.), the contrast between observed facts and Samuelson's (1948a, 1949) theoretical findings "acted as a devastating boomerang for the traditional theory and its claim in explaining the problems of the real world." Hirschman ascribed the relative success of Prebisch and Singer (and other development economists who focused on trade issues) to the fact that they took international inequality seriously and "because of the self-inflicted wound" from which neoclassical trade theory was then enduring due to the FPE theorem.

Nevertheless, as discussed further below, Samuelson did acknowledge the evidence about international divergence, which raised issues concerning the proper interpretation of his theorem. In a section entitled "Two Worlds?" – added to the 1958 edition of *Economics* and kept ever since – Samuelson (1961: 116-118) contrasted the economic growth of the United States and other industrialized countries since the end of the 19th century on one side and the prevailing poverty in most of Asia and Africa on the other. The goal of that section was to indicate how "fortunate" Americans were. As one might expect, an American perspective on economic matters pervaded Samuelson's textbook, especially in its first few editions. In the Preface to the first edition, Samuelson (1948b: v) announced that the book aimed at an understanding of the "economic institutions and problems of American civilization in the middle of the twentieth century." He removed that passage from the third edition, when the new chapter on development was introduced.

The international success of *Economics*, including massive sales in India, Latin America, the Middle East and other underdeveloped areas, signalled to Samuelson that its economic principles applied beyond the American economy. In the Preface to the fourth edition, Samuelson (1958: vi) celebrated the book's wide use abroad and its translation into many foreign languages as a "reflection of the fact that there do exist certain objective principles of economics which are relevant to societies of quite different institutional development." Some development economists disagreed, however. Dudley Seers (1963: 88-89) contended that Samuelson's "brilliant" textbook illustrated the dominant approach of most American and European economists of focusing on the economics of rich industrialized countries as if it was the rule, when it was really the economics of the "special case." Developed industrial economies were not typical, but rare cases, historically and geographically. Development economics was deemed more general, with its study of economies with a diverse range of structures. Seers (*ibid.*) referred in passing to Samuelson's chapter on development, but, apart from appearing only in the final part of the book, the chapter was criticized for lacking a discussion of the growth patterns revealed by contemporary research. Seers, however, did not engage with the actual arguments contained in the chapter.

Although Samuelson never explicitly contributed to the theory of economic development – which he found wanting – he remained an acute observer of the economic performance and policies of developing countries from the mid-20th century to early 21st century. He was particularly impressed by the economic transformations undergone by Japan, a country he would visit a couple of times: "The most remarkable phenomenon of economic development in this last century and in this last decade has

undoubtedly been the Japanese” (Samuelson 1964: 759). In that same sixth edition, Samuelson added a front-leaf chart displaying the evolution of income per capita in the United States, Great Britain, the Soviet Union and Japan since 1870 and in India (since the mid-1950s), kept and updated until the eleventh (1980) edition with the inclusion of West Germany. It showed the prominence that growth and development topics gradually acquired in the book. Data confirmed the convergence of incomes for the set of industrialized countries, including the Soviet Union, whereas poorer countries, represented by India, lagged behind. Samuelson’s (1964: 806-808) forecast that, in some scenarios, the Soviet economy would eventually overtake the US economy proved to be more controversial (see Skousen 1997: 148).

In the 1980s, Samuelson became attracted to the case of Argentina, a potentially rich country beset by poor economic performance since the 1950s. Referring to his Harvard professor Joseph Schumpeter (1942), Samuelson ascribed Argentina’s problems to political factors that undermined the working of capitalism in general and feared that a similar process could take place in the US. The economic development of the so-called Asian Tigers and China was another major event that caught Samuelson’s attention in several editions of *Economics* after 1985 and in a 2004 article in the *Journal of Economic Perspectives*, which vindicated his FPE theorem in the context of international technology transfer à la Gerschenkron.

By the last (posthumous) edition of *Economics*, Samuelson and Nordhaus (2010: chapter 26), in contrast with the first editions, referred to “decades of experience” and “learning” by development economists in the field, leading to a summary view of economic development policy largely based on market forces with an outward

orientation instead of the import substitution industrialization strategy that prevailed in the 1950s and 1960s. The “practical” or “applied” dimension of the subject, present from its inception, became even more prominent, although Samuelson and Nordhaus (ibid.: 531) warned against development policies based on “simple, holistic explanations” and “oversimplified approaches to a complex process.” By the early 21st century, Samuelson was less pessimistic about the status of development economics, but only slightly so.

2. Widening Differentials

Samuelson’s (1947) *Foundations of Economic Analysis* – which launched the idea that mathematical modeling was essential to the formulation of operational theorems in economics – was based on his Harvard PhD thesis written mostly in the late 1930s. Apart from a passing remark on Gustav Cassel’s concept (advanced around 1918) of uniform growth and a discussion of Malthusian and optimum population theories (Samuelson 1947: 312, fn. 6 and 296-298), there is close to nothing about economic growth and development in that book, despite a whole chapter 11 on “Some Fundamentals of Dynamic Theory.” In the last paragraph of *Economics*, Samuelson (ibid.: 355) hoped for further progress in economic theory along the lines of comparative dynamics, especially in tackling the “majestic problems of economic development.” Samuelson (1948c) was his first foray into growth economics, with special attention to the Harrod-Domar model put forward in articles and books by Roy Harrod and Evsey Domar between 1939 and 1948. Development planners often adapted the so-called Harrod-Domar formula, interpreted as the proposition that the rate of economic growth is determined by the quotient of the savings rate and the capital-output

ratio. It was regarded as the theoretical cornerstone of the so-called “capital fundamentalism,” that is, the notion that physical capital accumulation is the primary determinant of growth and development (see Boianovsky 2018). However, as Samuelson (1964: 743-746) explained, the relation between the natural, warranted and actual rates of growth in Harrod’s model is complex, with cyclical oscillations of and around the warranted rate. In particular, an increase in the savings rate may, under certain conditions, bring about a reduction in the actual growth rate.

Harrod (1948) denied that his model should be applied to problems of economic development. Whereas he assumed away in his dynamic economics the classical law of diminishing returns from land and Malthus’s population doctrine, he also suggested that the “old classical analysis” applied better to vast “poverty-stricken areas of the world today,” where population is “pressuring upon the means of subsistence” (ibid.: 19, 114). Samuelson largely shared Harrod’s neo-Malthusian perspective on development. From the first edition of *Economics*, demography was regarded as one of the foundations of the study of any economic system. Malthusian population theory was deemed relevant for understanding the economic underdevelopment of India, China and other areas where the balance between the size of the population and the food supply was a vital factor (see Samuelson 1948b: 25-26). In fact, it was a lecture on Malthus that got Samuelson started as a student of economics back in 1932 (see Barnett 2004: 528) and ignited his long-term interest in demography.

Samuelson (1964: 724-730) discussed classical “magnificent dynamics” (a term coined by Baumol) at the outset of his growth chapter. As a result of technological innovation and a reduction in fertility rates, developed economies had surpassed Thomas Carlyle’s

description of economics as a “dismal science.” But Carlyle’s term still applied to poor underdeveloped countries. Samuelson’s (1973: figure 38-2, p. 769) diagram of the divergence between advanced and less developed countries in the period 1960-1972 indicated that the rate of growth of total output was on average higher for less developed countries. However, such growth was “frittered away in burgeoning population growth,” resulting in “widening differentials” between the two groups of countries, as illustrated by a Lorenz curve showing unequal world income distribution – the poorest half of nations received 8% of total world income (ibid.: 768). This was one of the first applications of the Lorenz curve for that purpose. While visiting Japan in 1971, Samuelson, as part of a paper on “Economic Growth,” observed that, “When science introduces medical improvements that increase life expectancies in the developing nations, birth rates drop only after a lag, with the result that rapidly growing population again brings into play the classical law of diminishing returns. Among the developing nations economics remains what Carlyle called ‘the dismal science’” (Samuelson (1971) [1972]: 708).

The notion of the demographic transition – of the kind experienced by developed countries in the 19th and 20th centuries – as a “precondition” for economic development (Samuelson 1964: 761, 765) became especially prominent after the 1985 edition co-authored with Nordhaus. The chapter on development opened with a section on “Population Growth and Development,” including subsections on “Malthus and the Dismal Science” and “Neo-Malthusianism,” followed by a discussion of the “Population Explosion: The Legacy of Malthus” (see Samuelson and Nordhaus 2010: chapter 26). Some developing countries (e.g. Mexico, South Korea and Taiwan) had gone through demographic transitions, but not Sub-Saharan Africa and other parts of the

world, such as India (ibid.: 526).

Like the Harrod-Domar model, Solow's (1956) neoclassical growth model assumed away classical diminishing returns to land and Malthusian population dynamics (although it did feature a poverty trap caused by multiple equilibria when the rate of population growth depends on per capita income; see Boianovsky and Hoover 2014: 204). As Samuelson asserted (1964: chapter 35), the neoclassical growth model explained well the basic observed trends ("stylized facts") of economic growth in developed countries (as did Harrod-Domar). However, those models could not easily account for the divergence between developed and underdeveloped economies. Growth models applied to both groups of nations, but, as Samuelson (ibid.) pointed out at the end of chapter 35, "for the poor countries in particular, there must be added the important additional concepts of 'external economies', 'social overhead capital or infrastructure', and 'increasing returns' – as is done in the next chapter" (ibid.: 752).

Increasing returns were not a feature of growth models at the time; it would take a couple of decades for that to happen. Development economists of the post-war period, however, made extensive, if informal, use of the concept, especially Rosenstein-Rodan, Samuelson's colleague at MIT and author of an article often regarded as a founding work in the field of development economics (see Rosenstein-Rodan 1943). Rostow (1960) was another MIT economist who used increasing returns as part of his broad and influential concept of economic "take-off" (see Samuelson 1964: 761). Market failures associated with external economies and increasing returns were supposed to bring about a low-level inertial equilibrium trap in poor countries.

External economies played an important role in Samuelson's (1954) path-breaking theory of public goods as joint consumption. He referred to Rosenstein-Rodan for the first time in the fourth edition of *Economics* (Samuelson 1958: 769) – when he ascribed to Rosenstein-Rodan the concept of “social overhead capital,” in the sense of indivisible public utilities – shortly after the release of Roseinstein-Rodan's 1957 MIT working paper on the “Big Push,” eventually published in 1961. Whereas Samuelson's (1964) growth chapter assumed a neoclassical production function according with the “conventional principle of diminishing returns” and constant returns to scale, “in dynamic economic development, the phenomenon of ‘increasing returns’ is to be expected” (ibid.: 761). This assumption had been understood since Adam Smith's study of the advantages of large-scale division of labor in the *Wealth of Nations*, Samuelson observed.

The phenomenon of increasing returns “can make it possible for dramatic spurts and accelerations to occur in economic development” (ibid.: 762), which went a long way in explaining income divergences between countries (assuming they had undergone their “demographic transitions” already). External economies did not necessarily involve increasing returns (and vice versa); the same applied to social overhead capital. Nevertheless, the close connection between these three concepts warranted lumping them together, Samuelson claimed. From that perspective, economic underdevelopment resulted from a “vicious circle” or trap: “poverty creates want, want destroys thrift, absence of capital formation prevents improvement, limitation of mass production makes poverty – and so the vicious circle goes” (Samuelson 1955: 722). Productivity affected output, but the size of output also affected productivity – as also pointed out by Myrdal, Kaldor and others in connection with the principle of “cumulative causation”

and the so-called Verdoorn's law of economic growth.

The very interconnectedness of different sectors and firms provided a way out, since, once the economy makes a breakthrough on any front, there tend to be “favorable repercussions throughout the length and breadth of the economy. These ‘external economies’...can break the vicious circle and lead to accelerating spirals of development” (ibid.). This was close to Hirschman's (1958) later notion of unbalanced growth through the promotion of certain sectors of the economy with strong linkage effects. Indeed, Samuelson (1964: 762-763) criticized Rosenstein-Rodan's (1943) “fascination” with “balanced growth,” for both theoretical and historical reasons that some sectors develop before others, especially in open economies: “The phenomena of increasing returns, externalities, and social overhead capital provide some substance to notions of take-offs, spurts and big pushes. They suggest a scope for supplementation of competitive market forces. But they do not lead unequivocally to any simple concept of ‘balanced growth’” (Samuelson 1964: 773).

Samuelson (1948b: 49) had put forward a preliminary version of the “vicious circle of poverty” while contrasting the high capital-intensity and productivity of the American economy and the “plight of those backward nations that cannot get their heads above water because their production is so low that they can spare nothing for capital formation by which their standard of living could be raised.” Samuelson's remark raised criticism from Peter Bauer (1958a, b), presented at the ninth meeting of the Mont Pelerin Society held in Princeton in September 1958. Bauer regarded Samuelson's 1948 passage as a “typical formulation” of the vicious circle notion that dominated what he called the “new orthodoxy of economic development.” The “orthodox” view, from

which Bauer dissented, ascribed the stagnation of underdeveloped countries to “the failure of the traditional forces of economic progress, such as development of production for the market ... This vicious circle can only be broken by drastic national and international action” (Bauer 1958b: 2; see also Plehwe 2009 and Bauer 1971: chapter 9). Bauer – like Jacob Viner and Gottfried Haberler – rejected the then emergent mainstream view of development economics and argued instead for the role of market incentives in the development process, as elaborated in his joint 1957 textbook with Basil Yamey (see Tribe 2018).

Bauer’s early criticism would be repeated and expanded in Jane Shaw’s (1999) overview of how Samuelson addressed economic development issues through a sample of editions of *Economics* from 1951 to 1995. According to Shaw (ibid.: 135), Samuelson “merely reported” what the emerging dominant view was saying, instead of challenging the conventional wisdom based on “Keynesian growth theories.” In particular, she charged Samuelson with disregarding problems associated with government intervention in the economies of poor countries (e.g. corruption and other cases of “government failure”) and the role of institutions in shaping the development process. Samuelson (1964: 759) did mention corruption and institutions, but those factors would only come to the fore with the development of Neo-Institutional economics by Douglass North and others in the 1980s and 1990s, when Samuelson increased his awareness of institutional elements (see, for example, Samuelson and Nordhaus 2010: 529-530). Samuelson (1995) criticized the Coase Theorem proposition that market economic agents are able to cope with market failures (see also Skousen 1997: 145). He doubted the issue of allocation of property rights addressed by the Theorem could be understood mainly in terms of “transaction costs.”

Bauer was correct in putting Samuelson's *Economics* together with works by Rosenstein-Rodan, Nurkse, Myrdal, Lewis, Prebisch, Hirschman and other 1950s development economists who stressed market failures and supported development planning. Samuelson (1958: 761, fn. 1) noted Bauer's argument that no matter how poor some groups are, they do save, especially immigrants, but held to his original view and removed that note after the 1964 edition. By the eleventh edition, Samuelson (1980: 717, fn. 2) acknowledged Bauer and Yamey's (1957) "reasoned defense of the market as the main instrument for economic development." Yet, he remained unconvinced. As fashions changed and the neoclassical liberal counterrevolution took hold of significant parts of development economics (see Toye 2018), Samuelson and Nordhaus paid increasing attention, through several editions of *Economics*, to the so-called East Asian miracle, but pointed out that "the secret to success was not a doctrinaire laissez-faire policy," as East Asian governments had in fact practiced selective planning and intervention. Rather, the openness and outward orientation "allowed the countries to reap economies of scale and the benefits of international specialization" (Samuelson and Nordhaus 2010: 532-533).

In fact, instead of smothering the traditional "vicious circle of poverty" idea, Samuelson and Nordhaus (2010: 530-531), along the lines of new approaches to economic development modeling built on ideas originally advanced in the 1950s (see Ray 2008), reinterpreted it as a poverty trap caused by multiple equilibria, which could be avoided by a "big push" of coordinated investments helped by lower population growth. The new development models of the 1980s and 1990s were able to tackle analytical problems, notably increasing returns and external economies, that had remained

unsolved in the 1950s and 1960s. These issues, and his inability to solve them, had bothered Samuelson since the 1940s, as showed by the following revealing recollection:

Constant returns to scale, sans chance, change, externalities, and information uncertainties, is pretty much a finished book in economic theory ... Lively scholars...periodically stress deviations from this chaste model. In particular, increasing returns to scale received notice from Smith's division of labor...in connection with international trade by Bertil Ohlin...in vague connection with developmental growth in Allyn Young ... Always a bridesmaid but never a bride, so to speak. The trouble with increasing returns to scale is that after you have said the first things about it, it is deucedly hard to find second and third themes to develop ... My conscience was long bothered by our guild's neglect of a subject on the ground that it is so hard to tackle (Samuelson 2001: 498-499).

Regardless of the solution to the analytical issues involved, the view that poverty and underdevelopment are closely related to market failures – a perspective that can also be found, in another guise, in Samuelson's approach to Keynesian economics in his *Economics* and elsewhere (see Skousen 1997 and Backhouse 2015) – is conspicuous in his discussions of those topics. This is well illustrated by Samuelson's ((1979) [1983]) positive reaction to the World Bank's *Development Report 1978* (the first of a series of annual reports), with a Foreword by Robert McNamara, Bank president from 1968 to 1981. Samuelson had welcomed McNamara's strategy of "War on Poverty" carried out since the early 1970s (see Samuelson 1973: 710). In his *Newsweek* column, Samuelson ((1979) [1983]: 71) supported McNamara's recognition of "poverty as the enemy to be fought." The Bank, under McNamara and his predecessors, had successfully promoted

economic development in poor nations, “encouraging the use of market incentives and profitability tests to do so.” More than that, as put by Samuelson (ibid.), “I take off my hat to Robert McNamara for what has been his unique vision – his recognition that successful market forces alone can’t be relied on to mitigate flagrant inequality and abject poverty.”

One of the main elements of post-war development economics was the emphasis on underemployment – often called “disguised unemployment” – as an essential feature of underdevelopment. Disguised unemployment was generally associated with near zero marginal productivity of labor caused by low capital accumulation in economies with excess supply of labor. It was not the same as Keynesian unemployment caused by insufficient effective demand. Joan Robinson (1937) had introduced the notion of disguised unemployment in another context, but it gained prominence after Lewis (1954, 1955) turned it into a main ingredient of his model of development in dual economies (see Boianovsky 2019b). Samuelson’s new chapter on development included a paragraph about “disguised unemployment.” In “poor countries, particularly rural ones,” asserted Samuelson,

there often exists a large part of the manpower pool that does almost nothing because there is nothing for it to do ... When a boom or a development plan comes along sweeping them into productive city jobs, there is almost no reduction in the product back in the farm (Samuelson 1961: 783).

That was very close to Lewis’s (1954, 1955) framework. The theoretical concept and the empirical relevance of disguised unemployment were contentious issues in the

1950s, drawing criticism from Viner, Haberler and Schultz. Samuelson (1961: 783, fn. 1) acknowledged Haberler's and Schultz's misgivings, but removed that note after the 1964 edition.

A similar phenomenon could be found in developed countries, both in the subsistence farms regions and in the city streets, "where men eke out a bare existence doing door to door selling whenever productive jobs are unavailable" (Samuelson 1961: 783), as Robinson (1937) had pointed out. Indeed, in a joint paper with R.A. Nixon (his former Harvard colleague), Samuelson discussed in some detail the complications introduced by Robinson's disguised unemployment in the measurement of unemployment and the connections between cyclical changes in output and employment in the American economy (see Nixon and Samuelson 1940). Moreover, while discussing "poverty in agriculture" in the US, Samuelson (1961: 490) noticed that most family farms do not share in the "nation's economic progress" and that a "hidden surplus of population exists in the form of low-productivity marginal farms residents," just as in underdeveloped economies à la Lewis. Again, in his new chapter 39 on the economics of racial and sexual discrimination, Samuelson (1973: 783) claimed that the tools of development economics should be applied to foster understanding of the problems of American ghettos, which he regarded as underdeveloped areas contiguous with and in competition with the most developed economy in the world. Samuelson's interest in economic divergence and underdevelopment at the international level reflected, to some extent, his original concern with income distribution, inequality and poverty in the American economy and society – a distinguishing feature of early editions and drafts of his *Economics* as compared with previous textbooks, kept and enlarged in later editions (see Giraud 2014: 138; see also Samuelson 1948b: chapter 4 on "Individual and Family

Income”).

von Neumann’s 1937 famous general equilibrium linear growth model, translated in 1945-1946, attracted Samuelson’s attention from the day von Neumann presented it at a Harvard seminar in 1945 (see Samuelson 1972: 260). In von Neumann’s model, wage goods are fed back into the productive process as inputs, the supply of which determines the size of labor supply. Like Lewis’s (1954) later, non-mathematical, formulation, it was a “closed” model (see Boianovsky 2019b). Samuelson (1964: 748-749) provided a rare, for then, discussion of von Neumann’s model – “in which everything could be produced out of everything” – in an introductory textbook (see also Samuelson and Nordhaus 1985: appendix to chapter 36, section on “The Expanding Universe”). In von Neumann’s model, there is a maximal rate of balanced growth, which is equal to the rate of interest. The model was not just an impressive theoretical construction; it was deemed relevant for the interpretation of the actual economic development process:

Because development theory, for countries like India and the United States, is preoccupied with the concept of “balanced growth”, the Neumann model is of considerable interest. It is particularly relevant to the case where an industrial sector in a poor country finds it can get an unlimited supply of laborers from the rural sector at the same wage cost in terms of subsistence; needing little land, the industrial sector can ‘take off’ and grow at a constant Neumann percentage rate per year, provided it can produce the capital goods needed to match the new labor (Samuelson 1964: 748).

That was not the same as “balanced growth” in Rosenstein-Rodan’s sense as discussed above. Rather, it was related to the proof of existence and stability of a balanced growth

path in a multi-sector growth model, first advanced by Samuelson and Solow (1953) in their extension of von Neumann's (1937) [1945-1946] linear model to smooth linear homogenous production functions. As noted by Samuelson (1964: 749, fn. 2), the interpretation of the expansion of an industrial sector through the utilization of an unlimited supply of rural labor was mainly associated with Lewis (1954). Japan's economic development from 1890 to the First World War could be understood in Neumann/Lewis terms, as real wages remained relatively stable because of rural migration – the Japanese economy at the time “grew like a colony of yeast, with human labor being as necessary an input-output as cotton or fodder” (Samuelson 1964: 749).

Other Lewisian themes recognizable in Samuelson's (ibid.: chapter 36) development chapter are the positive link between income inequality and saving (ibid.: 761, 764) and the unproductive use of the economic surplus in underdeveloped countries (ibid.: 768). However, Lewis's accumulation mechanism – based on the difference between the average productivities of workers in the capitalist and traditional sectors – is not spelled out. In later editions, Samuelson (1973: 776) mentioned yet another aspect of labor surplus economies, that is, the argument that planners should apply “shadow prices” of factors (zero in the case of abundant labor) in order to maximize growth, an idea he associated with development planner and econometrician Jan Tinbergen.

Development planning benefited from Samuelson's turnpike theorem as a dynamic generalization of von Neumann's closed system, in the sense that whatever composition of consumption and capital goods the planner would like to achieve, one obtains the most of all goods if the (efficient) growth path is close to the von Neumann path for most of the time (see Niehans 1990: 438-439; for a comprehensive survey of the

literature see Turnovsky 1970). In his Foreword to a book by Indian economist Sukhamoy Chakravarty (1969) – who was a visitor at MIT in the 1960s – Samuelson (1969a: ix; italics in original) asked: “What makes for a beautiful problem in science?” It was the combination of “logical beauty” and, above all, “*useful* knowledge.”. Chakravarty’s application of optimal control to development planning, through the use of turnpike theorems and other analytical instruments, passed the test, since “India, and indeed much of the world, has a desperate need to develop economically. Bringing the beautiful tools of optimal control theory to bear upon this vital problem thus cannot help but add to their luster.” That applied to both production-terminal and consumption-terminal turnpike theorems. Samuelson was clearly pleased by the fact that his turnpike theorems proved to be helpful in the development planning literature, despite the fact that this did not happen by design.

3. Learning by Watching Others Doing

Although divergence was the dominant theme in Samuelson’s writings on development, he occasionally discussed episodes of international convergence throughout several editions of *Economics* and elsewhere. “Imitation of technology” was one of the main explanations of convergence, as illustrated by the economic growth of Japan, Germany and Russia, especially after the end of the 19th century. As put by Samuelson (1961: 789-790): “Here the underdeveloped countries have one possible advantage. They can hope to benefit by copying the more advanced technology of the developed nations.” Although he did not refer to Alexander Gerschenkron (1952) in that connection, he very likely had in mind the Harvard economic historian’s concept of “advantage of backwardness,” as the two men were close friends in Cambridge. He referred instead to

Veblen's (1915) study of German industrialization and catching up with Britain. Samuelson (1961: 778) did mention Gershenkron (1952) but in connection with the Russian Revolution of 1917 as the result of Russia's backwardness and its neglect by advanced countries.

Gershenkron's "advantage of backwardness" would be listed as one of the main approaches to economic development from the twelfth edition on (Samuelson and Nordhaus 1985: chapter 37), when the convergence debate became prominent among growth economists (see Jones 2002: chapter 3). Samuelson (1961: 791) used the Veblen/Gershenkron framework to interpret early 20th century American technological development, perceived as the result of the ingenious application of inventions mostly originating abroad. Deploying one of his favorite expressions, Samuelson (*ibid.*) asserted that "'Yankee ingenuity' is a phrase that explains nothing; but it does refer to a real phenomenon."

Unlike the case of the countries listed at the start of this section, nations that were economically successful from the 1950s to the 1970s were usually perceived as the outcome of economic planning – which is related to another aspect of Gershenkron's thesis, that is, backwards countries' search for "substitutes for prerequisites" for the productive factors, internal demand, or institutions that they lacked. Samuelson (1973: 81, fn. 3) pointed to "some success stories" of countries that had made "remarkable sprints of progress." Planning, he noted, had become fashionable and widespread in the underdeveloped world – and of course (although in another guise) in socialist countries such as the Soviet Union – sometimes with the use of input-output techniques of general equilibrium and of linear and nonlinear programming. Planners, however, often made

mistakes, which was part of the learning process. In fact, “a cynic can find in the annals of the 1950s and 1960s countless examples of governmental and private bungling.” But an optimist, “looking at ‘miracles’ of development in Thailand, Taiwan, Korea, Puerto Rico, Brazil, Mexico, Israel and El Salvador, can face the 1970s and 1980s with some confidence in the ability of nations to accelerate their own economic development” (ibid.: 784-785). Samuelson’s overall positive view of planning reflected as well his own experience as a planner at the National Resources Planning Board during the Second World War (see Backhouse 2017: chapter 19).

Brazilian economic growth between 1950 and 1980, when it doubled its fraction of US income per capita, was seen as a “notable and all too rare phenomenon” in less developed countries (see Samuelson (1984) [1986]: 499). Brazil’s rate of output growth was particularly intense in the period 1967-1973, when it reached as high as 10% a year and turned the country into “the veritable Japan of Latin America” (Samuelson 1973: 871). This “economic miracle” took place, as Samuelson pointed out, while the country was run by a military authoritarian regime, described as “fascist.” As the 1970s advanced, Samuelson suggested that the unfortunate positive association between economic growth and authoritarianism was also apparent in other successful developing countries at the time, including the Asian Tigers of Taiwan, South Korea and Singapore.

After the 1973 military coup d’état in Chile and the country’s economic reforms based on a free market approach imported from Chicago, Samuelson (1980: 815-816) coined the term “capitalist fascism” to describe the new pattern of alliance between efficient free markets and dictatorial or repressive political orders. The lack of a clear connection between business freedoms and personal freedoms – against the views of Friedrich von

Hayek and Milton Friedman – had been a matter of concern for Samuelson since the 1930s (see Samuelson 1983a: 6-7). In the absence of a democratic welfare state, there tends to be a significant increase in income inequality, as happened in Brazil at the time (see Samuelson 1980: 816; 1983a: 7). Given the historical record, Samuelson (1980: 816) did not expect capitalist fascism in developing countries to last, since its business freedoms were *imposed* on the “populistic voters.”

The influence of political and institutional variables made clear that Samuelson’s (1964: 764-772) approach to economic development through changes in production functions – as determined by skilled and unskilled labor supply, capital accumulation, natural resources and technical progress – was not enough. While discussing Japanese economic development in the early 1970s, he still believed, along the lines of growth accounting exercises by Solow, Angus Maddison and others, that “there can be no substitute for an economic theory of growth based upon the determinants of production” (Samuelson (1971) [1972]: 709). However, he would change his mind about the ability of the production function to explain different growth paths across countries. As he put it: “I erroneously hypothesized that a function F (unskilled labor; simply and poorly allocated capital; scientific knowledge, however acquired) might succeed in achieving respectable progress for approximate Q/L estimates of a society” (Samuelson 2001: 495). Likewise, Samuelson and Nordhaus (2010: 531) pointed out that the view that countries must combine productive factors and technology to grow rapidly is “no real formula,” as it is the equivalent of saying that an Olympic sprinter must “run like the wind.” The issue was why “Do some countries succeed in running faster than others?”

Samuelson (1964: 759-760) had eschewed explanations based on non-economic factors

– such as Max Weber’s emphasis on the “Protestant work ethic” – for posing new unsolved problems. However, the publication of Mancur Olson’s (1982) analysis of how the struggle between interests groups in democracies may end up in deadweight loss, prompted Samuelson to go back to Schumpeter’s (1942) discussion of the problems faced by capitalism and the reasons for nations’ economic and political failures. Samuelson (1983b) was attracted to his old Harvard professor’s argument that the competition for political leadership in democracies would lead to the use of power relations by self-interested voters and elites to form collusions and depart from laissez-faire Pareto-optimum equilibrium. He believed Schumpeter’s perspective could illuminate what he saw as one of the great puzzles of economic development in the post-war era: the failure of Argentina to catch up with the US and other developed economies (on Argentina as a classic example of “growth disaster,” see, for example, Jones 2002: 149-150). If asked in 1945 what part of the world would experience the most dramatic growth take-off in the next decades, Samuelson’s answer would have been Argentina, because of its temperate climate, favorable natural resources, homogenous population formed by migrants from Western Europe – as opposed to Brazil’s racial heterogeneity and tropical climate (here Samuelson gives some credit to the role of racial and climatic factors he had denied in his *Economics*, for example, Samuelson 1964: 759) – and for being in an intermediate stage of development poised for rapid growth (see Samuelson 1983b: 69).

How wrong would I have been ... The reasons do not seem to be narrowly economic. We cannot explain what has happened by appeal to Malthus’s law of diminishing returns. There has been no exogenous shift in world demand peculiarly unfavorable to that region of the world. [Argentina’s] sickness, Schumpeter would claim, is political

and sociological rather than economic. It has to do with the breakdown of social consensus. It has to do with the workings out of the logic of populist democracy (ibid.: 70).

The same argument applied to other southern countries of South America (Chile and Uruguay), with similar conditions and also beset by a lack of social cohesion and ensuing growth failures until the early 1980s. Samuelson thought Argentina and, to a lesser extent, Chile and Uruguay represented a paradigmatic confirmation of Schumpeter's forecast of "capitalism in the oxygen tent," which had not been confirmed (yet) for the US and other industrialized economies, but, in view of widespread stagflation, had turned into a likely possibility. The "Argentinian sickness" of economic stagnation and chronic inflation – caused by a social system more concerned with the division of the social pie through wage and price policies (started by General Perón's populism in the 1950s) than its total size and growth – haunted the American economy and brought about the risk of a "fascist solution," according to Samuelson (ibid.).

As the 1980s advanced and the average growth rate of Latin American countries (including Mexico and Brazil) declined, the contrast with the economic success of the Asian Tigers (and China later) became conspicuous. Samuelson (1980: 720; (1984) [1986]: 498-499) mentioned studies indicating the superior performance of the Asian export promotion strategy over Latin American import-substitution industrialization policies adopted since the 1950s under the intellectual leadership of the Argentinian economist Raul Prebisch, executive secretary of the United Nations Economic Commission for Latin America (CEPAL). Samuelson (ibid.) at first remained skeptical and argued against drawing sweeping conclusions from "controlled experiments" that

were not in fact controlled.

Samuelson (1955: 682-683) had given qualified support to protectionist industrialization policies based on Prebisch's (and Hans Singer's) influential (if controversial) thesis of falling terms of trade against agricultural goods exported by Latin American countries. According to Samuelson (*ibid.*; italics in original), Prebisch's point was "really an argument about what will be the *future* comparative advantage of the countries in question. To the degree that governments are smarter than private investors in discerning trends threatening to the terms of trade, a valid case can be made for their interfering with free market forces." Even before Prebisch's argument appeared, Samuelson (1948a: 183-184) had asserted, in his famous paper about FPE, the existence of a "historical drift" in the terms of trade of primary producers to decline (see also Toye and Toye 2003: 439). Moreover, (limited and temporary) protectionism was justified on the basis of the traditional infant-industry argument of "standard international trade theory" (Samuelson 1961: 795).

By the early 2000s, the "fundamental issue" of a country's policy toward international trade had been settled in development theory and practice (see Samuelson and Nordhaus 2010: 533-355). Outward-orientated policies, as in East Asia, had won the day, if not in the *laissez-faire* shape some had imagined but in the form of a "managed-market approach" combining strong government oversight with effective market forces. The matter was relevant also from the point of view of American international trade performance and policy, particularly in connection with outsourcing, international competition and their effects on employment and real wages. In a controversial article, Samuelson (2004) argued, using a Ricardian trade model, that if China or South Korea

made technical progress (probably through imitation) in producing a good in which the US previously had a comparative advantage, this would cause a permanent decline in real wages in the US, especially of unskilled workers. The result would be the same if mass immigration to the US of similar workers was allowed, accompanied by a substantial increase in income of the new immigrants as compared to their previous income before immigration.

The apparent ability of Samuelson's (ibid.) theoretical result to explain observed facts in the early 21st century, he claimed, vindicated his seminal FPE theorem advanced in 1948/1949. That theorem went beyond Ohlin by arguing that trade brings about actual and complete FPE, not just a partial tendency (the theorem had been proved by Abba Lerner in 1933 as a student paper written at the London School of Economics and unknown to Samuelson until the mid-1950s):

Therefore, as a result of my 1948-1949 revival and perfecting of the 1919-1933 Heckscher-Ohlin argumentation of *factor price quasi-equalization by trade in goods alone*, one could have foreseen the following at World War II's end. Historically U.S. workers used to have a *de facto* monopoly access to superlative capitals and know-hows...of the United States ... However, after World War II, this U.S. capital and know-how begun to spread faster away from the United States. That meant that in a real sense foreign educable masses – first in Western Europe, then throughout the Pacific Rim – could and did genuinely provide the same kind of competitive pressures on U.S. lower middle class wage earnings that mass migration would have threatened to do (ibid.: 144; italics in original).

The narrowing of the gap, separating the rest of the world from American affluent productivity, was the “leitmotif” of the half-century from 1950 to 2000, in Samuelson’s (2001: 500) view. It was not so much “learning by doing” as “learning by watching others doing” (ibid.). Imitation was apparently easy, but it did not operate in vast areas of Asia and Africa, which showed no signs of income convergence. International FPE – a concept close to, although not exactly the same as, income convergence – could only happen if technology transfer à la Gerschenkron took place, as implied by Samuelson (2004). In fact, one of the key assumptions of Samuelson’s (1948a) mathematical demonstration that factor prices are equalized through international trade was that countries have identical production functions, as in the Heckscher-Ohlin factor proportions trade model. He further assumed constant returns to scale and no specialization by any country in one product only (see also Niehans 1990: 428-430). Moreover, as was common in general equilibrium models of the kind used by Samuelson, the supply of productive factors was given and constant.

Upon deriving his theorem, Samuelson (1948a: 178) acknowledged that historically, even in periods when free trade was nearly achieved as from the late 1800s to the early 1900s, international differences in wages and other factor prices persisted. He ascribed the discrepancy between theory and facts to the unrealistic character of some of the theoretical assumptions. Nevertheless, Samuelson (1964: 737) kept claiming that a “strong polar case” like the one established by his theorem could shed light on reality, by referring to his suggested “policy implication” (Samuelson 1948a: 183-184) that moving goods by trade should have nearly the same effect on British living standards as moving British migrants to Australia – the same inference of his 2004 article concerning East Asian workers. Likewise, the empirical refutation of the Heckscher-Ohlin-

Samuelson factor proportions model implied by the “Leontief paradox,” enunciated in the early 1950s, was not enough to challenge the positive heuristics of Samuelson’s theoretical investigation of international trade as part of the general competitive equilibrium research program (see de Marchi 1976).

As pointed out by Hirschman ((1977) [1981]: 60), Samuelson’s (1948a, 1949) FPE theorem raised strong reactions from the then burgeoning field of development economics, though not exactly from Prebisch and Singer, the names mentioned by Hirschman in this connection. Moreover, against Hirschman’s reading of the textual evidence, not all reactions by development economists were negative. In the following, responses by three prominent development economists (Thomas Balogh, Gunnar Myrdal and Paul Rosenstein-Rodan) are briefly considered (see also Boianovsky 2019c).

Oxford economist Thomas Balogh (1949) provided the first and, in some respects, most detailed critical assessment of Samuelson’s 1948 theorem by a development economist. The problem was not so much the contrafactual implications of Samuelson’s proposition – although Balogh (*ibid.*: 193) did notice that such implications do not “seem so strange to him as they do to other people” – but the overall static nature of the Heckscher-Ohlin-Samuelson trade model. Balogh’s main piece of criticism was Samuelson’s assumption of linear homogeneity, which ruled out indivisibilities and increasing returns, deemed essential in treating international trade as the interaction between societies on different levels of development. As discussed above, Samuelson regarded increasing returns as hard to tackle in growth and trade models alike. Balogh (*ibid.*: 198) concluded that the role played by “Professor Samuelson’s brilliant

mathematical feat” was to clarify the static basis of “modern” pure trade theory and, by that, open the way to a new dynamic approach to an essentially dynamic problem.

Gunnar Myrdal (1957) addressed the issue of the incompatibility between trade theory and the international inequality problem in chapter 11 of his well-known book. A Swedish economist himself, Myrdal was well acquainted with and critical of the Heckscher-Ohlin trade model, and of its extension by Samuelson. The main problem with the pure theory of international trade (which was also true of the classical Ricardian version) was its inability to explain international income divergence. It was in this context that Myrdal (*ibid.*: 149, fn. 1) referred to Samuelson’s (1948a, 1949) discussion of the problem of FPE as a result of trade:

We thus see the strange thing that in recent decades, while international economic inequalities have been growing...the theory of international trade has developed in the direction of stressing more and more the idea that trade initiates a tendency toward gradual equalization of factor prices and incomes as between different countries.

The main problem with trade theory, as developed by Samuelson, was its prevailing assumption of stable equilibrium, instead of the more realistic assumption that economic processes are cumulative because of “circular causation.” The latter (Myrdal’s) approach would make clear the role of trade in increasing inequalities between developed and underdeveloped countries, Myrdal (*ibid.*: 152) claimed.

Paul Rosenstein-Rodan’s (1961: 65) interpretation of Samuelson’s theorem differed from both Balogh and Myrdal. He referred to Samuelson (1948a, 1949) while

discussing the argument that international trade would reduce the indivisibility of demand and therefore the size of the “big push” necessary to break the vicious circle of poverty, or even eliminate the need of a push altogether. Rosenstein-Rodan pointed out that the expansion of trade in the 19th century had led neither to equalization nor even a reduction of inequality of factor prices. The theoretical reasons for that, he argued, should be found precisely in Samuelson’s discussion of the *obstacles* to FPE: transportation costs, complete specialization and different production functions across countries. Indeed, this view – that Samuelson’s theorem was not really about the equalization of factor prices, but about bringing out the circumstances that may prevent even a tendency to equalization – could be found in surveys of trade theory (see, for example, Corden 1965: 31).

The fact that Rosenstein-Rodan and Samuelson were colleagues at MIT increases the likelihood that they discussed economic development issues, as also indicated by Samuelson’s references to Rosenstein-Rodan in *Economics* after 1955. Rosenstein-Rodan’s influential 1961 paper had circulated at MIT as a CENIS working paper since 1957. The main explanation for increasing international inequality in factor rewards, according to Rosenstein-Rodan (1961), was the heterogeneity of production functions. He quoted Samuelson to that effect. Although the “laws of nature” may be the same everywhere, the economic laws relating inputs and outputs differed due to the influence of “knowledge”:

Effective knowledge (‘know-how’) is probably as important a variable in understanding economic history and geography as is specific factor endowment ... It would be artificial in the extreme to explain any such empirical case by saying that ‘knowledge’ is

‘scarce’...in the one place relative to the other ... Knowledge is *not* an input such that the more you use of it, the less there is left (Samuelson 1948a: 181-182; italics in original).

The matter, Rosenstein-Rodan suggested, was at the core of the explanation of increasing returns in economic development. Indeed, Samuelson’s brief remarks about the character of knowledge as a non-rival good pointed the way to New Growth Theory that would be established by Paul Romer and others 40 years later.

A main difference between Samuelson’s (1948a, 1949) general equilibrium international trade models and trade models put forward by development economists was the assumption about labor supply and wage determination. Lewis’s (1954) extension of his path-breaking model of development, based on surplus labor, to an open economy provided new insights on the Prebisch-Singer hypothesis of deteriorating terms of trade between the “periphery” and the “center” (see also Boianovsky 2019b). The matter was further elaborated by Arghiri Emmanuel ((1969) [1972]) from the perspective of the Marxian labor theory of value, which attracted Samuelson’s (1976) critical attention. Emmanuel’s argument, constructed by means of involved arithmetical examples, did not make for easy reading. He criticized the theory of comparative advantage (in both its Ricardian and Heckscher-Ohlin-Samuelson vintages) by maintaining that a country with labor surplus and a given low wage is exploited by a country with a given high wage when they trade and capital is mobile between countries. Samuelson (ibid.) counterattacked what he understood as Emmanuel’s denial of the gains from international trade and investment. Upon his restatement of the validity of the theory of comparative advantage under Emmanuel’s assumptions,

Samuelson (ibid.: 107) concluded that “no new light has been thrown on the reason why poor countries are poor and rich countries are rich.” Samuelson’s criticism induced a response from Emmanuel, followed by a reply by Samuelson, without ever reaching an agreement. This was Samuelson’s only engagement in debate with a development economist; unsurprisingly, the topic was international trade, his favorite one.

However, as Negishi (1985: 137-139; 1991) pointed out, Samuelson missed the point that Emmanuel was not refuting the existence of gains from trade as such, but arguing about the deterioration of terms of trade of the lower wage country in comparison with the situation when there is no wage differential. As put by Bacha (1978: 319) in his restatement of unequal exchange in a Ricardian model of international trade with surplus labor and specialization, trade under these conditions is unequal to poor countries in the normative sense that “its terms of trade are lower than they would be under a Pareto-efficient trade arrangement allowing for perfect international labor mobility.” Samuelson (1981) would eventually acknowledge the effects of low wages on the terms of trade and unequal economic development. As part of an exercise in the forecasting of economic development trends, he stated that, only after underdeveloped countries experienced their “industrial revolutions” and demographic transitions,

Only then will the affluent nations stand to lose some of the historic consumer surplus that they have enjoyed from international trade – trade that has historically involved imports of fiber, food, and ores produced in the tropics by low-wage populations ... If that happy day comes when South-east Asia, Africa and Latin America afford a comfortable middle class standard of living to their stabilized populations, we should be content to depend upon mechanized mines and farms for our needed raw materials,

uncomplainingly paying the necessary costs for the goods we need (ibid.: 412).

This differed from Samuelson's FPE theoretical framework. If development economics was a field that appealed to the "venturesome" only (see Samuelson 1978), he was on occasion willing to take a chance.

4. Conclusion

Paul Samuelson paid close attention to economic development and international economic heterogeneity, especially, but not only, throughout the several editions of his *Economics*. This reflected in part his overall interest in the inequality of income distribution at the domestic and global levels, as well as the impact of widespread theoretical and political debates about international development. He was aware of the specific analytical issues raised by development economists, such as the roles of increasing returns and labour surplus in economic growth. At the same time, he acknowledged the theoretical hurdles posed by them, especially poverty traps caused by market failures prompted by increasing returns and externalities. Moreover, Samuelson deployed the Malthusian approach to population dynamics as a key tool for discussing underdevelopment. Production functions were seen as important but insufficient to explain distinct development paths, particularly under conditions of political instability, as in South America. Samuelson was generally positive about planning as a development strategy; indeed, development planners made use of the optimal control and turnpike theorems he had advanced in pure theory. On the other hand, his FPE theorem of international trade proved to be very controversial among development economists.

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