



Institute of  
National Affairs

# THE PATH TO KINA CONVERTIBILITY

## Study of the Foreign Exchange Market of Papua New Guinea

Discussion Paper No. 120  
Institute of National Affairs, February 2021

**MARTIN DAVIES**

*THE PATH TO KINA CONVERTIBILITY:  
Study of the Foreign Exchange Market of Papua New Guinea*

Institute of National Affairs: Discussion Paper No. 120

First published: February 2021

By: Martin Davies

Published by:

Institute of National Affairs  
PO Box 1530,  
Port Moresby  
NCD  
Papua New Guinea

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ISBN 9980-77-203-4

National Library Service - Papua New Guinea

*Disclaimer*

*This publication has been funded by the Australian Government through the Department of Foreign Affairs and Trade at the request of the Government of Papua New Guinea, through the Department of Treasury. The views expressed in the report are the author's alone and are not necessarily the views of the Australian Government*

**THE PATH TO KINA CONVERTIBILITY:  
Study of the Foreign Exchange Market of Papua New Guinea**

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*A note on nomenclature for the non-economist:*

We talk a lot about the exchange rate in this study. In fact, we talk about two types of exchange rates: the *nominal exchange rate* and the *real exchange rate*. We start with some definitions.

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The *nominal exchange rate* is the domestic price of foreign currency, the rate at which Kina is converted into USD, for example. You see nominal exchange rates quoted in the newspaper each day. By this definition, currently the Kina exchange rate is about K3.45 per USD.

The *real exchange rate* measures the rate at which PNG goods can be converted into foreign goods (the number of PNG goods per unit of foreign goods). This is determined by a number of factors, notably the foreign and domestic prices levels, and the nominal exchange rate. The *real exchange rate* indicates how competitive our goods are in comparison to goods from other countries, but more on that below in Section 11.1.

#### *A Guide to the Reader*

Given the long and detailed nature of this study we provide a short guide to the reader on how to approach it. We recommend that the reader begins with the Executive Summary (Section 1), and then moves to the Policy Recommendations and Discussion (Section 13). This section extends on and provides discussion of the policy recommendations outlined in the Executive Summary.

From there we recommend Section 5 (Recent Forex Market Conditions), and Section 6 (Reasons for the Foreign Exchange Shortages) particularly 6.2.ii (Fiscal Policy Settings). For deeper policy insight we then recommend Section 11 (Effects of an Exchange Rate Depreciation on the PNG Economy). For more technical insight into recent forex market conditions see Section 8.2 (Monetary and Exchange Rate Policy: 2014-2020). In terms of the key insights of the study see Section 7 (Links between Fiscal Policy and the Foreign Exchange Market), Section 9 (Dealing with the Backlog: Stock and Flow Imbalances) and Section 12 (Determination of the Equilibrium Real Exchange Rate: the path to Kina convertibility), particularly 12.3 (Discussion of Results). For policy objective definitions see Section 3.1 (External Balance) and Section 3.2 (Internal Balance).

For the less technically-minded reader we recommend the following sequence of sections: 1, 13, 5, 6, 9.1, 9.2, 10, 11, 12.3.

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### Foreword

Papua New Guinea adopted its own currency, the Kina, shortly before Independence in April 1975, and applied full monetary independence from the start of 1976, following 20 months of transition from the Australian dollar. As an open trading nation, with a strong export sector, initially dominated by export crops, and a dependency upon extensive imports, the authorities chose to pursue a so-called 'hard kina' policy, with the currency set against a weighted basket of currencies of PNG's main trading partners. This was aimed at providing stability for the value of the kina and of prices, together with low inflation. This stability was envisaged to provide security to businesses to hold kina and to invest in the country.

In the subsequent heady years, the kina appreciated to nearly AUD 1.50, and almost USD 1.20. During the subsequent years exports were dominated increasingly by a succession of new extractive resource projects, comprising both mining and oil production from 1992. While fostering expectations of stronger economic growth and revenue, this greater dependence upon extractive industries raised concerns, not only from social disruption, as occurred in Bougainville from 1988, but also from an increasingly dual economy, entailing a resources supported kina unduly constraining the prospects and viability of the other export and import replacement industries, including agriculture, which generated most of the country's employment. Low prices and poor fiscal management, including heavy borrowing, partly resulting from those unrealistic revenue expectations, in the end imposed undue pressure on foreign reserves and the Budget, forcing a 12% devaluation and subsequent floating of the Kina in 1984 and the abandonment of the 'Hard-Kina'.

The turbulent 1990s, which necessitated three structural adjustment programs, finally evolved into a decade of greater monetary and fiscal stability, thanks to a series of rigorous reforms, particularly to financial institutions, combined with an extended period of stronger commodity prices and prudent fiscal management. This enabled declining debt, low inflation and stable exchange rates, which even weathered the Global Financial Crisis relatively unscathed. The Central Bank gained independence over monetary management during the reform years at the start of the 2000s, along with the largest commercial bank being privatised and superannuation funds reformed.

The last decade, however, was more reminiscent of the 1990s, with turbulent commodity prices, inflated revenue expectations, high public expenditure, weak fiscal control, sustained deficits and growing debt and debt servicing costs, limited private investment and flat employment trends.

Despite having one of the world's largest positive current account surpluses (proportionately), even in the face of depressed commodity prices (notably for hydrocarbons), from 2014 both the economy and the government revenue were under growing stress, as exhibited in constant deficits

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and growing public debt and debts servicing costs, lack of investment, growth and new jobs. From mid decade foreign exchange shortage became a major constraint to business and investment, added to the longer-standing handicaps for economic activity and development. Maintaining currency stability may have provided some market assurance, inflation restraint and safety net to low income urban income earners, but at what cost to economic prospects?

Over the past four and a half decades economic policy objectives and economic conditions have invariably shifted. There have also been a few major reviews of the exchange rate policy and monetary management, including by Garnaut and Baxter in 1983, and by Fallon, King and Zeitsch, with the INA, in 1995, as well as ongoing internal reviews, in the face of changing conditions and policy agenda. Monetary and exchange rate policies are clearly not the only, or even principal determinants of PNG economic performance, and clearly they cannot work in isolation from sound and well-managed fiscal and debt policy, good governance and the need for quality public goods and other suitable business and investment conditions. They do, however, play an important part.

In this report, Assoc. Professor Martin Davies, provides both a theoretical and empirically-based examination of PNG's foreign exchange market, highlighting the drivers of external balance, namely terms of trade, budget deficit and government take (of resource revenue), each of which deteriorated over the past decade, invariably imposing downward pressure on the currency, at least in the absence of intervention, as occurred in PNG with a system of rationing access to foreign exchange. He examines the determinants of whether the currency is overvalued and by how much, and how far any adjustment in the nominal exchange rate is reflected in changes to the real exchange rate (which determines the real purchasing power of units of currency). He makes a series of policy recommendations for significant changes in exchange rates management and outcomes, based upon theory and empirical analysis. In this report he examines the impacts of intervention, including the backlog of foreign currency transfers, as against moving to more market driven exchange rate, and the potential impact of different policy options upon the economy as a whole, and upon different sectors and industries, including rural and urban sectors and more vulnerable households.

It is hoped that this study of the Papua New Guinea's Foreign Exchange Market, commissioned by the (PNG) Treasury and funded by the Government of Australia, will contribute constructively to the analysis and policy debate and towards providing 'a Path to Kina Convertibility'. Hopefully this will assist in addressing the long-standing and disruptive forex shortages and encouraging greater confidence in the currency and the economy, and in turn to renewed investment and growth. As stated, however, this requires a level of coordination in policies and their application, and trust and cooperation between government authorities and the private sector.

As highlighted in the acknowledgements, Dr Davies received invaluable inputs from a wide range of fellow researchers and analysts, including his former colleagues with ANU and UPNG, Dr



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Marcel Schroder, as well as from extensive dialogue with leaders in the financial sector and other stakeholders in PNG, both within government and the private sector, and from the international financial institutions. The task was certainly not made easier with the outbreak of the COVID-19 pandemic in early 2020, not least impacting directly some of the principal researchers. The Institute commends Dr Davies for this work and is pleased to have been able participate in this valuable study, and is grateful to all those who provided their time, funds and effort to this exercise, which we clearly hope will make a valuable contribution to policy dialogue in PNG related to this critical issue affecting the economy and peoples' lives and opportunities in PNG. We acknowledge the valued funding support from the Government of Australia, while emphasizing that the analysis and findings of the study are those of the principal research and author, alne.

Paul Barker  
Executive Director  
Institute of National Affairs  
22 February 2021

## 1 Executive Summary

- The non-resource sector has faced a chronic shortage of foreign exchange for the past 6 years leading to a large backlog of foreign exchange orders. Although this backlog has waxed and waned over time, it has remained a constant feature of the market.
- While estimates of the backlog have varied between around K1 billion and K4.5 billion, and current estimates have it at less than K1 billion, it is likely that it is higher than this. Firms and households are holding asset on their balance sheets that they would like to convert into foreign exchange, and also have latent demand for imported goods and foreign assets. This part of the backlog is not visible in the banking system.
- Despite the swing in the current account from deficit to large and persistent surplus in mid-2014 with the start of LNG shipments, the economy continues to experience a shortage of forex. This is, in part, due to the financial outflows associated with resource sector investments which have offset the current account inflows, in addition to other factors such as a deterioration in the budget balance.
- Since 2015, in the face of this shortage, the BPNG has rationed the market's access to foreign exchange, rather than allowing the exchange rate to depreciate. This has been implemented through guidance to the commercial banks, giving priority to some types of transactions and discouraging others, as a means to constrain the country's demand for foreign exchange. There has been some relaxation in this guidance over time.
- In 2019, there was some reduction in the backlog of unfilled forex orders with an increase in forex supply due the successful sovereign bond issue and loans from the World Bank and ADB, however the backlog has begun to increase again.

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- If policies remain unchanged the shortage of foreign exchange is likely to continue. Ongoing uncertainties caused by the Covid-19 pandemic, a likely sluggish global recovery, falls in commodity prices (except for gold), cessation of operations at Porgera, and the reduced likelihood of the signing of new resource projects have reduced current forex inflows and lowered expectations of a future increase in inflows.
- The rationing of foreign exchange has led to import compression. This reduces the growth of the economy through reduced investment which diminishes productive capacity, and increases costs which reduces current and future export opportunities. It also reduces the variety and availability of goods for domestic consumers which has a welfare cost to households. Given this, returning the Kina to full convertibility is of the highest priority.
- Given the divergent nature of demand-side (a continuous stream of smaller transactions) relative to supply-side transactions (a discrete number of larger transactions with intermittent arrival) it is necessary to have the BPNG act as a market maker, matching supply to the daily demand flows to avoid excess volatility in the exchange rate.
- The shortage of foreign exchange is caused by a structural imbalance between demand and supply in the foreign exchange market. Reasons for the shortage of foreign exchange include:
  - low supply of foreign exchange:
    - *Low government take from resource projects:* the government take has fallen from around 30 percent in 2011 to less than 5 percent in 2018.
    - *The expectation of a depreciation:* the view amongst foreign investors, exporters, and others wishing to repatriate funds to PNG is that a depreciation is likely at some point. The response to this expectation is to hold fund offshore until a depreciation has occurred to avoid capital loss.

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- *Backlog of foreign exchange orders:* given the backlog, to avoid queuing to have their forex orders cleared, PNG-based businesses return the minimum required amount of foreign exchange to PNG.
- high demand for foreign exchange:
  - *High propensity to import by the private sector:* PNG businesses import specialized capital equipment and intermediate inputs which are not produced in PNG. Similarly, PNG households import foreign durable and non-durable goods.
  - *Remittances of profits and dividends by domestic firms to international parent companies:* Domestic firms with foreign owners must return their share of profits to their foreign partners/owners.
  - *High propensity to import of government spending:* a high proportion of government spending falls onto imports, with about 60-70 percent of each Kina of government spending spent overseas, either directly or indirectly.
  - *Macroeconomic policy settings:* the government has run a sequence of high fiscal deficits (in historic terms) over the past 8 years, and given the strong links between the fiscal balance and the current account balance this increases the demand for foreign currency.
- We demonstrate the strong link between the fiscal deficit and the current account deficit in PNG (noted in the point above), showing that a one percent increase in the government's budget deficit as a proportion of GDP leads to a 0.8 percent increase the current account deficit as a proportion of GDP. This demonstrates that the large fiscal deficits over the past eight years have contributed significantly to the forex shortage.
- Macroeconomic policy-makers have two objectives for the economy: internal balance (*all resources in the economy are fully employed*) and external balance (*maintenance of currency convertibility without recourse to foreign borrowing which is so burdensome that it will reduce living standards of future generations below the level today*).

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Currently the PNG economy does not have external balance (currency convertibility) or internal balance (full utilization of resource).

- To gain insight into how to deal with the backlog of forex orders, we present an analysis which looks specifically at the relationship between the flow imbalances (excess demand for foreign currency) and the stock imbalances (backlog of outstanding orders), which are current features of the PNG foreign exchange market.
- In summary of this analysis, there is a stock of forex held by foreign investors, exporters, and those wishing to repatriate funds who are deferring their demand for Kina until exchange rate matches their equilibrium estimates of it to avoid capital loss. The holders of this forex will not bring it to market until the Kina has to depreciated to a level which is consistent with their expectations. Thus, in order for the Kina to return to full convertibility it is essential that the exchange rate weakens sufficiently so that the holders of this stock of forex enter the market.
- We present a new approach to determining the equilibrium real exchange rate (ERER) for PNG. The ERER is the real exchange rate that will lead to internal balance (full employment) and external balance (convertibility of the Kina). We adjust the standard internal-external balance model for features of PNG economy, which includes a large resource sector that is mainly foreign owned. A feature of this new approach is that enables us to determine the influence of changes in the government take on the ERER.
- We estimate PNG's equilibrium real exchange rate over the past 20 years and find that the current real exchange rate is overvalued by between 20 and 30 percent. We also find that a 10 percentage point decrease in the government take depreciates the equilibrium real exchange rate by 3.4%.

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- The reasons for the overvaluation of the real exchange rate include: *i.* the fall in PNG's terms of trade; *ii.* the high fiscal deficits over the past 8 years; *iii.* the large fall in the government take since 2011.
- On this basis, we recommend a 20 percent depreciation of the real exchange rate which will require a 33 percent depreciation of the nominal exchange rate (Kina relative to the USD). We recommend that the adjustment in the nominal exchange is front loaded, with a 20 percent depreciation immediately, and the remaining 13 percent spread out over the subsequent two years (approximately 6.5 percent in each year).
- A depreciation arranged in this way (front loaded with gradual adjustment later) is beneficial because it will kick start the necessary adjustment in the real economy, and it provides a credible signal to market participants that government wishes to address the forex market imbalances which should stimulate forex inflows. The adjustment in subsequent periods allows for continuation of the necessary adjustment while ensuring there is not an overshoot of the real exchange rate.
- We estimate that a 20 depreciation of the real exchange rate (33.3 percent depreciation of the nominal exchange rate) will have the following effects:
  - it will improve the trade balance by approximately USD 500 million per annum, increasing forex inflows by the same amount.
  - it will increase real agricultural export income by 33.4 percent (nominal agricultural export income will increase by 46.7 percent).
  - in the short run (at the end of the first year) real agricultural export income will have increased by 18 percent.
  - it will stimulate economic activity in the export and import-competing sectors, providing much needed stimulus to non-resource sector economic activity.

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- it will cause a redistribution of income from urban to rural households, however some of the falls in urban income will be moderated by the increase in non-resource sector activity.
  - the redistribution of income from urban to rural households will increase the relative attractiveness of being located in a rural setting relative to an urban one. This will slow, and perhaps reverse, urban drift.
  - it will stimulate the forex inflows from overseas investors as it brings the Kina exchange rate into closer alignment with market participants beliefs about the equilibrium rate.
  - given pass-through from a nominal depreciation to the price level of 40 percent, it will increase the domestic price level by approximately 13 percent.
  - it will lead to an increase the Kina value of PNG's foreign debt, both private- and government-held, however this will be offset by higher growth through stimulus to the tradables sector and the relaxation of foreign exchange rationing by the BPNG. The resulting higher tax revenues and increase in GDP growth will reduce the effects of the depreciation on the government's foreign debt to GDP ratio. Offsetting effects for firms include an increase in firm profits due to higher growth and better access to foreign exchange which reduce costs and allow remittance of profits and dividends.
- 
- In future policy-setting, there needs to be more flexibility in the nominal exchange rate to allow adjustment in the real exchange rate when PNG experiences large shocks to its terms of trade which happen frequently. In response to a negative terms of trade shock the nominal exchange rate should be allowed to depreciate more; in response to a positive terms of trade shock it will appreciate.
  - Policy-makers current reluctance to allow adjustment of the nominal exchange may be based on: *i.* elasticity pessimism; *ii.* a concern that a depreciation will lead to a long period of increased inflation; and *iii.* concern it will cause an unfavorable redistribution

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away from urban household. We provide evidence to counter concerns of *i.* (Section 11.5) and *ii.* (Section 11.3), and a discussion of *iii.* (Section 11.2).

- Given the tight links between the fiscal balance and the current account balance in PNG, the large fiscal deficits of the past 8 years have contributed significantly to the structural imbalance in the foreign exchange market. A fiscal rule, in addition to the Medium Term Debt Management Strategy, should be implemented to guide allocation of non-renewable resource wealth over time to ensure intergenerational equity. Such a rule will support achieving and sustaining currency convertibility.
- Once convertibility of the Kina has been re-established, we recommend that the BPNG establish an interbank market and conduct trading of forex through a daily auction. This will have clear benefits in terms of the efficient allocation of forex to the market. Such an arrangement is not feasible in the current circumstances with BPNG setting both the price (nominal exchange rate) and quantity of foreign exchange in the market.
- Any additional financing to improve currency convertibility should be undertaken with caution keeping in mind the external balance objective. When financing is deemed appropriate then it should only be undertaken on concessional terms.
- Investment of foreign exchange reserves in an actively managed portfolio is not appropriate given the need for reserves to be kept in a form which is liquid and readily usable. Investment of some fraction of reserves in highly liquid assets, such as US Treasury bonds, could be considered.
- The conversion of a significant proportion of PNG's foreign exchange reserves to gold (a gold bullion bank) should not be undertaken. This option increases the risk, and resource and transaction costs, involved in managing and using PNG's foreign exchange reserves.



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- The amounts of forex held abroad by SoEs should be determined by the government, not by the SoE. Further, SoE revenues should accrue to the government, and should be paid directly to the government and/or a sovereign wealth fund account at the government's direction. This requirement has the added benefit of increasing the transparency of SoE activities.
- It has been proposed that one way to solve the forex shortage is through stricter enforcement of the surrender requirement on resident exporters. Based on our analysis, we believe that it is likely that the costs of a stricter enforcement of the surrender requirement will outweigh benefits, and so we do not recommend taking this approach.
- Precipitous falls in the government take, as have occurred in the past 9 years in PNG, require difficult adjustments for the economy, and provide a challenge for policy-makers. A fall in the government take requires a depreciation to ensure internal and external balance, and leads to difficulties for government in managing expenditures relative to revenues.
- More stability in government take from resource projects is desirable. This requires the government to frontload the revenue streams of new resource projects relative to current arrangements. This could be achieved through greater use of royalties and less generous tax exemptions.
- Steps should be taken to improve foreign access to PNG's Treasury bond market. A prerequisite for this is a convertible currency. Given the successful sovereign bond issue in 2018 there is clearly an international appetite for PNG bonds. This will assist the government in managing the variation in revenues relative to expenditures caused by volatility in resources taxation revenues. It will also create additional discipline for government.

## 2 Introduction

The objective of this study is to provide an in-depth analysis of the foreign exchange market in Papua New Guinea, and to recommend adjustments to policy and foreign exchange market arrangements to facilitate the return to full Kina convertibility. While the focus of this analysis is the foreign exchange market in PNG, we begin by noting that the economy is an integrated system of markets, and the forex market is but one of these. Thus, while the focus of the analysis is the forex market, this market cannot be considered in isolation. The examination must occur in conjunction with other markets in the economy, notably the goods and money markets. The linkages between these markets mean that monetary and fiscal policies also influence the outcomes in the foreign exchange market. We find, as might be expected, that an outcome of full convertibility of the Kina requires an appropriate mix of monetary, fiscal, and exchange rate policies.

We begin by defining the policy objectives of internal and external balance for the PNG economy in Section 3. External balance is particularly relevant in the context of this study as it refers to the maintenance of currency convertibility over time without recourse to external borrowings that are so large that their servicing requires reductions in living standards in the future. The primary objective of this study is to recommend policies that drive a return to currency convertibility, and the concept of external balance grounds the analysis throughout this study. We look at the underlying characteristics of PNG's foreign exchange market in Section 4 and in Section 5 we discuss conditions in the forex market over the past 6 years with particular focus on the period since 2018.

In Section 6 we provide a list of reasons for the persistent structural shortage of foreign exchange outlining causes of the high demand and low supply. Given the influence of the recent large fiscal deficits this leads us into Section 7 which examines the links between the fiscal balance and the current account balance, and this is our first in-depth analysis. We find that a one percent rise in the fiscal deficit increases the current account deficit by 0.8 percent, a clear example of the twin deficits, which lies above estimates for other countries. We also include a brief

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discussion on fiscal rules, and how their implementation would support achieving and sustaining currency convertibility.

Section 8 provides a historical analysis of monetary and exchange policy in PNG over the past 20 years. This has relevance because from 2002 to 2013 PNG experienced a situation quite different to that of the past 6 years. This period was defined by: a positive terms of trade shock and an associated resource boom from 2002 to 2008; the global financial crisis in 2008-2010 and a very large fiscal expansion in 2009; and the LNG investment boom from 2010-2012. The Kina was fully convertible, there was pressure on the Kina to appreciate (which it did), and forex reserves increased. This stands in contrast to the period from 2014 to 2020. This period began with a negative terms of trade shock. Despite the commencement of LNG exports and a shift from a current account deficit to a large surplus there was pressure on the Kina to depreciate due to ongoing balance of payments deficits. Government take also fell precipitously. While there was some depreciation, a full adjustment was resisted, forex reserves fell, and forex rationing was introduced.

In Section 9, which presents our first of two new theoretical models specific to PNG, we examine the links between the flow imbalance and stock imbalance in the PNG forex market. This is particularly important because just achieving flow equilibrium, that is, a matching of daily demand and supply of foreign exchange, is not sufficient to return the foreign exchange market to convertibility given the large outstanding backlog of orders. We use a bathtub analogy to show the relationships between the net flows of orders and the backlog stock. We then present a theoretical model which determines conditions under which a stock equilibrium, a necessary condition for convertibility, is achieved. This provides some guidance about the type of policy that is required to return to full convertibility. It suggests that a large depreciation is required to bring the exchange rate into alignment with the expectations of holders of forex who wish to convert to Kina but want to avoid the capital loss associated with holding a depreciating Kina.

In Section 10 we provide an in depth analysis of various policy options that were presented to us as possible solutions to the persistent forex shortage. In our view, none of these policies alone, or in concert, will be sufficient to solve the forex shortage. A depreciation is a necessary

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requirement to solve the ongoing structural imbalance between the demand and supply of foreign exchange. Having said this, we do believe some of these suggestions have merit, and we make recommendations about how to implement them.

In Section 11 we provide an in-depth analysis of the effects of a depreciation on the PNG economy. This includes the effect on prices, on economic activity, the likely distributional consequences, the effect on inflation, and the real exchange rate. In particular, based on IMF analysis, we find that a 20 percent depreciation of the real exchange will improve the trade balance by about USD 500 million per annum, improving forex inflows by that amount each year. Further, we calculate the effect of a 20 percent depreciation of the real exchange rate on real agricultural export earnings and find that they will increase by 33.4 percent in the long run, and 18 percent after one year (after 12 percent real depreciation caused by at 20 percent nominal depreciation – more on this in Section 11.6).

In Section 12 we present our second new theoretical model which modifies the standard internal and external balance model to incorporate key features of resource rich developing economies, like PNG. This model is particularly useful because it incorporates features which allow us to analyze several of the key changes in the PNG economy over the past 6 to 8 years. These are a negative terms of trade shock, a large and persistent rise in the fiscal deficit, and a significant fall in the government take. We use the model to guide our empirical analysis to estimate the equilibrium real exchange rate in PNG. That is, the exchange rate that will bring the PNG economy into external balance (currency convertibility) and internal balance (full employment of resources). We find that the real exchange rate is overvalued by between 20 and 30 percent. This means that the current real exchange rate is appreciated relative to the value that would bring about currency convertibility by between 20 and 30 percent.

Based on this analysis, we outline our policy recommendations in Section 13. We recommend a 20 percent depreciation of the real exchange rate, which is brought about by a depreciation of the nominal (or Kina) exchange rate of 33 percent. We recommend an immediate depreciation of the nominal exchange rate by 20 percent, followed with a depreciation 13 percent spread over the

next two years. We list 14 policy recommendations and discussion points, divided into short run, long run, and other. This list includes the proposed policy actions from Section 10.

In Section 14 we look at possible alternative exchange rate arrangements for PNG. This is a preliminary analysis, suggesting prospective future research and policy recommendations based on it. In Section 15 we list the international technical partners and the assistance they could provide, and in Section 16 we outline examples of what types of foreign exchange policies have worked in other countries.

### 3 Policy Objectives for the PNG Economy

Macroeconomic policy-makers have two primary economic objectives for the economy: external balance and internal balance. We define this below.

#### 3.1 External Balance

External balance may most easily be defined as restriction on the level of the current account balance, however given the focus on currency convertibility in this study, a definition in these terms is preferred. From Garnaut and Baxter (1983, p. 56), external balance is defined as “the maintenance of currency convertibility at all stages of the international business cycle without recourse to external borrowings that are so large that their servicing requires reductions in average living standards at some future point in time.” An equivalent definition in terms of the current account is that external balance is level of the current account such that foreign borrowing in the short term should not be so large as to require living standards to fall below the present level when the debt is repaid in the future.

#### 3.2 Internal Balance

Internal balance refers to a situation of full utilization or full employment of resources in the domestic economy. For the labor market this means that all members of the working population that desire a job at the prevailing wage will have a job. In an economy like PNG with a large informal sector this definition requires some modification and we turn again to Garnaut and

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Baxter (1983, p. 54): “full employment can be defined as the state in which the number of people who prefer wage employment to village life, given the wage level and other factors affecting non-village life and village standards of living, roughly balances the number of wage and other non-village jobs available.”

## 4 Nature of Forex Market in PNG

On the demand side, there is a continuous daily demand for foreign currency to facilitate the purchases of imported goods and services for consumers, businesses, and the government. These include capital goods, intermediate inputs, and final goods. Given that PNG is a developing country with a small and relatively unsophisticated manufacturing sector, there is a high propensity to import a wide variety of manufactured goods for household and business use.

The supply of foreign exchange, on the other hand, arrives in larger discrete bundles. Main sources are receipts from sales of PNG commodity exports, particularly from the larger mining operators and agricultural exporters. In addition, there are tax payments and royalties from resource companies (LNG and minerals), income from foreign investments, remittance of profits from companies, and also quarterly or bi-annual remittances of dividends and profits by the SoEs. In the past, FDI has also been a large contributor to forex inflows, for example, when a resource project is in the construction phase, such as PNG LNG during 2010-2012. In recent times, the issue of sovereign bonds, commercial loans, and IMF, World Bank, and ABD support, and grants have also contributed to the supply of forex.

As a result of the divergent nature of demand side transactions (a continuous stream of smaller transactions) relative to supply side transactions (a discrete number of larger transactions with intermittent arrival, and some concentration at the end of each quarter) it is necessary to have a market making institution, such as the BPNG, to stand in the forex market to smooth the supply of foreign exchange to match the daily demand. This avoids increased volatility in the exchange

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rate. Without an institution taking on this function there would be longer periods of excess demand for forex leading to exchange rate depreciation somewhat randomly interspersed with short periods of excess supply and exchange rate appreciation that coincide with the arrival of larger forex inflows.

Given the relatively underdeveloped state of financial markets in PNG, and the limited experience of the commercial banks, domestic business and households in dealing with exchange rate volatility it is a preferable arrangement to have the BPNG limiting the private sectors exposure to exchange rate risk by providing some stabilization of the exchange rate.

In acknowledgement of the role of the BPNG in the forex market, the IMF classifies PNG's exchange rate regime as a de facto crawl-like arrangement (since 2014). A de facto crawl-like arrangement means that the exchange rate remains within a margin of 2 percent relative to a statistically identified trend for six months or more. Prior to this, since being first floated in 1994, it had been classified as a de facto floating exchange rate regime, independently floating (2003), and a managed float (2008).

The BPNG is the major recipient of forex inflows (from minerals and resource tax receipts and royalties) and thus sales of forex to the domestic market by BPNG account for a major share of the supply of foreign exchange. The domestic banks can match exporter and importer trades to some degree, however, they have insufficient foreign exchange on net and must resort to purchases from the central bank. The foreign exchange market is one-sided, meaning that BPNG only quotes a price for forex sales. This is because the commercial banks never have surplus forex, the BPNG never buys foreign exchange from them, and so there is no need to quote a buy-price.

## 5 Recent Forex Market Conditions

The non-resource sector has faced a chronic shortage of foreign exchange for the past 6 years, leading to a backlog of foreign exchange orders which has waxed and waned over time, but has

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remained a constant feature of the market over this period. Despite the swing in the current account from deficit to a large and persistent surplus from mid-2014 with the start of LNG shipments, the economy continues to experience a shortage of forex. This is due to the financial outflows associated with resource sector investments which offset the current account inflows. Since around 2015, in the face of this shortage, the BPNG has rationed the market's access to foreign exchange, rather than allowing the exchange rate to depreciate. This has been implemented through the issue of guidance by the BPNG to the commercial banks, giving priority to some types of transactions and discouraging others, as a means to constrain the country's use of foreign exchange.

Since 2018, the BPNG has reduced guidance to the banks on the allocation of forex (although there is current priority for pharmaceutical, medical supplies and food), and allowed some depreciation of the Kina. In 2019, there was some reduction in the backlog of unfilled forex orders with an increase in forex supply due the successful sovereign bond issue and loans from the World Bank and ADB. However, the backlog has begun to increase again. Recent support from the IMF and a loan from the Australian government in 2020 may help to temporarily lower the backlog.

Cast against this, however, are the ongoing uncertainties caused by the Covid-19 pandemic, the falls in commodity prices (except for gold), the cessation of operations at Porgera, and a reduced likelihood of the signing of new resource projects (and the related investment inflows this would bring). These factors reduce current forex inflows and lower expectations of a future increase in inflows. Without a depreciation the shortage of foreign exchange is likely continue. This will lead to a rise in the backlog of forex orders and in wait times for the execution of forex orders.

As noted in Section 4, while the domestic banks can go some way toward matching buyers and sellers of forex, they do not have sufficient forex balances to satisfy all of the forex demand, and they must revert to the BPNG to fulfil their forex needs. Currently the BPNG is selling about USD 50 million per month to the domestic banks. Rather than distribute it to the banks according



to competitive auction, this intervention tends to be grandfathered to the banks based on their share of domestic banking activity with the BSP taking the largest share of about 45 percent on this basis.

## 6 Reasons for the Foreign Exchange Shortages

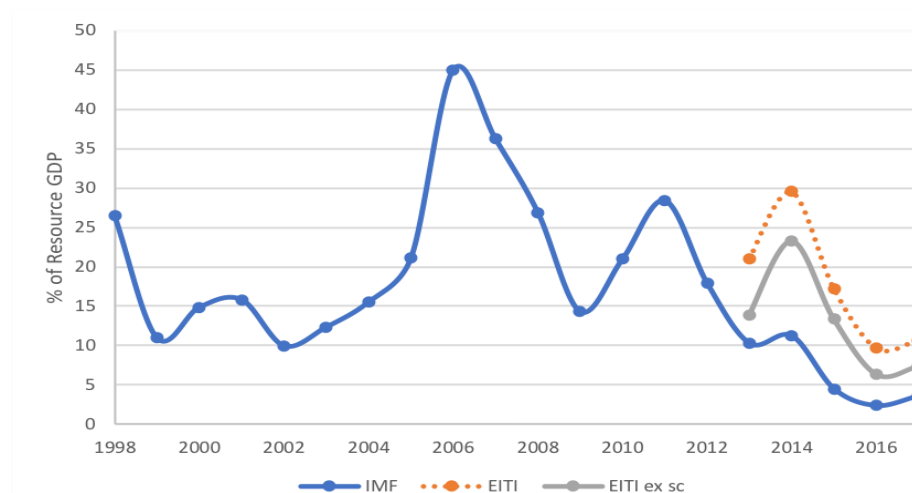
The cause of the foreign exchange shortage is a prolonged mismatch between the supply and demand for foreign currency (USD, AUD, etc). More precisely, at the prevailing exchange rate, the quantity demanded for foreign exchange has exceeded the quantity supplied of foreign exchange since around 2014. In other words, the Kina is overvalued relative to the currencies of PNG's trading partners.

### 6.1 Low supply of foreign exchange

The reasons for the low supply of foreign exchange include:

- i. *Low government take from resource projects:* The government's receipts from resource exports have been at a historic low over the past 6 years. This is because the PNG LNG project is in the early phase of its lifecycle, and has tax exemptions due to accelerated depreciation arrangements, and the revenues from other resource projects are very low.

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*Figure 1: PNG's government take 1998-2018*

Source: Authors

Figure 1 shows the variation in government take from resource projects as a percentage of resource GDP between 1998 to 2018. The data comes from two sources, the IMF and a new EITI database constructed by Davies and Schröder (forthcoming). What is clear from the IMF series is that government take as a percentage of resource GDP has been low over the past 6 years, falling from around 30 percent in 2011 to below 5 percent in 2018 by the IMF's measure. The EITI measures are slightly higher than this.

- ii. *Fall in the terms of trade:* Over the period 2011-2019, PNG's terms of trade fell by around 27 percent, reducing export revenues and the supply of foreign currency. The terms of trade is measured as the price of exports divided by the price of imports. This determines the rate at which PNG can convert exports (PNG's surplus goods sold to buyers overseas) into imports (goods from overseas that PNG desires to purchase). A fall in the terms of trade means that the rate at which PNG can convert exports into imports falls: each unit of exports buys fewer units of imports, thus reducing the supply of foreign currency.
- iii. *The expectation of a depreciation:* Given the ongoing imbalances in the foreign exchange market, and the large backlog, there is a view amongst foreign investors, exporters, and others wishing to repatriate funds to PNG that a depreciation is likely

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at some point. The response to this expectation is to hold funds offshore until a depreciation has occurred, or until market conditions improve to the point at which these market participants believe that the Kina is equally likely to appreciate or depreciate.

- iv. *Backlog of foreign exchange orders:* Given the backlog of foreign exchange orders, PNG-based businesses are aware that delays to the clearing forex orders are common. Hence, PNG businesses that export and earn foreign exchange have an incentive to return the minimum required amount of foreign exchange to PNG. This allows them to avoid queuing when they next have a need for foreign currency, for example to pay foreign suppliers for import purchases.

## 6.2 High demand for foreign exchange

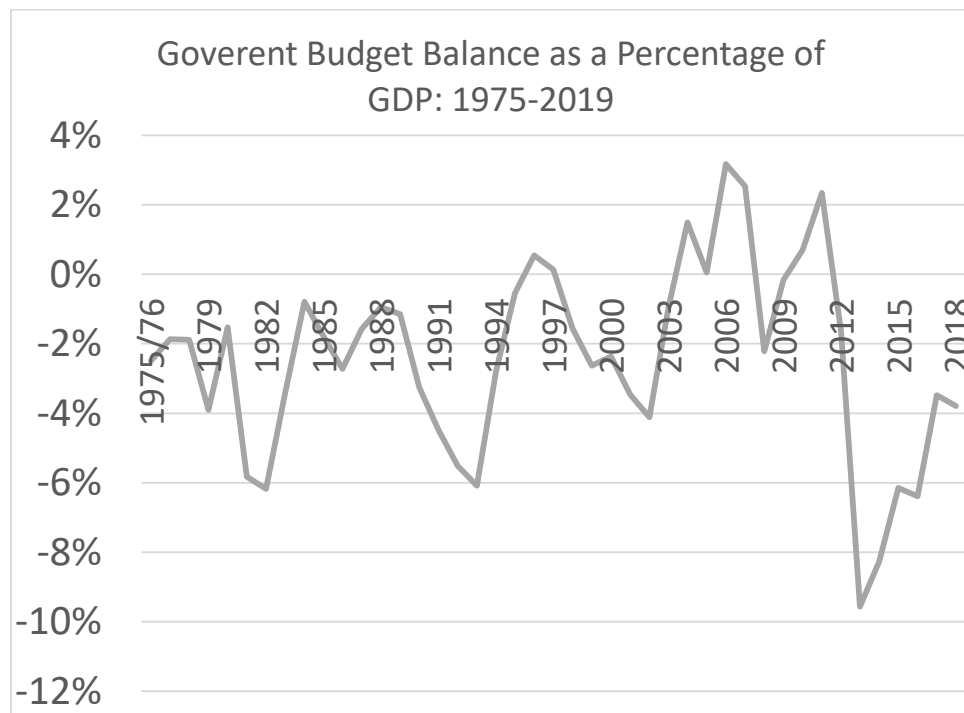
Reasons for high demand for foreign exchange:

- i. *High propensity to import by the private sector:* In order to produce goods and services for the domestic market, PNG businesses need specialized capital equipment and intermediate inputs. As PNG is a developing country, these goods are often not produced in PNG, and hence they need to be imported from overseas suppliers. It should be noted that the ability to access imported capital goods and other inputs is important for the efficiency and viability of PNG businesses, and access to them lowers the cost, and increases the range, of goods provided in the domestic economy. Similarly, PNG households import foreign durable and non-durable items, such as household appliances, medical supplies, and food, which are not produced in PNG.
- ii. *High propensity to import of government spending:* A high proportion of government spending falls onto imports, with about 60-70 percent of each Kina of government spending spent overseas, either directly or indirectly. This increases the demand for foreign currency. A large share of government spending is on wages and salaries for public servants, and the expenditures of these urban wage earners fall largely onto imports of durable and non-durable (food) items.

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iii. *Fiscal policy settings:* The government has run a sequence of high fiscal deficits over the past 8 years, and this increases the demand for foreign currency as will be outlined in more detail in Section 7. These fiscal deficits are large in historic terms for PNG, as evidenced in Figure 2. Prior to 2012, the fiscal deficit as a percentage of GDP had only touched the 6 percent level briefly on two previous occasions (early 1980s, and mid-1990s). Over the past 7 years this boundary has been exceeded during a contiguous number of years (2013-2016), with the deficit as a percentage of GDP approaching the 10 percent level in 2013.



*Figure 2: Government Budget Balance and a Percentage of GDP, 1975-2019*

Source: Development Policy Centre, ANU

## 7 Link between Fiscal Policy and the Foreign Exchange Market in PNG

### 7.1 Basic Concepts

We will show below that a persistent budget deficit translates into a current account deficit which, in turn, has to be offset either by financial inflows or through running down reserves if the exchange rate is fixed, or through depreciation if the exchange rate is floating.

We start with two basic equations for the economy: the income-expenditure identity (equation (1)) and the balance of payments (equation (2)).

$$CA = (S - I) + (T - G) \quad (1)$$

$$BOP = CA + FA \quad (2)$$

where  $CA$  is the current account,  $S$  is savings,  $I$  is investment,  $G$  is government expenditure,  $T$  is taxes,  $BOP$  is balance of payments,  $FA$  is the financial account. Further, it should be noted that the current account is determined by,

$$CA = EX - IM + \text{Net Factor Income}$$

where  $EX$  is exports, and  $IM$  is imports. *Net factor income* (NFI) is the difference between the income earned by PNG nationals living abroad and the income earned by foreigners living in PNG.

In equation (1),  $T - G$  is the budget balance or budget surplus (as shown in Figure 2), and  $S - I$  is net private sector savings. Equations (1) and (2) are key in elucidating the relationship between fiscal settings and the foreign exchange market. The link shows that fiscal policy settings will influence outcomes in the foreign exchange market.

Equation (1) shows that for a given level of net private sector savings ( $S - I$ ), an increase in the budget deficit (a fall in the budget surplus,  $T - G$ ) will decrease the current account balance,  $CA$ . The link between government expenditure and the current account is particularly strong in Papua

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New Guinea (as noted in Palmer, 1979; Garnaut and Baxter, 1984; Duncan et. al. 1998) and is driven by the high propensity to import of government spending (as we discuss in Section 6).<sup>2</sup>

#### 7.2 Estimation of link between Budget Deficit and Current Account Deficit

We demonstrate the strength of the link between the budget balance and the current account balance in the following analysis. In Figure 3 we show a plot of the change in Budget Surplus as a percentage of GDP ( $\Delta ((T-G)/GDP)$ ) against the change in CA as a percentage of GDP ( $\Delta(CA/GDP)$ ) over PNG's history from 1975-2019.<sup>3</sup> We find that when the budget deficit increases (T-G falls) the current account deficit also increases (CA falls). Another way of saying this is that an increase in the budget deficit leads to an increase in the current account deficit.<sup>4</sup> As we demonstrate below, this puts pressure on the exchange rate.

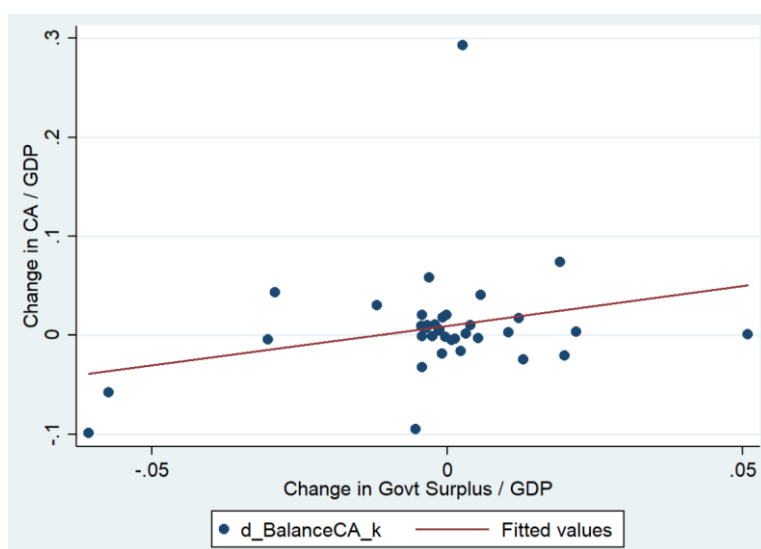


Figure 3: Effect of Government Budget Balance on Current Account Balance, 1975-2019

Source: Authors

<sup>2</sup> As an aside, this was a motivating factor behind the hard Kina policy which was in place over the period of independence to the mid-1990s

<sup>3</sup> Note that the  $\Delta$  symbol indicates a change in the variable.

<sup>4</sup> The purpose of the section is to point out that an increase in the fiscal deficit will lead to an increase in the current account deficit *ceteris paribus* (all else equal or unchanged). There are certainly other factors which may impact the relationship between the budget deficit and the current account deficit, however an increase in the fiscal deficit has had a significant impact on the current account deficit as this analysis demonstrates.

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We estimate the relationship between the change in the fiscal balance and the change current account balance using regression analysis (simple OLS). We find that a one percent increase in the government's budget deficit as a proportion of GDP (a decrease in  $(T-G)/GDP$ ) leads to a 0.8 percent increase the current account deficit as a proportion of GDP (a decrease  $CA/GDP$ ).

$$\Delta \frac{CA}{GDP} = 0.001 + 0.801 \Delta \frac{(T - G)}{GDP}$$

This relationship is commonly known as the twin deficits, which is a causal link between the budget balance and the current account balance. While this analysis is simple, our estimate fits with others found in the literature, although the sensitivity of the PNG's current account to a change in the fiscal balance appears to be on the high end. For example, Bluedorn and Leigh (2010) examine an international dataset that includes 17 OECD countries and find that a one percent decrease in fiscal balance causes a 0.6 percent decrease in the current account balance.

We have established that in PNG a fall in  $T-G$  leads to a fall in current account,  $CA$ . Equation (2),  $BOP = CA + FA$ , provides the link between the government's fiscal position and the foreign exchange market. Equation (2) is the balance of payments, and summarizes all of PNG's international transactions: between the PNG economy and the economies of all the other countries with which it trades. Thus, the balance of payments summarizes activity in the foreign exchange market. The balance of payments is the sum of the current account ( $CA$ ) and the financial account ( $FA$ ), where the current account includes the trade balance (the difference between exports and imports) and net factor income. The financial account,  $FA$ , is the difference between private sector capital inflows into PNG (the purchases of PNG assets by foreigners) and capital outflows (the purchase of foreign assets by PNG citizens).<sup>5</sup> The balance of payments is directly linked to the foreign exchange market as noted above (and the diagram in Figure 4) with the demand for foreign exchange determined by imports and capital outflows (PNG's purchases

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<sup>5</sup> In recent years, the IMF has defined the balance of payments as  $CA=FA$  where the financial account ( $FA$ ) includes both private and government transactions, that is, it includes the change in official reserve assets. For the purposes of this exposition, it is more transparent and assists in elucidating the current situation if we revert to the previous definition and define the financial account as the difference private capital inflows and outflows. The balance of payments ( $BOP$ ) is then the change in official reserve assets, which is the sum of forex market interventions by the BPNG.

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of foreign goods and assets) and the supply of foreign exchange determined by exports and capital inflows (the world's purchases of PNG goods and assets). When there is an imbalance between the demand and supply for foreign currency, as in the current situation where there is an excess demand for foreign currency, then the balance of payments is in deficit and the BPNG must sell foreign currency reserves to support the fixed exchange rate, or allow the exchange rate to depreciate.

Linking equations (1) and (2) allows insight into the current situation in PNG. From equation (1), when the fiscal deficit increases, as has happened over the past seven or eight years, then the current account balance falls. We have noted the strong link between the two above. Looking now to equation (2), as the current account falls then, to keep the balance of payments at its initial equilibrium (to keep the foreign exchange market in equilibrium), either there must be increased borrowing from abroad so that the financial account (FA) increases by an offsetting amount, or alternatively the exchange rate must depreciate. A depreciation makes PNG's goods cheaper to the rest of the world, and will increase PNG's exports and decrease imports which undoes the deterioration in the current account caused by the fiscal expansion.<sup>6</sup> In the absence of an increase in foreign borrowing, and when the exchange rate is fixed, in response to an increase in the fiscal deficit, the balance of payments moves into deficit, and there is an excess demand for foreign currency. The BPNG will have to sell reserves to support the exchange rate at its current level and country's stock of foreign reserves will start to run down.

In summary, under a fixed exchange rate regime, an increase in the fiscal deficit will lead to a running down of foreign exchange reserves. Alternatively, if the exchange rate is floating then an increase in the fiscal deficit will cause a depreciation of the exchange rate. Under a crawling peg, there will be some combination of both; that is, a weakening of the exchange rate and a decline in reserves. Thus, fiscal restraint is imperative in supporting of the stability of the exchange rate regime both in fixed or floating exchange rate regimes, or a crawling peg regime (which lies somewhere between a fixed and floating regime). In the case of a fixed or crawling peg exchange

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<sup>6</sup> We talk more about this in Section 11.5 when we discuss export supply elasticities and import demand elasticities, and the response of the trade balance to a depreciation.



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rate arrangement, fiscal restraint allows the central bank to maintain the currency peg without having to defend it by spending reserves. In the case of a floating rate, the exchange rate does not depreciate.

#### 7.3 Fiscal Rules

The existence of a strong link between fiscal settings and the foreign exchange market in PNG suggests the need for fiscal restraint to support the exchange rate regime, and the convertibility of the Kina. We provide a brief discussion of fiscal rules which can be seen as a tool to assist government policy-makers in achieving appropriate fiscal settings to support both convertibility in the forex market, and development goals.

Policy-setting in a resource rich developing country is complex and challenging. Looking across the entire lifespan of a country, the exploitation of a non-renewable resource provides a short but significant pulse of income which should be shared across both current and future generations to ensure intergenerational equity. This suggests that the governments should save some fraction of the wealth generated by resource projects today for future generations. However, against this the government must balance the demands of current development needs.

Fiscal rules can help to guide governments in balancing this trade-off. PNG already has one fiscal rule in place, the Medium Term Debt Management Strategy, which puts a limit on the government debt to GDP ratio (currently 35 percent). However, in countries with large resource wealth like PNG, it is good to have in place additional fiscal rules to guide allocation of resource wealth over time (how much should be spent now, and how much should be saved). One such rule is the Permanent Income Hypothesis (PIH), which specifies that for a country receiving only resource revenues, a sustainable level of expenditure is such that the deficit in the non-resource primary balance is held to the perpetuity value of resource wealth (the value of a perpetual annuity earned on total resource wealth). Such rules provide useful benchmarks, and while they should be used more as a guide than a strict rule, they can give policy-maker a sense of whether or not current saving is high enough. Such rules have the added benefit that they help to

coordinate on lower levels of fiscal spending which will support achieving and sustaining currency convertibility.<sup>7</sup>

## 8 Monetary and Exchange Rate Policy in PNG: 2000 – 2020

In 2000, the BPNG was granted independence from the government, following a trend in many developed countries in the preceding decade, beginning with New Zealand in 1989. The central bank was given a dual mandate to keep inflation low and to promote macroeconomic stability and economic growth. The BPNG was granted instrument independence, allowing it to choose its policy instruments, and was required to publish semi-annual monetary policy statements outlining their outlook and policy responses over the forthcoming six months.

The BPNG approach to monetary policy is not classified as following an inflation-targeting regime, like central banks in more developed markets, given the difficulties with inflation forecasting in PNG. In order to do so would require better and more timely data on the state of the economy. It could be safely argued that the BPNG has been acting with constrained discretion over this period, seeking to meet their inflation objectives *first*, and given that then seeking to meet the full employment and growth part of the mandate. While the inflation-target for the BPNG has not been explicitly stated, the IMF noted in 2006 that the BPNG had a medium-term inflation target of 4 percent (IMF Article IV, March 2007, p. 7).

Given the PNG economy's high dependence on imported inputs for consumer goods, business inputs, and fuel, the rate of inflation is particularly sensitive to exchange rate movements, as evidenced in Sampson *et.al.* (PEB, 2006), who find that the pass-through of exchange rate movements to underlying inflation is around 50-60 percent. Sampson and Kauzi also find that pass-through is complete after between four and six quarters. The IMF and the BPNG estimate that pass-through is between 30 and 40 percent, and that it is complete in four quarters. During

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<sup>7</sup> Further, in a resource boom, savings should be held in a sovereign wealth fund. This will assist in managing domestic liquidity.

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this decade, the BPNG ran the exchange rate as a managed float, an appropriate setting given the relatively thin market and volatility in resource inflows.

International capital mobility for PNG is very low, with capital inflows primarily taking the form of foreign direct investment, donor-related flows and capital outflows of loan repayments and profit remittances. This is a result of the low substitutability of domestic and foreign assets.

There is very little, if any, of the short term flows that link interest rate changes to exchange rate changes in countries where domestic and foreign assets are more closely substitutable. The low capital mobility in PNG is evidenced by the observation of a deterioration in the balance of payments when the government undertakes a fiscal expansion. This is driven by a deterioration in the current account (as we note Section 7) with little offsetting response in the financial account in the face of the higher interest rates induced by fiscal expansion. This immobility affords the BPNG the opportunity to set both the interest rate and the exchange rate; an option not available to central banks in countries where financial flows respond more freely to interest rate differentials.<sup>8</sup>

#### 8.1 Monetary and Exchange Policy: 2002-2013

In setting policy over this period of time, the BPNG acted to influence both the domestic interest rate and the exchange rate to moderate and control domestic inflation. From the BPNG's Monetary Policy Statements of this period, it appears that the BPNG saw a division in the roles of these two policy instruments, with the exchange rate targeted at reducing or moderating the impact of foreign inflation, and changes in Kina Facility Rate (KFR) used to influence domestic interest rates and through them domestic economic activity.<sup>9</sup> The KFR, the BPNG official policy rate, was introduced in early 2001 to indicate the central bank's policy stance, with the view that changes in it would translate into change in market interest rates. However, over this period and particularly from 2008 onwards, liquidity in the banking system was high, leading to a situation in which the KFR did not have direct influence over domestic market interest rates. In recognition of this, the bank's Monetary Policy Statements in the later part of this period began

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<sup>8</sup> Indeed, monetary policy-makers are subject to the Impossible Trinity, which deems that it is impossible to set both the exchange rate and the interest rate in circumstances where capital mobility is very high.

<sup>9</sup> For example, an appreciation of the Kina could be used to lower inflation.

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to refer to the KFR specifically as a device to signal the bank's policy stance. Instead the BPNG used open market operations, buying and selling central bank bills (CBBs) and Treasury bills, adjustments in the cash reserve ratio (CRR) (the minimum reserve-deposit ratio for PNG-based banks), and the "repo" rate to influence domestic monetary conditions.<sup>10,11</sup>

During the commodities price boom from 2003-2008, the high export tax receipts to the government were converted into Kina and deposited in commercial banks. There were not fully sterilized by the central bank resulting in excess liquidity in the banking system. While the excess liquidity did not increase credit growth due to a lack of lending opportunity for the banks and was not inflationary, it did increase the demand for CBBs and short-term Treasury bills by banks. This pushed down domestic interest rates below the KFR, reducing the effectiveness of monetary policy. In order to remove the excess liquidity, the central bank primarily sold CBBs, though it also raised the CRR, with outstanding CBBs increasing by a factor of 32 over the period 2004 to 2011 (IMF Article IV, 2012). This arrangement was costly to the central bank, and highly profitable to the domestic banks who were paying low interest rates on the government's trust account deposits and using them to buy central bank bills, which paid significantly higher interest rates. This led to the transfer of seigniorage, otherwise belonging to the PNG Treasury, to the domestic banks. While the BPNG made ongoing requests to the government to move their trust accounts to the BPNG, they were largely unheeded.

## 8.2 Monetary and Exchange Rate Policy: 2014-2020

With the start of exports of LNG in mid-2014, over the past six years Papua New Guinea has run large current account surpluses. This, however, has not translated to sufficient foreign exchange

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<sup>10</sup> This policy set-up was not dissimilar to that used by the People's Bank of China at the time, though in their case capital immobility was imposed by policy, and not a nature feature of the economy. Further, while the BPNG relied more on CBB sales and less on increases in the CRR, the opposite was the case in China.

<sup>11</sup> Over this period, the means through which the BPNG conducted monetary policy was by controlling the growth of reserve money, which then influenced the growth of the broader monetary aggregates which influenced the price level. While the KFR was moved infrequently and was used to signal policy stance, the repurchasing facility rate (or 'repo' rate), which trended with but moved independently of the KFR, was the main policy rate influencing market interest rates by anchoring the short end of the yield curve. (maybe move this into the main body of text)

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holdings to satisfy the excess demand. The reason is that the current account surpluses are offset by financial outflows due to debt repayments associated with the PNG LNG project.

As a result, during this period the Bank of Papua New Guinea has been rationing the issue of foreign currency to PNG-based businesses and households. The constraining of the access to foreign currency limits imports of foreign goods and services, purchases of foreign assets, and limits profit repatriation. In this event, while the Bank of PNG is accumulating foreign exchange reserves, there is an accumulation of foreign exchange orders from domestic agents within the banking system that exceeds the reserve accumulation. Evidence of this imbalance is the accumulation of a stock of outstanding foreign exchange orders within the banking system over the period. Estimates of the outstanding orders has varied widely over this period. At its height, during the period of the Ok Tedi mine closure, the stock of outstanding orders may have risen as high as K4.5 billion.

This situation is illustrated in the foreign exchange market in Figure 4. On the vertical axis we have the exchange rate, defined as the number of Kina per USD. The supply curve,  $S_{FC}$  represents the supply of USD in the foreign exchange market. Sales of PNG goods overseas contribute to the supply of foreign currency, as does foreign investment in PNG. As the exchange rate depreciates, the supply of foreign currency increases as PNG's goods become cheaper to overseas buyers, and so the supply curve slopes upwards. The demand curve,  $D_{FC}$ , represents the demand for USD in the foreign exchange market. Purchases of imports by PNG business, households and the government contribute to the demand for foreign currency, as does the repatriation of profits by foreign-owned PNG-based businesses.

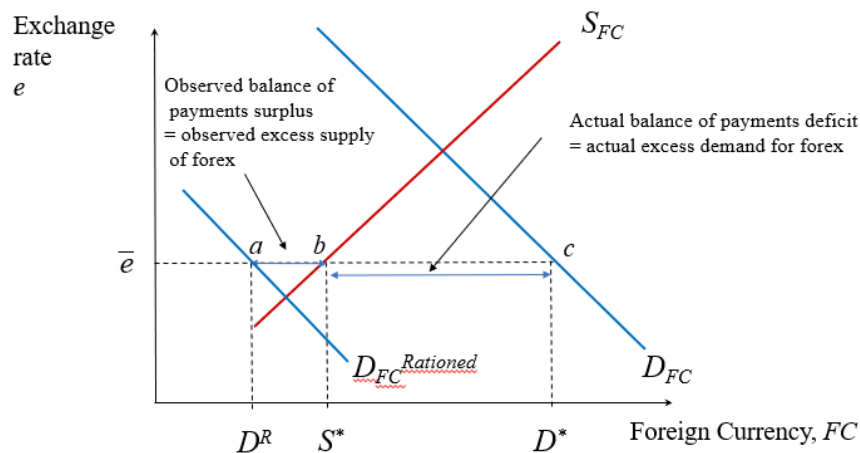
At the prevailing exchange rate,  $\bar{e}$ , there is a mismatch between the demand and supply for foreign currency, with the demand for foreign currency exceeding the supply of foreign currency. This can be seen as the distance  $bc$  in the diagram. This distance also represents the balance of payments deficit. By rationing access to foreign exchange, the BPNG is limiting imports and profit repatriation. This has the effect of reducing the demand for foreign currency, shifting the demand for foreign currency to the left to  $D_{FC}^{Rationed}$ . Now at the exchange rate,  $\bar{e}$ , the

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supply of foreign currency,  $S_{FC}$ , exceeds the demand for foreign currency,  $D_{FC}^{Rationed}$ , by distance  $ab$ . A balance of payment surplus is observed, with the BPNG accumulating forex reserves.

However, because the true demand for foreign currency remains above the rationed level, unmet orders for foreign exchange accumulate in the banking system as market participants seek to purchase imports and repatriate profits in the face of the restricted access to foreign exchange. In the diagram, while the BPNG accumulates reserves, given by distance  $ab$ , unmet orders for foreign exchange of distance  $ac$  accumulate in the banking system. The true mismatch between the demand and supply demand for foreign exchange is the distance  $bc$ , which is the difference between the unmet orders ( $ac$ ) and the accumulation of reserves ( $ab$ ).



*Diagram: PNG Forex Market: observed BOP Surplus, actual BOP deficit*

*Figure 4: Position of PNG's Foreign Exchange Market over past 6 years*

Over this period of rationing, domestic importers have adjusted to this regime, relying on the support of foreign parent companies, and by managing the expectations of their overseas suppliers around delays in payments due to the rationing of foreign exchange. Firms have also delayed payments of dividend and remittances and, in some cases, have reinvested them in onshore projects rather than wait to send them offshore. While the domestic banks are able to form an estimate of the stock of outstanding orders, there is evidence that companies are not placing orders to repatriate profits until they are assured that the transaction will clear within a

reasonable period time. This makes measuring the true magnitude of the stock of outstanding orders difficult.

## 9 Dealing with the Backlog: Stock and Flow Imbalances

### 9.1 Context and Market Conditions

There has been an ongoing shortage (excess demand) for forex in the PNG foreign exchange market over the past 6 years. While the BPNG has undertaken some sales of foreign exchange to the market to partially meet this shortage, rather than allowing the exchange rate to depreciate, the market's access to foreign exchange has been rationed. The rationing has been implemented through the issue of various directives by the BPNG as a means to limit the country's demand for foreign exchange. The BPNG has instructed the official foreign exchange dealers to prioritize certain types of transactions in the queue for foreign exchange, and to give lower priority to, or to prevent the execution of, other types of transactions. For example, there was a period of time in 2015 and 2016 during which remittance of business profits and dividends was prevented.

In a situation where the currency is fully convertible, there would be no queue for foreign exchange and market participants would be able to buy (or sell) their desired quantity of foreign currency at the price prevailing in the foreign exchange market. The limits on access to forex have altered the behaviour of PNG-based businesses because they have had to adjust to a regime where access to foreign exchange is constrained and the filling of a foreign exchange order can be delayed by weeks and sometimes months. There has been some firm selection, with weaker businesses exiting the market. Firms have also had to manage the expectations of their foreign suppliers in terms of the timing of payments of invoices, and also the expectations of their overseas parent firms (if they have them) in terms of the delays of dividend payments and profits. In some cases, rather than remitting profits overseas, businesses have reinvested them in PNG. In the face of constraints on access to foreign exchange, business have faced trade-offs between the remittances of profits against the purchases of imports of good to sell or as inputs into production.

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The costs to the economy of import compression are significant as this leads to a reduction in investment (preventing capital deepening), and an increase in business cost which reduce exporting opportunities, both of which reduce growth. Import compression also reduces variety and availability of goods for domestic consumers which also has a welfare cost.

Because rationing of foreign exchange has persisted for an extended period, as a result of the ongoing flow imbalance (the daily excess demand for foreign exchange) there is now a backlog of outstanding orders which is made up of an accumulation of foreign exchange orders in the banking system, and unexecuted orders on company and household balance sheets. That is, companies and household are holding domestic assets that they would prefer to convert to foreign currency or foreign goods that they have not yet brought to market because of the lack of convertibility. This part of the backlog is hidden from the conventional measures, which just look at the outstanding orders held by commercial banks.

The true backlog is likely to be considerably higher than the estimates of it, which have varied between K1 billion and K4.5 billion over the past 6 years and is currently estimated at less than K1 billion by the BPNG. Given the difficulties business and household have faced in accessing forex over the past 6 or 7 years, many firms and households will be holding assets on their balance sheets that they would like to convert into forex and will have latent demand for imported goods. Once convertibility of the Kina begins to improve, this demand will begin to appear in the banking system as these groups readjust their portfolios and the latent demand for imports is expressed.

#### **9.2 A Bathtub Analogy for the Backlog**

One way to think about this situation is by analogy. A bathtub can be filled with water when you turn the tap on and can be drained of water when you pull out the plug. If the flow into the tub exceeds the flow out of the tub, then the bathtub starts to fill up. We can think of the water in the bathtub as the stock of outstanding foreign exchange orders, the flow into the tub as new orders for foreign exchange, and the flow out of the tub as the execution of foreign exchange orders either from the existing stock or the flow of new orders. In a system with full currency convertibility, the bathtub is empty and each day the flow into the bath (the new orders) is equal



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to the flow out (the meeting of those orders). The daily demand for foreign exchange equals the daily supply of foreign exchange, and the spot market clears.

Because there has been a long period during which the demand for foreign exchange (the flow into the tub) has exceeded the supply of foreign exchange (the flow out of the tub), there is now a stock problem: a large quantity of unfulfilled foreign exchange orders (a lot of water in the tub). As noted in recent BPNG Monetary Policy Statements, there are now days where the spot market clears. However, the stock of outstanding orders remains. It is misleading to state that the spot market is clearing in the presence of a substantial backlog. One of the challenges of returning the market to full convertibility is dealing with this stock of orders. In the next section, we present a model to analyze this situation.

### 9.3 A Model of a Forex Market with a Backlog of Orders

Firstly, some basic characteristics of the PNG foreign exchange market. As we have noted in Section 8, capital mobility is low. That is, domestic and foreign assets are poor substitutes and as a result capital flows are relatively insensitive to interest rate differences between domestic and foreign countries. Further, sales of foreign exchange are tightly controlled, so there is no risk of speculative attack on the exchange rate and the standard models of currency crisis don't apply. As noted above, there has been a pent up demand for forex over an extended period of time and as a result there is a large backlog, or stock of Kina waiting to be converted into forex. Part of this stock is visible in the domestic banking sector, part of it is hidden in the balance sheets of domestic businesses and households.

There is also a demand for Kina, that is, a stock of forex being held outside the country waiting to be converted into Kina when the price is right. This includes investors, exporters who want to remit profits, and speculators. The holders of this stock will not enter the market until the exchange rate adjusts to a level consistent with the expectations that they hold about what the value of the Kina should be in terms of forex. The reason that the holders of the stock of forex are withholding their demand for Kina (the conversion of their holdings of foreign currency into Kina) is that they know that if they convert currency at the current exchange rate they will suffer

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a capital loss when the Kina depreciates. They are deferring their demand until a time at which the Kina exchange rate is closer to their equilibrium estimates of it.

We now put some specifics to the model. We define  $F_D$  as the backlog of unmet orders for foreign exchange, which is the cumulative excess demand over the period during which foreign exchange has been rationed. This comprises the unmet desired purchases of imports and desired capital outflows (purchases of foreign goods and assets, remittances of profits). We define  $F_S$  as the speculative stock of Kina demand, which is the export receipts and desired capital inflows (FDI inflows, for example) that have been held offshore in foreign currency because of the exchange rate misalignment.

The spot demand for foreign currency,  $D_{FC}$ , is made up of imports, capital outflows and the fraction of the backlog that is being brought to the market in this period,  $\gamma F_D$ , where  $\gamma$  is a parameter determining this fraction, which lies between 0 and 1. The demand for foreign currency is made up of flow ( $IM, K_O$ ) and stock ( $F_D$ ) components. We take the value of  $\gamma$  to be 1, which means that the entire backlog is brought to market. This is justified in two ways. Firstly, the holders of Kina are compelled to convert their currency into forex for economic reasons; for example, to exploit unmet opportunities. Secondly, like the holders of forex below, they believe that the Kina is currently too strong. Thus, they expect it to depreciate, in which case they will suffer a capital loss if they are still holding Kina when it does depreciate. Imposing that  $\gamma = 1$  imposes that holder of the backlog,  $F_D$ , will continue accept conversion from Kina to forex as the exchange rate weakens, that is, they don't withdraw their orders from the market as the Kina weakens. This fits with our observations of behaviour the PNG foreign exchange market.<sup>12</sup> The spot demand for Kina may be written as

$$D_{FC} = IM + K_O + \gamma F_D$$

The spot supply of foreign currency,  $S_{FC}$ , consists of exports, capital inflow (overseas purchases of PNG asset) and the fraction of the stock of outstanding Kina orders which is being brought to the market in this period,  $\tau(e_L, e_H)F_S$ . Again  $\tau(e_L, e_H)$  lies between 0 and 1, and determines the

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<sup>12</sup> We discussed foreign exchange market arrangements with a number of the commercial bank in PNG.

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fraction of the outstanding Kina orders that will be brought to market. However the value of  $\tau$  depends on the level of current exchange rate relative to the beliefs or expectations that the holders of forex have about the true equilibrium value of the exchange rate. We assume these expectations are distributed uniformly on the interval  $[e_L, e_H]$ .<sup>13</sup> So, if the exchange rate,  $e$ , is at or below  $e_L$ , that is  $e \leq e_L$  then  $\tau = 0$ . That is, the entire stock,  $F_S$  is being held out of the market. In this circumstance all of the agents believe the Kina exchange rate will depreciate relative to its current level, and so will not be willing to convert their forex into Kina at the current rate because they will incur a capital loss. This is what is currently happening in the PNG forex market. If the exchange rate is at or above  $e_H$ , that is  $e \geq e_H$ , then  $\tau = 1$ . In this case, all of the agents will bring their forex exchange to the market for conversion into Kina because their expectation is that the Kina will hold its value or appreciate, which means a capital gain.<sup>14</sup> The important point is that there is a widespread view among this group that the value of the Kina is currently too strong, that they expect it to depreciate, and so anyone with foreign currency will hold back from making a trade into Kina. The spot supply of foreign currency is

$$S_{FC} = EX + K_I + \tau(e_L, e_H)F_S$$

To simplify the solution of the model we assume that the flows ( $IM$ ,  $EX$ ,  $K_I$ , and  $K_O$ ) are small relative to stocks  $F_D$  and  $F_S$ . This allows us to ignore them, and to focus on the stock imbalance.<sup>15</sup> Given this then

$$D_{FC} = F_D$$

$$S_{FC} = \tau(e_L, e_H)F_S$$

Since holders of  $F_S$  have expectations that the correct exchange rate is distributed uniformly on  $[e_L, e_H]$ , then  $S_{FC}$  is an upward sloping line drawn between  $e_L$  and  $e_H$ . Since holders of  $F_D$  will

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<sup>13</sup> Also that and further that  $S_{FC}$  is also uniformly distributed across all holders of the stock of forex. These assumptions ensure that  $\tau(e_L, e_H)F_S$  is linear in  $e$ .

<sup>14</sup> We do not specify here how these agents form these expectations of the exchange rate as that would require a fuller specification of the economy, however that could be done in a straight-forward manner.

<sup>15</sup> This does not affect the solution of the model or the policy implications.

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purchase foreign exchange at any price,  $D_{FC}$  is a vertical line. These curves are drawn in the diagram below.

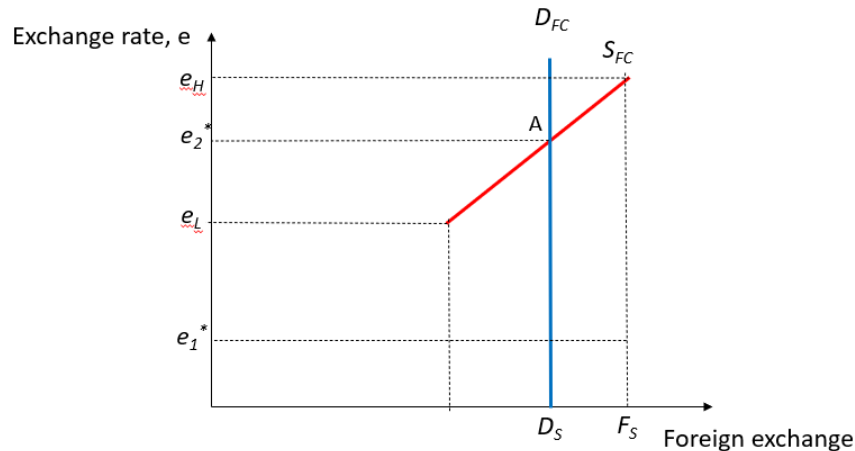


Figure 5: Stock equilibrium in the forex market

Exchange rate  $e_1^*$  is the current market exchange rate and exchange rate  $e_2^*$  is the exchange rate that will clear the backlog and bring the forex market back into equilibrium. In order to clear the backlog, the exchange rate must depreciate from its current level to a level at which the holders of  $F_S$  are enticed to convert their forex into Kina. That is, the exchange rate must depreciate to the level  $e_2^*$ , which lies between  $e_L$  and  $e_H$ .

#### 9.4 Conclusion of Analysis and Guidance for Policy

The conclusion of this analysis is that to entice the holders of the stock of forex to bring it to market the Kina has to depreciate to a level which is consistent with the beliefs or expectations of this group. Thus, in order for the Kina to return to full convertibility it is essential that the exchange rate depreciates by a sufficient amount, in this case from  $e_1^*$  to  $e_2^*$  in Figure 5. That is, to a point such that fraction of this stock of forex that enters the market is large enough to match the current backlog. As noted above, the holders of the stock of forex are deferring their demand for Kina until the exchange rate depreciates to a level at or above their equilibrium estimates of it to avoid capital loss. Once the Kina depreciates far enough, they believe that the Kina will not weaken further, that is, it will either hold stable or appreciate. It is not until the Kina has depreciated to this point that they will enter the market.

## 10 Proposed Policy Actions that could be used to address the Shortage

In this section, we provide analysis on seven proposed policy actions that could be used to address the shortage of foreign exchange. At the outset, we will state that, in our view, none of the seven proposed policy actions on their own, or in concert, will be adequate to address the lack of convertibility in the PNG foreign exchange market. As noted throughout this document, the fundamental problem is a structural shortage of foreign exchange, that is, a mismatch between the demand and supply for foreign currency at the given Kina exchange rate. Having said this, we support a number of the proposed policy actions listed below.

### 10.1 Avoiding inappropriate investments for a State, including the lost FX on the Solwara deal and the UBS borrowings;

Any investments in foreign assets by the State, whether deemed appropriate or not, will increase the demand for foreign currency. The use of foreign currency for these activities will reduce the forex available for other market participants, and will contribute to a forex shortage if one exists when the transaction is executed. Once the investment is made, the government now holds a foreign currency asset. If the asset holds or increases its value, it can be converted back into Kina in the future, at which point it will contribute to the supply of foreign currency. However, if the value of the asset diminishes, as in the case of the Solwara deal and the UBS borrowings, then this conversion back into Kina either does not happen or happens at a diminished level.

While UBS loan and the Solwara deals are in the past, they may indicate a predilection for speculative investment by the State. One of the questions that arises here is the role of the state in investment, that is, what types of investment should the state be involved in. Usually investment by the state is directed towards situations of market failure. Here, if left in the hands of the private sector, the outcome will result in under investment and a welfare loss due to under provision of a good or service. By this criteria, the state would leave speculative investment to the private sector. A general guideline might be that the state should not use public financing to

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engage in investment unless there is a market failure, and without state involvement the private sector will either not invest, or will underinvest. However, the identification of market failures is difficult. Further, the observation of an investment opportunity that the private sector is not exploiting does not imply there is a market failure. In fact, the lack of private sector involvement may reveal something about the true viability or value of the investment.

A key issue relating to government investment is how large an equity stake the PNG government should take in resource projects going forward. There is significant risk associated with taking equity stake in resource projects, as can be seen from equity stake, and associated loan, taken in PNG LNG which resulted in a loss of around USD 250 million. A lower risk strategy is to have a more balanced stream of income from resource projects over time. That means to have more frontloading of resource revenue streams relative to the current approach. This can be achieved through higher royalty payments and less generous tax depreciation schedules.

In terms of the effect of government behaviour on the foreign exchange market, of much greater relevance here is the large increases in the fiscal deficits over the past 8 years. As we have discussed these issues in depth in Section 7 we will not elaborate on them further here.

#### 10.2 [Require SOEs and/or other businesses to remit all revenues back to PNG instead of holding FX revenues overseas](#)

Remittances of forex revenues held overseas by SOEs should be returned to PNG, unless there is a specific and compelling reason to hold them offshore, for example, for future investment or to cover costs. These revenues will contribute to the supply of foreign currency, and thus can reduce the shortage of forex at the point at which they are remitted. However, as we understand from various discussions, the SOE's foreign exchange revenues are not large enough to contribute materially to filling the backlog in forex orders, or to reduce in any significant way future forex shortages arising from exchange rate overvaluation.

As noted in Section 9.3, one of the reasons that domestic business may not return overseas foreign exchange earnings to PNG is because by holding them offshore, they avoid needing to

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join the queue for forex the next time they need to need to make an overseas purchase. The same rationale applies to SOEs. In addition, SOEs may have an incentive to keep revenues offshore because it allows them to avoid government oversight of their activities, and to protect their profits from use by government for purposes other than their own.

In addition to contributing to the supply of forex, requiring SOE's to remit revenues back to PNG has an additional benefit in that it increases the transparency of SOE activities, and makes it more difficult for them to conceal earnings from the government. In principle, revenues should accrue to the government, and be paid directly to the government and/or a sovereign wealth fund account. The amounts held abroad should be determined by the government, not by the SOE.

In terms of PNG resident exporters, the answer is less clear. Firstly, there has been a surrender requirement in place since 2015 which requires resident exporters to repatriate forex proceeds in excess of foreign liabilities within 3 months. However, the level of compliance for this requirement by exporters is unclear, as is how strictly the requirement is being enforced.

Secondly, one of the goals of this exercise is to have a currency which is fully convertible. This means that individuals and business are able to freely exchange domestic and foreign currency at the prevailing exchange rate in their desired quantity. While it seems somewhat counter to this objective to require that privately-owned business be compelled to remit foreign exchange revenues, there is actually some rationale for this, which we will elaborate on below.

A coordination problem in an economic system occurs when a group of agents (firms or individuals) could achieve a more desirable equilibrium but do not because they cannot coordinate and align their decisions. A classic example is two friends who would like to meet at either the movies or the opera. They would each receive more enjoyment out of attending the same venue together, but they cannot coordinate their attendance at the same event in advance (they can't call or text each other). Coordination problems result in multiple equilibria and some equilibria may be preferable to others. It could be argued that firms holding their forex receipts

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offshore is a result of a coordination failure. Because all other firms are holding their forex offshore, a firm knows that if they remit their funds and convert them into Kina they will then have to join the queue the next time they want foreign currency. However, this is only the case because all other firms are holding their foreign currency offshore. The equilibrium that results is one in which all firms keep their forex offshore. However, an alternative equilibrium may exist, which would be one in which all firm convert all of their forex into Kina. Because all firms have taken this action there are adequate foreign exchange reserves, and there is no queue. Firms can immediately convert their Kina into forex if they so desire. This alternative equilibrium requires all firms to coordinate on the action of returning their forex earning to PNG.

A surrender requirement is one way to assist firms in coordinating on the latter equilibrium. However, this requires that the foreign exchange earnings of resident exporters are sufficient to meet the demands of the market, including the clearing the backlog. If one includes the large resource multinational companies, this might actually be the case. However, given that they are exempt from surrender requirements, then perhaps it is rational that the other exporters keep their forex earnings offshore in acknowledgement that even if they were all to remit their earnings a queue for forex would still remain.

The reasons that resident exporters don't remit foreign exchange earnings extend beyond a desire to avoid the queue of course. As we explain in Section 9, firms may also withhold their demand for Kina from the market in order to avoid capital losses because they expect a depreciation.

A more strict enforcement of the surrender requirement may be worth considering if the sum of forex earnings held offshore (excluding the resource companies who have an exclusion) would be sufficient to clear the foreign exchange backlog, and facilitate balance between the demand and supply of foreign exchange into the future. However, it cannot be assured that this would be the case. Further, the costs of enforcing the surrender requirement may be very high, and firms may find it easy to prevent the forced return of forex either through evasion (hiding forex), or avoidance (appealing to multi-jurisdictional status or through other legal means).



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Based on the analysis above, it is likely that the cost of a stricter enforcement of the surrender requirement is likely to outweigh benefits, and so we would not recommend this action.

#### 10.3 More active management and use of PNG's foreign exchange reserves

The active management of PNG's foreign exchange reserves would allow these assets to earn a positive rate of return, thus increasing their value over time. However, given that PNG's foreign exchange reserve holdings are relatively small any invested foreign exchange would need to be held in assets with high liquidity, meaning they could be easily converted back into foreign exchange because they need to be readily usable.

Firstly, we begin by discussing the purpose of foreign exchange reserves, which are as follow:

- A country holds foreign exchange reserves to defend the value of the currency if the exchange rate is fixed, or there is a managed float / crawling peg like in PNG. This means that if there is downward pressure on the currency due to current market conditions, the central bank can buy Kina using foreign exchange to maintain the Kina's value.
- Foreign exchange reserves are held to maintain liquidity in the event of an economic crisis. For example, suppose there was an economic crisis in which PNG exports receipts fell significantly and PNG's foreign creditors refused to lend the country any money. This is called a sudden stop. In this case, the foreign exchange reserves would allow PNG to continue to pay for imports of important products like food and medicine during the crisis.
- Adequate holdings of foreign reserves are reassuring to international investors and international lenders. For international investors, adequate holdings of foreign reserves indicate the central bank has the fire power to defend the value of the currency, particularly in the case of a speculative attack against the currency so that investors will not take a capital loss of the value of their in-country assets.<sup>16</sup> For lenders, adequate

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<sup>16</sup> As mentioned elsewhere in this document this is unlikely to occur in PNG given the low mobility of capital, and restrictions on foreign exchange trading.

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foreign currency reserves mean that convertibility is assured and there is sufficient forex to meet external obligations such as loan repayments.

As can be seen from the list above, foreign exchange reserves may be needed for use during a crisis, and at short notice. If PNG's foreign exchange reserves were invested they must be held in assets that are highly liquid, that is, in assets which can quickly and costlessly converted back into foreign currency. Examples of such assets are US government bonds, and gold. Having an actively managed portfolio means that some funds would be held in illiquid assets, which would make it difficult and costly to access them at short notice.

As a point of comparison, China has a vast stock of foreign exchange reserves; currently USD 3 trillion, though in the past it has been as high as USD 4 trillion. China invests their reserves in a wide portfolio of assets including the highly liquid assets we have mentioned, but also in less liquid assets like stocks, and company bonds. China has the freedom to hold a more diverse and less liquid portfolio, which will earn a higher rate of return, because it holds foreign exchange reserves which are vastly in excess of any reserves it might need for the purposes noted above.

The return that can be earned on liquid assets is lower than that on less liquid, or illiquid, assets. Given that PNG's would need to hold a portfolio of liquid assets if it were to invest its foreign exchange reserves, the return would be low. To form an estimate on the return that could be earned, the current yields on US Treasury bonds is at around 0.5 percent per annum for 5 year treasury bonds, 0.7 percent per annum for 10 year bonds, and 1.5 percent per annum for 30 year bonds. Note that because of the deep secondary market for US government bonds it is not necessary to hold a bond to maturity, and it may be sold at any time. Given this, it would be possible to construct a highly liquid portfolio consisting of US Treasury bonds earning in the region of 1 percent per annum.

Since PNG has foreign exchange reserves of around USD 2.5 billion, if 75 percent of these reserves were invested at a return of 1 percent per annum they would earn around USD 19

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million per annum. This is clearly not enough to make a material difference to the current imbalance between the demand and supply for foreign exchange, which is considerably higher than this. However, this is an option which is still worth considering. As an aside, when the sovereign wealth fund becomes active, its investment strategy will be appropriately different, and active management would be recommended.

Investment of foreign exchange reserves in an actively managed portfolio is not appropriate given the need for reserves to be kept in a form which is liquid and readily usable.

#### 10.4 Consider a Gold Bullion bank/reserves option

Changing the denomination of foreign exchange reserves from USD to gold does not alter the supply, demand or price of foreign currency. The fundamental imbalances in the foreign exchange market would remain whether PNG foreign exchange reserves were held in USD, AUD or gold.

Further, holding physical gold as reserves may lead to a number of additional challenges which we outline below:

- i. The price of gold fluctuates widely relative to US dollar, the global reserve currency, and hence, if held in gold the USD value of reserves would also fluctuate. Over the past 10 years the gold price has varied between about USD 1000 and USD 2000 per troy ounce, with a high in 2011 of USD 1830 falling to USD 1070 in 2015 and returning to USD 2070 in 2020. If foreign exchange reserves were held as gold, their value in USD would fluctuate in proportion with the gold price, so from 2011 to 2015 they would have essentially halved in value, before returning to their original value (if there was no additional reserve accumulation). Since the purpose of foreign currency reserves is to hold an adequate level international purchasing power (as noted 10.3) having a level of reserves that fluctuates widely relative to the global numeraire (USD) would require risk management for the contingency of low gold prices.

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Since gold prices generally rise during global shocks (such as the current pandemic) this would provide some insurance in the face of a global shock, increasing the value of PNGs reserves during times of global stress when having a higher level of reserves may be useful. However, negative shocks to the PNG economy do not always coincide with global shocks. There is no reason to expect that the times at which PNG might need to use its reserve will always coincide with high gold prices and levels of reserves. For example, the shutdown of the Ok Tedi mine in 2015 due to drought was a PNG specific shock that occurred when gold prices were at around USD 1100, the lowest point in the past 10 years. Hence, it would be taking on significant additional risk to hold reserves only in gold.

- ii. There are resource costs in holding physical gold which could prove to be significant. Since PNG is a gold producer it seems likely there would be a desire to hold gold reserves in-country. To hold a large quantity of gold one would need to construct and then maintain a specialized high-security gold storage facility. This would require the purchase of land, and the construction of a specialized vault with adequate space for expansion. There would be the ongoing costs of security and maintenance of the facility to secure the gold.
- iii. When undertaking larger interventions in the foreign exchange market, or in the event of a crisis, gold would need to be converted to USD or other currency which could incur significant transactions costs, particularly if large sales of gold were necessary, or if gold needed to be physically moved.
- iv. It may encourage domestic policy-makers to consider moving to a currency backed by gold, which would be a mistake. Historical evidence suggests that moving to a gold standard would be highly problematic and it should be avoided at all costs. Economic growth and inflation both tend to be more volatile under a gold standard. For example, for the US the volatility (standard deviation) of both growth and inflation in the gold

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standard era (1880-1933) was about twice that of the post-Bretton Woods era (post-1944). When the currency is backed by gold, the central bank fixes the rate at which Kina is converted into gold (although the exchange rate between gold and Kina can be altered). This then fixes the money supply to grow at the rate at which the gold supply grows. In such situations, inflation becomes much more variable (the price level is less stable). For example in periods when the output of the economy grows faster than the gold reserves there will be downward pressure on prices, leading to deflation, which can destabilize the financial system.<sup>17</sup> As further evidence against the gold standard, for the US the frequency of banking crises was much higher during the gold standard era (5 crises) than in the subsequent periods (only 2).

On the basis of these arguments, we would strongly recommend against holding a large fraction of PNG foreign exchange reserves as gold.

#### 10.5 Fixing the broken foreign exchange market with the aim of restoring a fully convertible Kina

Fixing the foreign exchange market requires clearing the backlog of orders and depreciating the exchange rate to level at which supply matches demand.

We begin by noting that while there are benefits to enhancing foreign exchange market efficiency, this will not remedy the structural shortage of foreign exchange. In terms of addressing the foreign exchange shortage, focusing on the efficiency of the forex market is of secondary importance.

As noted earlier, the BPNG is the country's major recipient of forex inflows (from minerals and resource tax receipts and royalties). Since the domestic banks receive insufficient forex from their exporter trades to cover their desired importer trades, they must rely on sales of foreign

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<sup>17</sup> In the 1880s, in the US low money supply growth in conjunction with high GDP growth led to ongoing negative inflation of around 3 percent.

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exchange from the BPNG to cover their positions. The direction of trade is always one way because the commercial banks are in ongoing net negative forex positions.

Currently the BPNG sells about USD 50 million per month to the domestic banks. This intervention is grandfathered to the banks based on their share of domestic banking activity. In addition, there is some parallel market activity with a large domestic petroleum importer buying foreign exchange directly from a locally based LNG partner.

A suggestion for improving the allocation of forex exchange would be creation of an interbank market and a daily auction for foreign exchange. The banks and other large foreign exchange market participants would bring their net foreign exchange positions to the market to allow those with deficit positions to bid for surplus foreign exchange. This would have clear benefits in terms of efficiency. Firstly, it would ensure convertibility; that is, market clearing at the prevailing price. Secondly, it would ensure that foreign exchange was being allocated to the highest bidder. And finally, it would give market participants, including the BPNG, transparency about the scarcity of foreign exchange in the market, and level of intervention necessary from the Bank to achieve their exchange rate objectives, while ensuring currency convertibility.

However, under the current circumstances, such an auction will not work. With the BPNG as the market-maker and main supplier of forex, either they would have to give up their control of the exchange rate (the price), allowing it to adjust to the market determined level given their fixed daily allocations of forex. Alternatively they could keep the exchange rate at their desired level, and feed the market the level of foreign exchange it desires at that price. Given the current imbalances in the market and the backlog this would result in a quick draw down of the country's foreign exchange reserves.

As a practical example of what we are describing above, one of the domestic banks that we spoke to during the study expressed concern at such an arrangement because they feared that, in an auction situation and in the face of a limited supply of foreign exchange, one of the non-bank

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foreign exchange market participants, Puma Oil, with a high valuation of forex, would outbid the entire market pushing down the value of the Kina, and keep foreign exchange from the banks.

The BPNG's current desire to control both the price (exchange rate) and quantity of forex traded will undermine the success of a move to a system with interbank market and collection of bids from market participants to match demand and supply. A market maker can choose to control only either the price or the quantity. By attempting to control both, the BPNG remains in a position where it must distribute scarce forex to market participants using some non-price mechanism, as it is currently doing.

While the current shortage persists, it is unclear how a more efficient system of allocation can be implemented. However, once the Kina returns to convertibility we recommend the creation of an interbank market and a daily auction for foreign exchange, as described in the paragraph above.

#### 10.6 Maximizing 'friendly' concessional finance to increase access to cheap overseas foreign exchange

The option of accessing concessional finance brings to the forefront the question of external balance which, as we have defined in Section 3.1. External balance is a situation in which the currency is fully convertible without resorting to foreign borrowing which is so high as to burden future generations with a level of debt which will lower their standard of living below that of the current generation. This is the key criteria in assessing the use of this option.

The problem with taking out a foreign exchange loan, which would provide a much needed increase in the supply of foreign exchange and will help to reduce the backlog of forex orders, is that without a depreciation the structural imbalance in the foreign exchange market remains. It is like putting a band-aid on a wound without treating the underlying problem. While there may be temporary relief, the underlying cause remains and eventually the same issue will reappear because the problem has not been treated.

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PNG's experience with recent foreign exchange loans is illustrative here. In 2018 and 2019, PNG issued sovereign bonds (USD 500 million), took out a commercial loan (USD 180 million) and loans from the World Bank and ABD (USD 250 million)). This external borrowing contributed to reducing the backlog of forex orders in early 2019. However, by late-2019, the backlog had begun to increase again, with the estimated backlog at the end of 2019 at K1.2 - K1.3 billion (IMF, 2020). While the foreign exchange loans contributed to an improvement in convertibility in the short term, this improvement was only temporary. Further, the cost of this temporary improvement is that the country has increased its holdings of foreign debt, and these loans will have to be repaid in the future in foreign currency. So by taking out loans without address the underlying structural imbalance in the foreign exchange market, the problem is being pushed in the future, and PNG will accumulate additional foreign exchange debt.

Increasing a country's holdings of debt in foreign currency has an additional risk beyond that of domestic debt holdings, which is that it carries exchange rate risk. A depreciation in the currency increases the Kina value of the foreign exchange loans (more Kina is required to pay back the loans), which would create an additional burden future generations. High levels of foreign debt can lead to concerns about a country's credit-worthiness and this can have a negative impact on a country's credit rating. This may affect the terms at which the country can borrow in the future.

In summary, the use of concessional finance is a short-term solution at best. The borrowing would increase the supply of foreign currency temporarily, but not change to the underlying structure of the foreign exchange market; the forex imbalance would remain. The borrowed foreign exchange would be dissipated over time. Once the borrowed forex is used up, the shortage would reappear, but with the additional drawback that PNG's indebtedness would have increased, despite the concessional terms.

One circumstance under which concessional finance could be considered is when there is certainty that there will be a significant ongoing increase in the supply of foreign exchange



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within a short time horizon; for example, due to the start of the investment phase of a new resource project, or the expiration of tax-concessions on the revenue stream of an existing resource project, such as PNG LNG. While the date of expiry of the tax-concession for the LNG project is unclear, it is likely to be at least 5 years away as LNG prices are currently below the price-even price for the project, and the LNG partners will now also offset the additional costs of recovery from the damage caused by the 2018 earthquake. In terms of forthcoming resource projects, despite earlier optimism, the currently likelihood of the signing of new resource projects has been reduced. In light of the global economic crisis due to COVID-19, and the possibility of ongoing sluggishness in the global economy, such projects may also be less likely to materialize in the coming years.

Finally, if it is determined that a loan is necessary, and can be justified according to the external balance criteria, grants and loans which are concessional are much preferred to non-concessional loans. Government should try to avoid external commercial borrowing. There should also be stronger efforts to promote greater foreign participation in the domestic currency bond market. This further underscores the need for removing restrictions on convertibility which impede foreign investment.

#### **10.7 Revisit continuing the stalled Tariff Reduction Program (TRP)**

Reducing tariffs will increase the forex shortage. Non-tradable and imported goods are substitutes in consumption. A fall in tariffs, which leads to a fall in the price of imported goods, will lead to an increase in the demand for imported goods, while the demand for non-tradables decreases. This will cause current account balance to deteriorate, and the excess demand for foreign exchange will increase. The action of reducing tariffs alone is likely to exacerbate the foreign exchange shortage.

However, there are some mitigating circumstances to consider. For example, if the tariff reduction was part of the PACER Plus Free Trade Agreement, and the falls in PNG's tariffs were

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matched by increased access to the markets of our trading partners, as they lowered their tariffs, reduced other non-tariff barriers, and improved opportunities for cross investment flows, then there would be offsetting benefits. For example, an increase in PNG's exports to its trading partners, and increased cross-border FDI flows. Ideally, increased access to key external markets would be complemented with an exchange rate depreciation which would make PNG's non-resource exports and import-competing industries more competitive.

In the longer term, benefits of tariff reduction include the reduction in the price of imported equipment and materials would benefit local industry and stimulate further export activity.

## 11 Effect of an Exchange Rate Depreciation on the PNG Economy

In this section we analyze the effects of a nominal depreciation of the Kina on the PNG economy.

### 11.1 Effect on Prices and Economy Activity

PNG is a small open economy and faces fixed world prices for the goods that it exports and also for those that it imports. Thus, a depreciation will increase the Kina prices of both goods that PNG exports, and goods that it imports. This means that a depreciation will create some winners and losers, that is, some groups of people in the PNG economy will gain and others will lose. We can see the effect on prices as follows:

$$P_{EX} = e.P_{EX}^*$$

$$P_{IM} = e.P_{IM}^*$$

where  $e$  is the nominal exchange rate (the number of Kina per USD),  $P_{EX}$  is the Kina price of exports,  $P_{EX}^*$  is the world price of the goods that PNG exports,  $P_{IM}$  is the Kina price of imports, and  $P_{IM}^*$  is the world price of the goods that PNG imports. When the Kina depreciates, the nominal exchange rate,  $e$ , increases (the number of Kina per USD goes up) and so the Kina prices,  $P_{EX}$  and  $P_{IM}$  increase (taking world prices  $P_{EX}^*$  and  $P_{IM}^*$  as fixed).

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We can see that exporters will see the Kina prices paid for their goods rise. Producers of import-competing goods will also see their prices rise. Both of these groups will respond to the higher prices by increasing their output, and their incomes will rise. Producers in the tradables sector (producers of exports and import competing goods) will be amongst the winners. Importers will also see their Kina prices of the goods that they import rise, and this will make these goods less attractive to domestic consumers. So companies who import will sell fewer goods. This is because domestic consumer will substitute away from more expensive imports and toward domestically produced import-competing goods.

We can see that a depreciation provides a stimulus to the tradable sector, which includes the producers of exports and import-competing goods. Thus, depreciation will be a stimulus to the non-resource sector.<sup>18</sup> In response to the higher prices, exporters will produce more, and so exports will rise, and producers of import-competing goods will also produce more and so imports will fall. This will increase jobs and incomes in the tradables sector. The trade balance will also improve, which has the effect of increasing the country's receipts of foreign exchange. We examine this in more detail in Section 11.5.

Because the agricultural sector produces goods which are exported, then a depreciation will lead to an increase agricultural output and agricultural exports, and the income in this sector will rise. We analyze the effect of a depreciation on agricultural export earnings in more depth in section 11.6.

Consumers of imports, which include most PNG households will have to pay higher prices for the imported goods that they buy. Thus, a depreciation will lead to an increase in the price level faced by households, however the size of the price level increase that the household faces (the increase in the cost of the households consumption basket) will depend on the fraction of the household's expenditure that falls on imported goods. Given that the household's real income is determined as follows

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<sup>18</sup> In fact, the depreciation has the same effect as a permanent production subsidy on tradable goods (without any cost to the government) as the depreciation increases the Kina prices of these goods, *all else equal*.

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$$\text{Real Income} = \frac{\text{Money Income}}{\text{Price level}}$$

then the effect on a household's real income will depend on the share of their income spent on imported goods (which determines how much the price level they face increases), and the response of their money income to the depreciation. If the household's money income rises by proportionately less than the increase in the cost of the household's consumption bundle (the price level the household faces) then real income falls. On the other hand, if the household's money income rises by more than the increase in the price of their consumption bundle then the household's real income rises. Whether a household wins or loses in response to the depreciation depends on the whether their real income rises or falls, and we examine this more depth in the next section.

#### 11.2 Effect on Urban and Rural Households

We now examine the impact of a depreciation on urban and rural households.

*Urban Households:* Given the high proportion of imported goods in the consumption baskets of urban dwellers means that a depreciation will increase the cost of their weekly shopping baskets by more than for rural households. Urban households have a diminished ability to substitute away from more expensive imported food to locally produced food because of limited access to local produce markets and gardens where they could grow their own food. The effect on the real income of urban wage earners will depend on whether they receive a compensating increase in their money wages in response to the higher price level. Given that wages are no longer fully indexed in PNG, urban wage earners are likely to see their real incomes fall since any response in wages will be less than the increase in the price level induced by the depreciation.

*Rural Households:* Households in rural areas have a different consumption bundle, relative to urban households, spending a much smaller fraction of their incomes on imported goods. In addition, rural households are more easily able to substitute away from more expensive imported food by buying produce from local markets and growing more food in their own gardens. Thus, the effect of a depreciation on the price level that rural households face will be smaller. The effect on the real income will depend on their source of income, whether they are a wage earner or producer of cash crops for export, for example. In the case of the wage earner, it is likely their

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real income will fall (like urban wage earners), as wage increases are likely to be smaller than the increase in the price level they face. A household producing some cash crops and earning some wage income may see their real income rise or fall, depending on the fraction of income earned from cash crops / wages and the fraction of imported goods in their consumption basket. A household earning its income from entirely cash crops is likely to see its real income rise with its money income rising more than the price level it faces.

Thus, a depreciation causes a redistribution of real income away from urban wage earning households toward rural cash crop producing households. One implication of this redistribution is that it increases the attractiveness of being located in a rural setting relative to an urban one, because rural real incomes rise, and urban real incomes fall. Thus, it will slow and possibly reverse urban drift.

### 11.3 Effect on Inflation

Given the PNG economy's high dependence on imported inputs for consumer goods, business inputs, and fuel, the rate of inflation is sensitive to exchange rate movements. A depreciation of the exchange rate will lead to an increase in the domestic price level, and this will lead to an increase in inflation, as noted in Section 11.2. However, based on previous research and past experience, the increase in inflation is likely to be temporary, and will not lead to a persistent increase in inflation.

There are a variety of estimates of the pass-through of the nominal exchange to inflation. The IMF and the BPNG have reached a consensus that pass-through of exchange rate movement to underlying inflation is between 30 and 40 percent. Sampson *et.al.* (PEB, 2006) find that pass-through is around 50-60 percent. For the time taken for pass-through to be complete, the IMF estimates a period of 4 quarters, while Sampson *et. al.* estimate that it takes between four and six quarters. This means that the increase in inflation caused by a depreciation will have worked its way through the PNG economy within 12 months by one estimate, and 18 months by another, and inflation will return to its original trend level after this, *all else equal*. For our analysis we take a central point of these estimates, taking pass-through at 40 percent, and 12 months for pass-through to be complete. This means that a 10 percent depreciation will lead to a 4 percent

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increase in inflation, and that inflation will return to its trend level after a period of 4 quarters (one year).

The IMF further supports the view that inflation is likely to be temporary (as their estimates of pass-through suggests), noting recently that their proposal of an 11-18 percent depreciation over three years would only have a modest impact on inflation (IMF, 2020). Looking to past episodes where there has been a large depreciation, Duncan et. al. (1998) note that the large depreciation in the mid-1990s did not lead to an ongoing increase in inflation.

#### 11.4 Effect on the Real Exchange Rate

In this section we discuss the real exchange rate and show that a depreciation of the nominal exchange rate will lead to a depreciation of the real exchange rate.

The real exchange rate is of interest to us because it tells us the rate at which PNG goods can be converted into foreign goods (the number of PNG goods per unit of foreign goods). It indicates how competitive our goods are in comparison to goods from other countries. As we will see in Section 11.5, an increase in the real exchange rate makes our goods cheaper relative to foreign goods, and will increase the demand for our goods from foreign countries.

The real exchange rate is defined as the foreign price level in Kina terms divided by the domestic price level. To calculate the foreign price level in Kina terms we multiply the nominal exchange,  $e$ , by the foreign price level,  $P^*$ . The real exchange rate is given by

$$RER = \frac{eP^*}{P}$$

The real exchange rate can change either due to a change in the nominal exchange rate,  $e$ , or a change in the domestic price level,  $P$  (taking the foreign price level,  $P^*$ , as given). A nominal depreciation (an increase in  $e$ ) causes the real increase exchange rate to depreciate (to increase) as well. On the other hand, an increase in the domestic price level,  $P$ , will cause the real exchange rate to appreciate, that is, to fall in value.

As noted in Section 11.3, a depreciation of the nominal exchange rate will cause a rise in the price of imported goods, which increases the domestic price level, and leads to a temporary

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increase in domestic inflation. The effects of a depreciation of the nominal exchange rate ( $\uparrow e$ ), and an increase in domestic inflation ( $\uparrow P$ ) have opposing effects on the real exchange rate, as can be seen from the equation above.

We now examine the impact of a 10 percent depreciation in the nominal exchange rate on the real exchange rate. As determined above, the long run pass-through from the nominal exchange rate to inflation in PNG is 40 percent. A 10 percent depreciation will lead to a 4 percent increase in domestic inflation ( $0.4 \times 0.1$ ). This allows us to determine the effect of a nominal depreciation on the real exchange rate. Using the equation above, it follows that,

$$\% \text{ change in } RER = \% \text{ change in nominal exchange rate} - \% \text{ change in } P \text{ level}$$

Since the change in the nominal exchange rate is 10 percent and the change in the price level is 4 percent, then the real exchange rate depreciates (increases) by 6 percent ( $10 - 4 = 6$ ). The effect of a nominal depreciation of 10 percent is a 6 percent depreciation in the real exchange rate.

Hence, a nominal depreciation leads to a real depreciation.

Later in this study we recommend a 20 percent depreciation in the real exchange rate. Using the analysis above we can determine that this will require a 33.3 percent depreciation in the nominal exchange rate, and that this will cause a 13 percent increase in the price level (a one-off inflation of 13 percent).

#### 11.5 Effect on the Trade Balance

When the nominal exchange rate depreciates, the rate at which Kina is converted into USD increases, and more Kina must be spent to buy one USD. This will cause the real exchange rate to depreciate as we have determined in Section 11.4. As a result, a depreciation will make PNG's goods and services cheaper to foreign buyers, and foreign goods and services will become more expensive to PNG households and businesses (as noted in Section 11.1). Thus, there is an opposing effect on the volume exports and the volume of imports. Because our goods are cheaper to foreigners, exports receipts will rise when the exchange rate depreciates. And because foreign goods are more expensive, the imports bill may rise or fall when the exchange rate

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depreciates – there are opposing effects on the import bill as the volume of imports falls but the cost of each unit of imports rises. It is possible that a depreciation of the exchange rate will lead to an improvement in the trade balance and thus the current account balance. We determine below whether or not this is the case in PNG.

We begin by stating the Marshall-Lerner Conditions, which is a theoretical result which determines whether or not a depreciation will lead to an improvement in the trade balance.

*Marshall-Lerner Condition:* From an initial position of trade balance, if the sum of the export and import demand elasticities exceeds one, then a depreciation of the real exchange rate will lead to an improvement in the trade balance.

When the Marshall-Lerner condition is satisfied, a depreciation of the real exchange rate will improve the trade balance, which will lead to an increase in forex inflows.

The export demand and import demand elasticities for Papua New Guinea are estimated by Nakatani (2017) who finds the following:

*Export supply elasticity for PNG:* Nakatani estimates the export supply elasticity with respect to the real exchange rate using three alternative approaches and finds values ranges between -0.3 and -0.7. Given additional results from individual commodities (which we discuss further below) which are weighted to give a total export elasticity, Nakatani concludes that the export supply elasticity is around -0.4.

*Import Demand elasticity for PNG:* Nakatani also estimates the import demand elasticity with respect to the real exchange rate for PNG using two alternative approaches and finds values that ranges from 0.8 to 1.1.

*Marshall-Lerner Condition Holds:* Summing the absolute value of the export supply elasticity and the import demand elasticity ( $0.4 + 0.8 = 1.2$ ). Nakatani finds a value that exceeds one, and thus the Marshall-Lerner condition holds for PNG. This means that a depreciation in the real exchange rate will lead to an improvement in the trade balance.



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*Effect of a depreciation on trade balance and forex inflows:* Nakatani estimates the effect 10 percent depreciation of the real exchange rate on the supply of forex, and finds that it would increase forex inflows by approximately USD 250 million per annum. This is based on data from 2017. More specifically, using an export supply elasticity of -0.4 and an import demand elasticity of 1.0, he uses the IMF's framework of BOP forecasts to make this calculation. He finds that the impact of a 10 percent depreciation of the real exchange rate would increase export receipts by around USD 150 million and would reduce the import bill by about USD 100 million, resulting in an increase in the trade balance of USD 250 million in 2017. This is not a one-off effect, but rather would persist into the future *all else equal*, meaning that in every future year PNG's trade balance be about USD 250 million higher. This would contribute an extra USD 250 million in foreign exchange earnings each year.

Currently, the approach to alleviating the forex shortage is to improve the current account balance by increasing the trade balance through import compression by rationing access to foreign exchange, while holding the exchange rate fixed. This prevents any adjustment on the export margin, and forces all of the adjustment on the import margin. This policy is damaging to the economy as the act of compressing imports reduces investment, and through increasing costs diminishes future exports opportunities, both of which reduce economic growth. It also reduces the variety, and increases the prices, of final consumption goods leading to a welfare loss for households. With an exchange rate depreciation, activity in export and import-competing sectors in PNG is stimulated. The price of imports increases and so consumers and businesses willing substitute away from imports and toward the import-competing goods produced by domestic producers. This happens without the BPNG enforcing directives which reduce access to foreign goods and services and constrain the optimal choices of businesses and households.

#### 11.6 Effect on Export Earnings in the Agricultural Sector

In this section we calculate the effect of a depreciation of the Kina on export earnings in the agriculture sector. A depreciation will increase the Kina prices received by domestic agricultural producers for each unit of produce they sell on world markets. Although the world price has not

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changed, because each USD now purchases more Kina, while the domestic producers is still receiving the same number of USD for their goods, they will receive more Kina.

Nakatani estimates the export supply elasticity for the agriculture sector using three methods. He finds that the short run (one year) elasticity for agricultural exports in response to a change in the real exchange rate ranges from -0.5 to -0.7, while the long run elasticity for agriculture exports is -0.67. The long run elasticity of -0.67 may be interpreted as follows: a 10 percent depreciation in the real exchange rate leads to a 6.7 percent rise in the volume of agricultural exports.

*Effect of 20 percent depreciation in the real exchange rate (brought about by a 33.3 percent depreciation in the nominal exchange rate) on export earnings in the agriculture sector in the long run*

We now calculate the long run effect of a 20 percent depreciation in the real exchange rate on the real export earnings of the agriculture sector. The 20 percent real depreciation is implemented by a 33.3 percent depreciation of the nominal exchange rate. Nominal (or money) agricultural export earnings may be determined by the product of the price of agricultural output,  $P_A$ , and the volume of agricultural exports,  $Q_A$ .

$$\text{Nominal Export Earnings} = P_A Q_A$$

Since PNG is a small open economy, prices of agricultural goods are determined by world markets and so the prices received by PNG producers in Kina is given by

$$P_A = e.P_A^*$$

When the nominal exchange rate depreciates (when  $e$  increases) the Kina price,  $P_A$ , rises.

Because agricultural producers are now receiving higher prices they will respond by producing more output.

However, the nominal depreciation also increases the domestic price level. As we have noted in Section 11.4, a nominal depreciation of 10 percent leads to a depreciation in the real exchange rate of 6 percent. Thus, a 33.3 percent depreciation in the nominal exchange rate will thus cause a 20 percent depreciation in the real exchange rate.<sup>19</sup>

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<sup>19</sup> See the bottom of Section 11.4 for a recap on calculations if necessary.

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Given that the long run export supply elasticity for the agriculture sector is -0.67, then a 20 percent depreciation in real exchange rate will lead to a 13.4 percent rise in the volume of agriculture exports ( $-0.20 \times -0.67 = 0.134$ ). Thus, the volume of agricultural exports will rise by 13.4 percent in response to the 33.3 percent nominal depreciation.

The effect on nominal agriculture export earnings of the 33.3 percent nominal depreciation is as follows. A 33.3 percent nominal depreciation will increase the Kina prices received by agriculture producers by 33.3 percent. The nominal depreciation also causes a real depreciation of 20 percent. In response to the higher prices that agriculture producers face they will increase output and export volumes will rise by 13.4 percent as calculated above. So  $P_A$  is now 33.3 percent higher, and  $Q_A$  is now 13.4 percent higher, than their original levels. To calculate the change in nominal agriculture export earnings we note that

$$\% \text{ change in Nominal Export Earnings} = \% \text{ change in } P_A + \% \text{ change in } Q_A = 46.7\%$$

Thus, nominal agricultural export earnings will increase by 46.7 percent.<sup>20</sup>

To calculate the change in real agricultural export earnings we need to divide nominal earnings by the domestic price level,  $P$ ,

$$\text{Real Export Earnings} = \frac{P_A Q_A}{P}.$$

From the equation above the change in real agricultural export earnings may be calculated as follows,

$$\begin{aligned} \% \text{ change in Real Export Earnings} &= \% \text{ change in Nominal Export Earnings} - \% \text{ change in } P \\ &= 30.2\% \end{aligned}$$

Since the change in nominal export earnings is 46.7 percent and the change in the price level is 13.3 percent, then the long run change in real agricultural export earnings as a result of a 33.3 percent depreciation in the nominal exchange rate (and a 20 percent depreciation in the real exchange rate) is an increase of 33.4 percent ( $33.4 = 46.7 - 13.3$ ).

*Effect of 20 percent nominal depreciation (which will cause a 12 percent real depreciation) on short run export earnings in the agriculture sector*

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<sup>20</sup> % change in Nominal Export Earnings = % change in  $P_A$  + % change in  $Q_A$  = 33.3% + 13.4% = 46.7

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Here will calculate the effect on agricultural incomes one year after a 20 percent nominal depreciation (which is a policy we recommend in Section 13). To determine the effect on real agricultural export earnings a year after a 20 percent depreciation in the nominal exchange rate we perform a similar calculation to the above, but instead use the short run agricultural export elasticity of -0.5. A 20 percent depreciation in the nominal exchange rate will cause a 12 percent depreciation in the RER in one year (pass-through is complete after one year). Given an export supply elasticity of -0.5 then export volumes will increase by 6 percent in response to a 12 percent real depreciation ( $-0.5 \times -0.12 = 0.06$ ). Nominal agriculture export earnings will increase by 26 percent as a result ( $0.2 + 0.06 = 0.26$ ). Since a 20 percent depreciation in the nominal exchange rate will increase inflation by 8 percent after one year, then real agricultural export earnings will rise by 18 percent ( $0.26 - 0.08 = .18$ ) after one year.

#### 11.7 Effect on Government's Holdings Foreign Debt

The PNG government borrows both from foreign and domestic sources to fund domestic expenditure. Generally, developing countries are not able borrow from foreign sources in their own currency, and must therefore borrow in foreign currency. This is the case for PNG. This is because foreign creditors are generally unwilling to take on the exchange rate risk associated with lending to a country in their own currency.

When the PNG government borrows in foreign currency, the Kina value of the foreign debt will vary with the exchange rate. This can be seen from the expression below, which shows the relationship between the Kina value of foreign debt and the USD value of foreign debt (the currency in which the loans are frequently, but not always, made)

$$\text{Kina Value of Foreign Debt} = e \cdot \text{USD Value of Foreign Debt}$$

When the exchange rate depreciates ( $e$  increases) then the Kina value of foreign debt increases. While the value of the foreign debt measured in foreign currency is unchanged (assuming no further borrowing), the value of the foreign debt measured in Kina increases, meaning that more Kina will need to be paid to retire or clear the debt. For example, if the Kina depreciates by 20

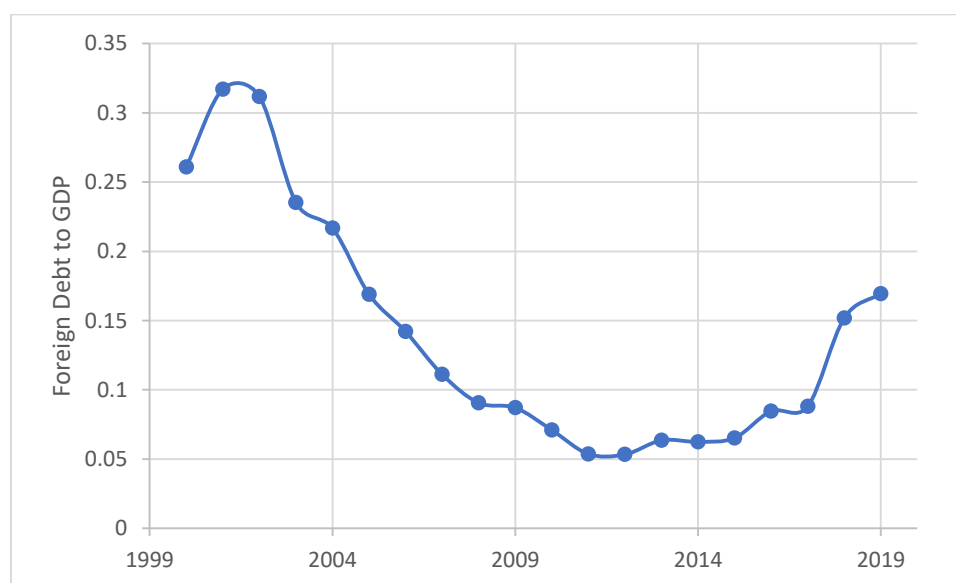
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percent, then the Kina value of PNG's foreign borrowings will increase by 20 percent. The Kina value of debt repayments will also rise by 20 percent.

However, there is more to this story. The burden of the external debt to the government, and therefore to the domestic economy (taxpayers, now or in the future, will eventually pay back the debt unless the government defaults) is also dependent on the resources available to the government. The resources available to the government depend on the size of the economy, which we measure by GDP. This reflects the size of the tax base, which increases with GDP. To measure the burden of foreign debt to the government and the domestic economy, we divide the Kina value of foreign debt by GDP as follows.

$$\text{Kina Value of Foreign Debt as a proportion of GDP} = \frac{e \cdot \text{USD Value of Foreign Debt}}{\text{GDP}}$$



*Figure 6: Foreign Debt to GDP, 2000-2019*

As we can see from the formula above, the Kina value of foreign debt to GDP will vary due to three factors: the level of foreign currency debt, the nominal exchange rate ( $e$ ), and GDP. In

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Figure 6 we show the Kina value of PNG's foreign debt as a proportion of GDP over the past 20 years.

When considering the effect of a depreciation on the Kina value of foreign debt to GDP (the burden of foreign debt to the domestic economy) in PNG we must consider four factors:

- i. Firstly, the depreciation will increase the Kina value of foreign debt (the numerator in the expression above), which increases the Kina value of foreign debt as a proportion of GDP.
- ii. Secondly, as discussed in sections 11.1 and 11.5, the depreciation will stimulate economic activity in the domestic economy which will increase GDP. This has the effect of reducing the Kina value of foreign debt as a proportion of GDP.
- iii. Thirdly, the depreciation will increase the availability of foreign exchange, reducing the BPNG's rationing of foreign exchange. As discussed in Section 9.1, this policy has led to import compression which has reduced growth. Hence, a relaxation of foreign exchange rationing will have pro-growth effects, reducing the Kina value of foreign debt as a proportion of GDP.
- iv. Finally, when the economy is not in external balance (running a balance of payments deficit), as is currently the case in PNG, a depreciation will bring the economy closer to external balance. This will reduce or remove the need to borrow from foreign sources now and into the future.

In the current circumstances, while a depreciation will increase the Kina value of foreign debt (as noted in i. above), this will be offset now and into the future by higher GDP growth (ii. and iii. above), and a reduction in the need to borrow from foreign sources now and into the future (iv.). On balance, concern about the effects of a depreciation on the Kina value of foreign debt are not justification for avoiding a depreciation.

#### 11.8 Effect on the Balance Sheets of Private Sector Firms

While households are very unlikely borrow in foreign currency, medium- and large-business enterprises, particularly those that import goods, are likely to have foreign creditors. A common

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arrangement for larger firms that import goods into PNG is that they are domestic or PNG-based subsidiaries of larger foreign parent companies.

Similar to the case above, a depreciation will increase the Kina value of the foreign debt held by domestic firms. So, for example, a 20 percent depreciation will lead to a 20 percent increase in the Kina value of foreign debt. However, there are a number of mitigating factors which we outline below:

- i. The group holding the largest amount of foreign debt is domestic importers with foreign-based parents. The effect of the depreciation on the Kina value of this foreign debt will be internalized within the domestic subsidiary – foreign parent relationship. That is, the loss is absorbed in part by the foreign-based parent, offsetting some of the impact on the domestic firm.
- ii. The depreciation is likely to bring about an increase in the availability of foreign exchange to domestic importers due to a reduction in forex rationing. This will allow firms to remit profits and dividends owed to foreign parents. Further, it will reduce the resources they must expending in manage their orders of forex to pay foreign suppliers.
- iii. The depreciation will stimulate the domestic economy increasing domestic demand for the products of domestic firms and firm profits.
- iv. Firms that export may hold foreign assets, for example, foreign exchange bank accounts. A Kina depreciation will increase the Kina value of these assets; for example, a 20 percent depreciation of the Kina will increase the Kina value of these foreign assets. At a macroeconomic level, these positive balance sheet effects will, in part, offset the negative effects experienced by importers with foreign creditors, moderating the private sector wealth effects of a depreciation.

## 12 Determination of the Equilibrium Real Exchange Rate: the path to Kina Convertibility

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In the section we determine the real exchange rate that will allow PNG to achieve external balance (currency convertibility) and internal balance (full employment). This is called the equilibrium real exchange rate. This is of great importance to us because it tells us how much the Kina has to adjust to achieve full convertibility. Hence, it shows us *the path to Kina convertibility*.

We begin by presenting a model that modifies the standard internal balance – external balance framework to account for key features of the PNG economy, which is classified as a resource rich developing country (RRDC). Following this we then calculate the equilibrium real exchange rate (ERER) using the standard model, and also using our modified model.

By comparing our calculations of the equilibrium real exchange rate with current real exchange rate we can determine the current overvaluation of the real exchange rate in PNG. This allows us to determine policy will correct the overvaluation and move the PNG economy back to a position of currency convertibility (external balance) and full employment (internal balance). In our analysis we find that the current real exchange rate in PNG is overvalued by between 20 and 30 percent.

#### 12.1 Theory Section: a Model of Internal and External Balance for RRDCs

RRDCs are defined as low- and lower-middle-income countries with exhaustible natural resources comprising at least 20 percent of total exports (IMF, 2012). With natural resource exports at around 70 percent of total exports, and GNI per capita in the low- and lower-middle-income range PNG is thus classified as a RRDC. A further common feature of RRDCs is that a large fraction of the resources sector is foreign-owned, as is the case in PNG. The unique characteristics of RRDCs have implications for policy.

The first feature of RRDCs that net factor income (NFI) is large and negative.<sup>21</sup> This is because the resource sector is a significant part of the economy, and it is largely foreign owned. It follows that gross national product (GNP) (or gross national income) is significantly less than gross

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<sup>21</sup> NFI is the difference between the income earned by a home country's nationals living abroad and the income earned by foreigner living in the home country.



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domestic product.<sup>22</sup> Looking at a sample of 29 RRDCs, over the past 20 years the ratio of GNP to GDP is 0.93, that is GNP is 7 percent less than GDP. Over the corresponding time period for G-10 countries the ratio is very close to 1. In PNG over the past 20 years the ratio of GNP to GDP has averaged 0.93, with a minimum of 0.88 in 2003 and a maximum of 0.99 in 2008. The second feature is that the high foreign ownership share in the resources sector means that the fraction of resource sector output that accrues to the domestic economy is small, and hence NFI is large and negative..

In our theoretical model, we find that the internal balance objective should focus on full employment in the non-resource sector, rather than the entire economy. The justification for this is that few PNG workers are employed in the resource sector, and the capital used in the resource sector is almost entirely foreign owned. Secondly, we present a modified condition for external balance which considers the share of export revenues that accrue to the government, called the government take. These modifications suggest a new equilibrium real exchange rate target, which will be at a depreciated (higher) level relative to that determined by the standard internal balance-external balance framework. Our empirical analysis in the next section confirms this result.

In an RRDC, Gross Domestic Product (GDP), is determined by sum of the economic activity in the non-resource sector,  $Y_{NR}$ , and resource sector,  $Y_R$ . GDP may be written  $Y_{GDP} = Y_{NR} + Y_R$ . As noted above, in RRDCs the resources sector employs little domestic labor and the capital used in the resources sector is mostly foreign-owned.<sup>23</sup> For simplicity we assume that output of the resource sector is produced entirely by foreign owned capital and foreign labor exploiting PNG's non-renewable resources. While this is a simplification, it is a reasonable one. For example, there are only about 20,000 national workers employed in PNG's resource sector. We make another

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<sup>22</sup> Gross Domestic Product (GDP) refers to the value of all economic activity within a country's borders, while Gross National Product (GNP) refers the value of economy activity produced by factors of production owned by a country's citizens. GNP is calculated by adding net factor income (NFI) to GDP, that is,  $GNP = GDP + NFI$ .

<sup>23</sup> As a simplification we assume that the resource sector employs no domestic labor. Further, we assume that foreigners do not own any capital in the non-resource sector, and Papua New Guinea does not own capital in any foreign country. In addition foreigners do not work in the non-resource sector, and Papua New Guineans do not work overseas. These assumptions simplify the set up of the model, and in particular the relationship between GNP and GDP, however they are not key to the results.

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simplification which is to assume that the entire output of the resources sector is exported so that resource exports,  $EX_R$ , are equal to  $Y_R$ .

The government owns a share  $\alpha$  (where  $\alpha$  lies between zero and one) of the resource sector, and hence is entitled to a fraction  $\alpha$  of the output of the resources sector,  $\alpha Y_R$ . The remainder,  $(1-\alpha)Y_R$ , belongs to the foreign owners. However, the government also levies resource rent taxes, taxing the foreign share of output at rate  $t_R$  and so foreigners receive only  $(1-t_R)(1-\alpha)Y_R$  of resource sector output, with resource tax revenue of  $t_R(1-\alpha)Y_R$  accruing to the government. In total the PNG government receives its share of output,  $\alpha Y_R$ , plus the resource tax revenue,  $t_R(1-\alpha)Y_R$ . The sum of these is  $(\alpha+(1-\alpha)t_R)Y_R$  which we simplify to  $\tilde{\alpha}Y_R$ , defining  $\tilde{\alpha} = \alpha+(1-\alpha)t_R$ . The PNG's government's share of resource sector output, which is called the government take, is given by  $\tilde{\alpha}$ . We have discussed PNG's government take in Section 6.1 and Figure 1. The share received by foreigners is the remainder,  $(1-\tilde{\alpha})$ .

This set-up allows us to simply represent net factor income, which as we have noted is defined as payments earned by PNG's factors of production abroad less the payments to foreign factors of production located in PNG. Here, net factor income is  $-(1-\tilde{\alpha})Y_R$ , the share of resource sector output accruing to foreigners. This allows us to define the current account balance, which is the trade balance adjusted for net factor income, as we know from Section 7. Exports are divided into resource exports,  $EX_R$ , and non-resource exports,  $EX_{NR}$ , and recalling that PNG exports all of its resource sector output ( $EX_R = Y_R$ ) then the current account may be written  $CA = EX_{NR} + EX_R - IM - (1-\tilde{\alpha})EX_R$ . The external balance condition simplifies to

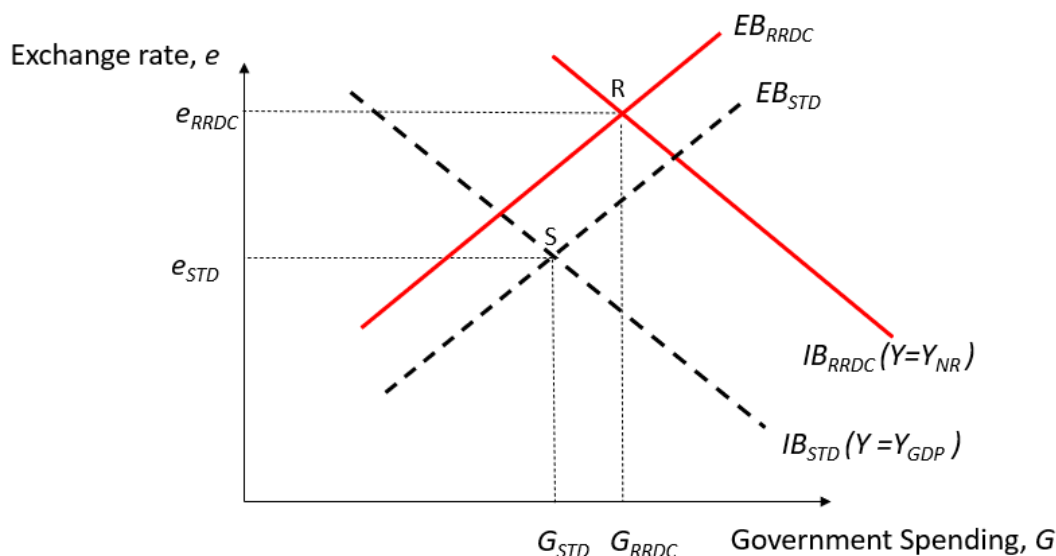
$$CA = EX_{NR} + \tilde{\alpha}EX_R - IM = 0.$$

For internal balance, recalling that there are no domestic factors of production employed in the resource sector, then the internal balance condition just requires employment of all domestic factors of production (labour and capital) in the non-resource sector,

$$Y_{NR} = Y_{NR}^f$$

where  $Y_{NR}^f$  is the full employment level of output in the non-resource sector

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*Figure 7: Determination of the Equilibrium RER in a RRDC*

Figure 7 demonstrates the effect of the modifications to the standard model noted above on the equilibrium real exchange rate. Under the standard model the equilibrium exchange rate is  $e_{STD}$ , which is determined at the intersection of the dashed black  $IB_{STD}$  and  $EB_{STD}$  lines, at point S. With the modifications to include the RRDC features, the equilibrium exchange rate is now  $e_{RRDC}$ , determined at the intersection of the solid red  $IB_{RRDC}$  and  $EB_{RRDC}$  lines, at point R. As can be seen,  $e_{RRDC}$  is greater than  $e_{STD}$ , that is ERES determined by the RRDC model is at a more depreciated level than that determined by the standard model. Further, another result that the model predicts is that a decrease in government take will cause the ERES to depreciate, that is,  $e_{RRDC}$  will rise. In our empirical analysis we show this to be the case.

## 12.2 Empirical Estimation of Equilibrium Real Exchange Rate

To estimate the extent of real exchange rate overvaluation in PNG, we follow the approach of Fox and Schröder (2018) who estimate PNG's RER misalignment over 1990–2017. It is widely accepted among economists that purchasing power parity (PPP) theory does not hold in practice, and that the equilibrium RER (ERER) is time varying and needs to be estimated. As a first step, we define the RER and ERER.

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The RER is defined as the relative price of non-tradable to tradable goods, expressed in domestic currency:

$$RER = \frac{P_{NT}}{e \times P_T}$$

The term in the numerator refers to the price index of non-tradables, while  $e$  in the denominator is the nominal exchange rate (local currency per foreign currency) and  $P_T$  is the price index of tradable goods.<sup>24</sup> A decrease in RER denotes real depreciation.

The EREER is defined as the value of the RER, which attains both internal and external balance, taking as given sustainable values of all the relevant variables. Internal balance prevails when nontradable goods and labor markets clear. External balance refers to a situation where the country's external position is on a "sustainable" path.

The EREER definition of Nurkse (1945) implies that the EREER is determined by a set of macroeconomic variables. Edwards (1989), Montiel (1999), and Faruquee (1995) formally derive the EREER as a function of the following macroeconomic fundamentals:

- The terms of trade (TOT) [+/-],
- Trade openness [-],
- Productivity differentials between PNG and its trading partners (Balassa-Samuelson effect) [+],
- Government consumption of tradables [-] and nontradables [+], and
- Net international indebtedness [+/-],

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<sup>24</sup> Note that this definition is the inverse of the way the RER has been defined elsewhere in the document.

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where the signs of the partial derivative are parenthesized.

As discussed in the theoretical section, in resource rich developing countries, the government's take from the resource sector is also an important determinant of the ERES. Below we will present estimates of RER misalignment with and without government take as an ERES fundamental.

To estimate the ERES we use the single-equation approach (SEA), which is a three-step procedure. The first is an estimation of the long-run relationship between the RER and the above listed macroeconomic fundamentals:

$$RER_t = \beta F_t + u_t$$

In the second part, in accordance with the ERES definition, the sustainable value of the fundamentals need to be derived. In practice, as explained below, this is done using statistical techniques of trend-cycle decomposition. The ERES can then be calculated on the basis of their values ( $F_t^S$ ) and the long-run parameters ( $\beta$ ):

$$ERES_t = \beta F_t^S$$

In the third and final step the extent (in percentage terms) of RER misalignment can be computed:

$$RER\ misalignment_t = 100\% \times \frac{RER_t - ERES_t}{RER_t}$$

where positive (negative) values denote RER overvaluation (undervaluation).

#### 12.2.1 Data Sources

We use the dataset of Fox and Schröder (2018) and extend the series which is original from 1980–2016 to 1980–2018. The RER is a trade-weighted CPI-based proxy sourced from the International Monetary Fund's International Financial Statistics database. The terms of trade series comes from the World Bank's World Development Indicators (WDI) database, World Development Reports, and the BPNG. Trade openness is proxied through the trade ratio (exports

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plus imports relative to GDP), which we source from the WDI. Since there are no data on government consumption of tradables and non-tradables, we impose an equality restriction on the parameters attached to these variables, which allows the inclusion of total government consumption (*GC*) in the RER equation instead. We obtain the series *GC* from the BPNG. We retrieve data on net international indebtedness from Lane and Milesi-Ferreti's (2007) updated Wealth of Nation's database, which we extend using the procedure described in Fox and Schröder (2018). Finally, we proxy government take by the ratio of total resource revenue to resource GDP. The former comes from the International Centre of Tax and Development's database on government revenue, while the latter is sourced from the Australian National University's PNG budget database. Government take is only available until 2017.

#### 12.2.2 Estimation

To briefly describe the estimation procedure, we first test the stationarity features of the data. Augmented Dickey-Fuller tests suggest that the data are a mixture of I(0) and I(1) series. We employ the dynamic ordinary least squares (DOLS) estimator, which is suitable for a mix of stationary and non-stationary regressors. The DOLS method adds leads and lags of the first differenced regressors to the static co-integrating OLS regression, while Newey-West standard errors allow for statistical inference. The sustainable values are based on the trend component based on the Hodrick-Prescott filter.

The estimated long-run relationship between the RER and its fundamentals is as follows<sup>25</sup>:

$$\ln RER = 3.64 + 0.18 LTOT - 0.59 NFA$$

(0.3)    (0.06)    (0.11)

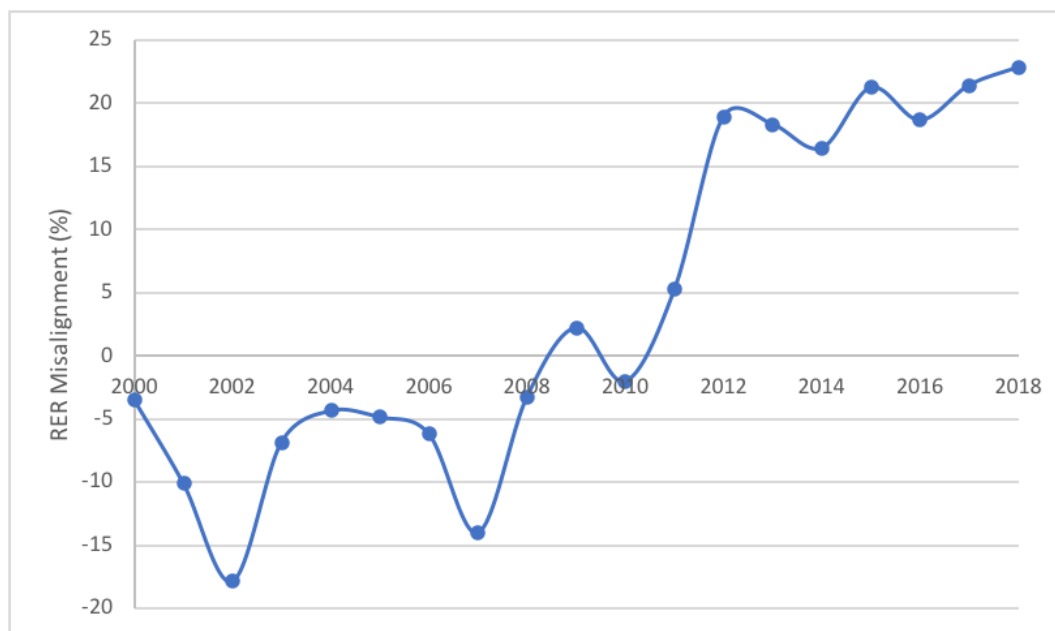
where the standard errors appear in parentheses below. The point estimate of *LTOT*, the logarithm of the terms of trade, suggests that a 10% increase in this variable appreciates the RER by 1.8% on average. A 1 percentage point improvement in the net foreign asset position (*NFA*, measured relative to GDP) depreciates the RER by about 0.6% on average.

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<sup>25</sup> The process of selecting a long-run relationship among various possibilities is described in detail in Fox and Schröder (2018).

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Figure 8 shows estimated degree of RER misalignment over 2000–2018. The results suggest that the RER has been substantially overvalued since about 2012. In 2018, real overvaluation is estimated at 20%, which is consistent with the earlier estimates of Fox and Schröder (2018).



*Figure 8: RER misalignment estimates, 2000–2018*

Note: Positive values indicate real overvaluation.

Source: Authors

### 12.2.3 RER misalignment estimates based on government take

When including government take as one of the fundamentals, the estimated long-run relationship becomes:

$$\ln RER = 4.29 - 0.74 NFA + 0.34 GovTake$$

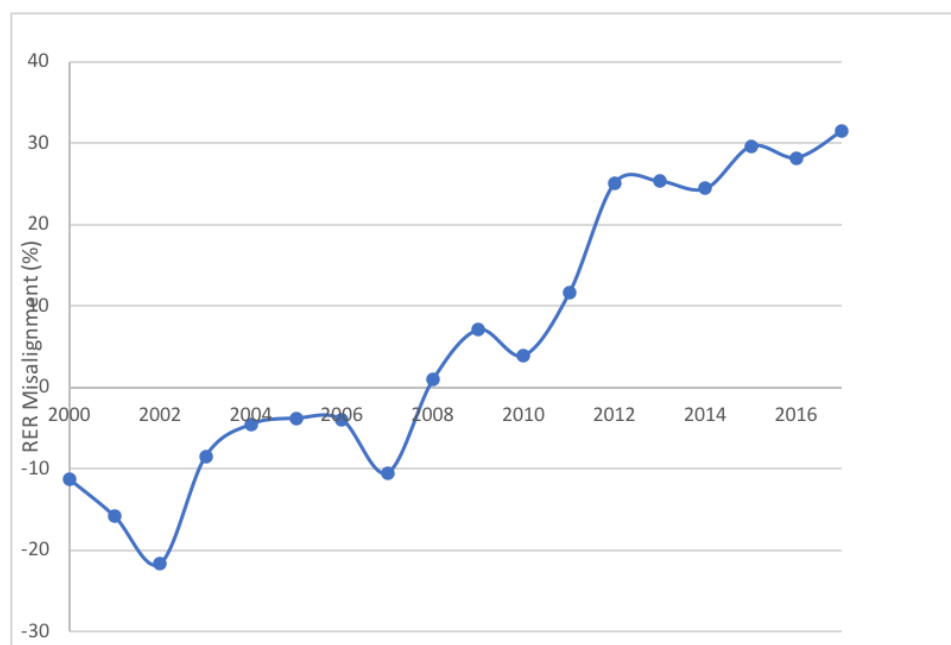
(0.18)    (0.39)    (0.18)

The results suggest that a 10 percentage point increase in government take appreciates the ERER by 3.4%, as predicted by the theoretical model of internal and external balance in Section 12.1.

Figure 9 reports the extent of RER overvaluation based on government take as a fundamental from 2000–2017. The general pattern remains is similar to the other estimates in that the RER

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seems to have been substantially overvalued since 2011, but the magnitude of the overvaluation is larger. In 2017, the last year of the sample period, real overvaluation is 30%.



*Figure 9: RER misalignment estimates based on government take, 2000–2017*

Note: Positive values indicate real overvaluation.

Source: Authors

### 12.3 Discussion of Results

Economic theory suggests that the real exchange rate should depreciate in response to a fall in the terms of trade, an increase in the fiscal deficit, and a fall in the government take in order to maintain both internal and external balance. This has not happened in PNG, which would suggest that the real exchange rate is now overvalued. The empirical results in this section confirm this. If PNG wants to put an end to the foreign exchange shortage, there must be a greater willingness to accept real depreciation.

Figure 10 shows the actual real exchange in PNG over the past 20 years. Overall, there has been a downward trend in the RER over this period, meaning that the RER has appreciated.

Normalizing the value of the RER in 2010 at 100, in 2002 the RER was 130 and in 2018 it was 82, that is a 37 percent appreciation over this period. We can explain this trend as follows. PNG



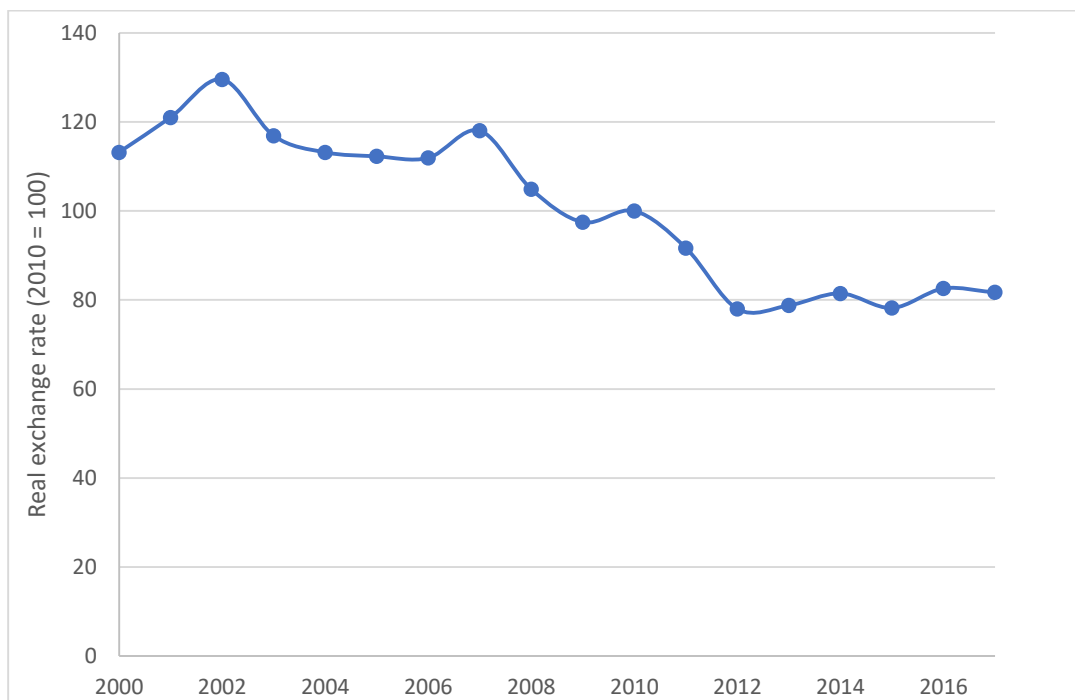
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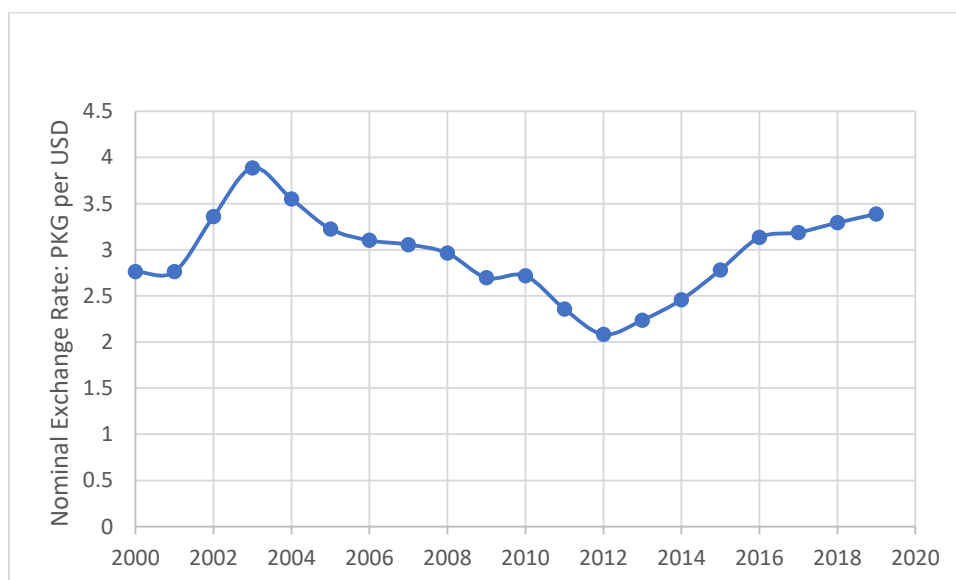
experienced a resources boom over the period 2002-2008 with sustained high prices in export commodities pushing up PNG's terms of trade. The increase in the terms of trade caused the RER to appreciate (to fall) which is a natural response for the economy. Following this, over the period 2010-2012 there was investment boom due to the construction phase of the PNG LNG project. The inward FDI flows associated the construction phase caused an appreciation of the Kina and appreciated the RER further, as can be seen by the fall in the RER over 2010 to 2012. Following this, in 2014 exports of LNG began however financial outflows associated with the resource sector investments offset the improvement in the current account. Just prior to the start of LNG exports, oil and LNG prices fell significantly (by more than 50 percent), other commodity prices also fell, and PNG experienced a negative terms of trade shock. At this point, in 2014, it would have been natural for the RER to depreciate, that is, to rise to a higher level due to the negative terms of trade shock. However, the depreciation in the Kina was resisted. Over the past 6 years, the RER has remained almost constant, with slow trend of slight weakening in the Kina offset by higher inflation in PNG relative to its trading partners. A yearly nominal depreciation of merely 3-5% in the context of an inflation differential relative to trading partners of a similar magnitude means that PNG's real exchange rate has remained stable. As a result, the economy has moved away from external balance (loss of currency convertibility) and internal balance (the non-resource sector has experienced low growth and periods of recession).

Figure 10 and Figure 11 allow us to view the relationship between the real and nominal exchange rates over the period 2012 to 2018. Given the inflation differential of between 3 and 5 percent that PNG has with its trading partners, while the nominal exchange rate was depreciating at a rate of between 3 and 5 percent per annum over the period 2012 - 2018, the real exchange rate remained constant.

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*Figure 10: Real Exchange Rate in PNG: 2000 – 2018 (IMF Data)*



*Figure 11: Nominal Exchange Rate in PNG: 2000 – 2019 (IMF Data)*

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Over the period from 2012 to the current day, the equilibrium real exchange rate, ERED (the exchange rate that will bring about internal and external balance), has depreciated in response to a number of factors. Firstly, the terms of trade have fallen. Secondly, there has been a sequence of increases in government spending and associated large fiscal deficits. And thirdly, government take from the resources sector has fallen significantly, from around 30 percent in 2011 to less than 5 percent currently.<sup>26</sup> Our results predict that a 10 percentage point decrease in government take depreciates the ERED by 3.4%,

With the ERED depreciating and the actual RER remaining constant, there has been an increasing divergence between the equilibrium rate and the actual RER. This divergence can be seen in Figure 8 and Figure 9. The divergence means that the RER has become significantly overvalued, and we calculate that currently the overvaluation is now between 20 and 30 percent.

A depreciation of the RER will help to correct this divergence and will bring the PNG economy into internal and external balance. In more concrete terms, not only will a real depreciation help to restore the convertibility of the Kina, it will also provide a stimulus to the economy, directed at the non-resource sector which will increase jobs and income. Although there will be winners and losers (as noted in Section 11.2), on net this policy will improve economic outcomes in PNG. A depreciation of the RER is *the path to Kina convertibility*.

## 13 Policy Recommendations and Discussion

Based on the analysis in this study we make the following policy recommendations.

### *Short Run Policy Recommendations*

1. The primary issue in the foreign market is chronic structural imbalance between demand and supply. This must be addressed first. We recommend a 20 percent depreciation of

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<sup>26</sup> It should be noted that part of this fall is due to an increase in the denominator of the expression for government take, which is resource sector output. The commencement of LNG exports in 2014 led to an increase in total resource sector output.

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the real exchange rate, based on our estimates that the real exchange is currently overvalued by between 20 and 30 percent. (Section 12.3)

2. To bring about a 20 percent depreciation in the real exchange rate will require an approximate 33 percent depreciation in the nominal exchange rate, given the pass-through of nominal exchange rate changes to inflation. For each 10 percent depreciation of the nominal exchange rate, inflation increases by 4 percent. A 33.3 percent depreciation in the nominal exchange rate will lead to a 13.3 percent increase in inflation (with pass-through complete in one year), and thus a 20 percent depreciation in the real exchange rate (see Section 11.4 for calculations).
3. We recommend that the adjustment in the nominal exchange is front loaded, with a 20 percent depreciation immediately, and the remaining 13 percent spread out over the subsequent two years (approximately 6.5 percent in each year).
4. A depreciation arranged in this way, which is front loaded but has gradual adjustment in subsequent time periods, is advantageous on a number of levels, and is justified as follows:
  - a. It kicks starts the necessary process of adjustment in the real economy. As noted in Section 12.3, relative to its trading partners PNG has higher inflation, with an inflation differential of 3 – 5 percent per annum. Thus, in order to bring about an adjustment of an appropriate magnitude in the real exchange rate, a large nominal depreciation is required.
  - b. Given the large backlog of forex orders, a front loaded depreciation is likely to stimulate forex inflows from overseas investors who expect the exchange rate to depreciate and are currently withholding trades into Kina to avoid capital loss associated with a depreciation (see Section 9.4).
  - c. It provides a credible signal to market participants that the government is serious about addressing the imbalances in the forex market. The expectation of

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improved access to foreign exchange will lead to an increase business confidence stimulating economic activity.

Points a. and b. above will contribute to improving convertibility in the foreign exchange market. The nominal depreciation in subsequent time periods allows for a necessary continuation of the adjustment of the real exchange rate at a slower pace, while allowing for some experimentation to ensure that it does not overshoot.

5. A 20 percent depreciation of the real exchange rate (33.3 percent depreciation of the nominal exchange rate) will have the following effects:
  - a. It is likely to lead to a substantial improvement in the trade balance which will increase forex inflows by an equivalent amount *all else equal*. In support of this, Nakatani (2017) finds that a 10 percent real depreciation will lead to a US 250 million per annum increase in forex inflows. (Section 11.5)
  - b. It will increase real agricultural export income by 33.4 percent (nominal agricultural income will increase by 46.7 percent). (Section 11.6)
  - c. At the end of the first year (after the 20 depreciation in the nominal exchange rate) real agricultural export income will have increased by 18 percent. (Section 11.6)
  - d. It will stimulate economic activity in the tradables sector (export and import-competing sectors) providing much needed stimulus to non-resource sector activity. (Section 11.1)
  - e. It will stimulate the supply of foreign exchange through increased financial inflows as it brings the exchange rate into closer alignment with market participants beliefs of the equilibrium rate. As the exchange rate comes into closer alignment with its perceived equilibrium value, expectations of future depreciations will diminish, and with them concerns of capital loss from holding Kina assets (also noted in point 4 above). (Section 9)

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- f. it will cause a redistribution of income from urban to rural households, however some of the falls in urban income will be moderated by the increase in non-resource sector activity.
- g. The redistribution of income noted above will increase the relative attractiveness of being located in a rural setting and will slow, and perhaps reverse, urban drift.

### *Longer-run (Less Immediate) Policy Recommendations*

6. In the longer term, more flexibility in the adjustment of the exchange rate should be allowed. Given the divergent nature of demand and supply transactions in the foreign exchange market in PNG we agree that some management of the exchange rate by the BPNG is necessary (e.g., managed float / crawling peg - see Section 4). However, in the face of the large terms of trade shocks that PNG experiences, there needs to be more flexibility in the exchange rate. Policy-makers should allow this adjustment. This means that in response to a negative terms of trade shock, the nominal exchange rate should be allowed to depreciate more. It also means that in response to a positive terms of trade shock the nominal exchange will appreciate. Not allowing adjustment will result in a divergence between the RER and the ERER, with consequences for both external balance (loss of currency convertibility) and the internal balance (low growth and recession in the non-resource sector). As a result of resisting this adjustment over the past 6 years the Kina is no longer convertible and growth in the non-resource sector has varied between slow and stagnant. (Section 12.3)
7. Given the tight links between the fiscal balance and the current account balance in PNG, the large fiscal deficits of the past 8 years have contributed significantly to the structural imbalance in the foreign exchange market. A fiscal rule, in addition to the Medium Term Debt Management Strategy, should be implemented to guide allocation of non-renewable resource wealth over time to ensure intergenerational equity. Such rules have the added benefit that they help to coordinate on lower levels of fiscal spending, which

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will support achieving and sustaining currency convertibility. Savings should be held in a sovereign wealth fund. (Section 7)

8. Once convertibility of the Kina has been re-established, we recommend that the BPNG establish an interbank market and conduct trading of forex through a daily auction. This will have clear benefits in terms of the efficient allocation of forex to the market. Such an arrangement is not feasible in the current circumstances with the BPNG setting both the price (nominal exchange rate) and quantity of foreign exchange in the market. (Section 10.5)
9. Precipitous falls in the government take, as have occurred in the past 9 years in PNG, require difficult adjustments for the economy and the government. A fall in government take depreciates the equilibrium real exchange rate, requiring a depreciation of the Kina to maintain external balance (currency convertibility) and internal balance (full employment). Given the borrowing constraints that the PNG government faces, it is difficult to manage the large variations in revenue relative to expenditure that coincide with significant changes in government take. More stability in the government take is desirable. This requires the government to frontload the revenue streams of new projects relative to current arrangements, through greater use of royalties and less generous tax exemptions. (Section 6.1, Section 12.3)
10. Steps should be taken to improve foreign access to the domestic bond market. A prerequisite for foreign investment in PNG government bonds is a fully convertible currency. Given the successful sovereign bond issue in 2018, there is clearly an international appetite for PNG's government bonds. This will assist the government in managing divergences that arise between revenue and expenditure, particularly because of the volatility in resources taxation revenues. It will also create additional discipline for government as international investors are not captives of the domestic market, unlike domestic savers, particular the large institutional savers, who have limited other options.

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11. Any additional financing to support the external account should be undertaken with caution keeping in mind the external balance objective (*external balance is the maintenance of currency convertibility at all stages of the international business cycle without recourse to external borrowings that are so large that their servicing requires reductions in average living standards at some future point in time*). If external borrowing can be justified with full consideration of the external balance criteria, it should only be undertaken on concessional (and not commercial) terms. (Section 11.5)

#### *Other Policy Recommendations and Discussion*

12. Policy-makers current reluctance to allow adjustment in the nominal exchange may be based on a number of factors which we will address here:
  - a. Firstly, *elasticity pessimism*, that is, a belief that the trade balance does not respond to a depreciation. We present compelling evidence that the Marshall-Lerner condition holds (Nakatani 2017), and that a real depreciation will improve the trade balance. Evidence suggests that a 10 percent real depreciation leads to an improvement in the trade balance of around USD 250 million (see Section 11.5).
  - b. Secondly, *a concern that a depreciation will lead to a long period of increased inflation*. Indeed, a nominal depreciation does increase inflation, however, pass-through is moderate at only between 30 and 40 percent (a 10 percent nominal depreciation increases inflation by between 3 and 4 percent) and pass-through is complete after only four quarters. This means that inflation returns to its trend level after a year, and there is no evidence of a persistent increase in the trend level.(Section 11.3)
  - c. Thirdly, that *it will cause an unfavorable redistribution of income* and this may be unpopular to the electorate. A depreciation will create winners and losers. It redistributes income away from urban and towards rural households, so urban



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households will be likely to oppose, and rural households to favor, a depreciation (see Section 11.2). However, a depreciation provides a stimulus to activity in export and import-competing sectors (as noted in Section 11.1, a depreciation has an effect equivalent to an ongoing production subsidy to the tradable sector without any cost to the government), and to the non-resource sector. Stimulus to these sectors will improve the incomes of both urban and rural households, offsetting to some degree the effects of the depreciation on the incomes of urban households.

- d. Finally, there may *psychological attachment with a belief that stronger exchange rate is preferred to a weaker one*. Economic theory is agnostic on this (the ideal exchange rate is one that brings about internal and external balance). From a mercantilist's (that is, businessman's or businesswoman's) perspective, a weaker exchange rate is preferred. For example, for many years, China and other East Asian economies ran their exchange rates at a depreciated (or weaker) level in pursuit of a policy of export-led growth, and reserve accumulation. From a nationalistic perspective a stronger exchange rate may be viewed as a sign of strength.<sup>27</sup>

13. Investment of foreign exchange reserves in an actively managed portfolio is not appropriate given the need for reserves to be kept in a form which is liquid and readily usable. Investment of reserves in a passively managed portfolio of highly liquid assets, such as US Treasury bonds, could be considered. Given foreign exchange reserves of USD 2.5 billion, if 75 percent of reserves are invested, and a return of 1 percent per annum is earned, then annual earnings would be around USD 19 million. (Section 10.3)

14. The conversion of a significant proportion of PNG's foreign exchanges to gold (a gold bullion bank/reserves option) should not be undertaken. This option increases the risk,

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<sup>27</sup> It is interesting to note that Donald Trump has espoused both views (nationalist and mercantilist) during his time as President of the US, talking up and talking down the value of the USD.

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and resource and transaction costs, involved in managing and using PNG's foreign exchange reserves. It might also be a gateway to a gold standard which if taken would worsen economic outcomes in PNG. There is a substantial body of international evidence that recommends against the use of a gold standard. (Section 10.4)

## 14 Future Exchange Rate Arrangements

In this section we discuss briefly possible alternative options for PNG's exchange rate regime. There are a number of exchange rate regime options available to a small open resource rich country developing country like PNG. From Independence in 1975 until 1994, the Kina was pegged to a trade weighted basket of currencies, consisting mainly of USD and AUD. In late 1994 the Kina was floated, and has operated as a managed float / crawling peg since, with the IMF's classification switching from managed float to crawling peg in 2014.

The Kina is pegged relative to the USD, and this has been the case for a number of years.

Alternative exchange rate regimes that PNG could consider are:

- i. to change the currency against which it pegs to the AUD;
- ii. to peg to a basket of currencies;
- iii. to adopt of an external currency in place of the Kina.

Regimes ii. and iii. are currently in use in other Pacific Island countries. For example, Fiji, Samoa, Solomon Island and Tonga all peg to a currency basket. The micro-states of the Cook Island, FSM, Kiribati, Marshall Islands, Nauru, Palua, Timor-Leste and Tuvalu all use an external currency. Like PNG, Vanuatu also uses a managed float / crawling peg.

One of the interesting characteristics that must be accounted for in considering PNG's optimal exchange rate regime is that PNG's exports are primarily priced in USD. However, because about 50 percent of PNG's imports are sourced from Australia, its imports are largely priced in AUD. Looking at the price of exports,  $P_{EX}$ , and imports,  $P_{IM}$ , in Kina then

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$$P_{EX} = e_{K/USD} \cdot P_{EX}^{US}$$

$$P_{IM} = e_{K/AUD} \cdot P_{IM}^{AU}$$

The price of PNG's exports in Kina is determined by the product of the Kina to USD exchange rate,  $e_{K/USD}$ , and the USD price of exports,  $P_{EX}^{US}$ . On the other hand, the Kina price of PNG's imports is determined by the product of the Kina to AUD exchange rate,  $e_{K/AUD}$ , and the AUD price of the imported goods,  $P_{IM}^{AU}$ . Thus, the terms of trade, which is the Kina price of exports divided by the Kina price of imports (the rate at which imports can be converted into exports) is given by

$$\frac{P_{EX}}{P_{IM}} = e_{AUD/USD} \frac{P_{EX}^{US}}{P_{IM}^{AU}}$$

PNG's terms of trade is dependent on the price of exports in USD relative price of imports in AUD and the AUD to USD exchange rate,  $e_{AUD/USD}$ . Usually when we calculate the terms of trade for a small open economy, the exchange rate terms drops out because imports and exports are both priced in a common international currency. However, this is not the case for PNG and as a result there is an extra term in the terms of trade, which is the exchange rate between the AUD and the USD.

Any movements in the AUD/USD exchange rate will influence PNG's terms of trade. The AUD/USD exchange rate is freely floating, and moves widely over the economic cycle. For example, over the past 10 years, it has varied between about 0.6 USD per AUD and 1.1 USD per AUD, the highest value being more than 80 percent above the lowest value. This is an additional source of movement in the terms of trade, beyond movements in the prices of PNG's commodity exports,  $P_{EX}^{US}$ , and the prices of Australian imports,  $P_{IM}^{AU}$ . While  $P_{EX}^{US}$  rises and falls with global economic activity,  $P_{IM}^{AU}$  is fairly stable moving in line with the rate of inflation in Australia which averages around 2 percent. As the USD strengthens relative to the AUD, then  $e_{AUD/USD}$  rises and PNG's terms of trade will improve.

In the face of a global shock, such as the Covid-19 pandemic, commodity prices,  $P_{EX}^{US}$ , tend to fall putting downward pressure on PNG's terms of trade. However, since the USD strengthens

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during global shocks, and  $e_{AUD/USD}$  rises, this provides an offsetting movement in the terms of trade which helps to stabilize it.

Pegging the exchange rate to a trade weighted basket of currencies, which would include the AUD and USD, would help to reduce the volatility in the terms of trade introduced through the inclusion of the AUD/USD exchange rate term.

Ideally the exchange rate regime is chosen to minimize the volatility of GDP; although there can be other criteria, for example, minimizing the volatility in trade flows. A standard approach to calculating the optimal weights in the basket to minimize volatility as in Yoshino *et. al.* (2003). An analysis of this problem is left for future research.

#### 15 International technical partners that could assist with the development and implementation of the recommended policy actions

##### 1. International Monetary Fund

###### Assistance:

- a. input on fiscal rules to support equitable distribution of resource wealth over time.  
Such rules will also assist in achieving and sustaining currency convertibility.

##### 2. RBA, RBNZ

###### Assistance:

- a. advice on set-up of an interbank foreign exchange market with daily auctions.
- b. advice on passive investment of foreign exchange reserves.
- c. advice on steps to take to improve foreign access to the domestic Treasury bond market.

##### 3. Development Policy Centre, Australian National University and Institute of National Affairs

###### Assistance

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- a. study on the welfare implications of an exchange rate depreciation on different groups within PNG.
  - b. exchange rate arrangements: study on the optimal currency or basket of currencies against which to peg the Kina.
4. INA – CIMC

#### Assistance

- a. assistance with dispersing the message to the community about the effects of an exchange rate depreciation, and the likely impacts of the depreciation on the economy, on businesses and on households.

## 16 Examples of what has worked elsewhere and international best practice

Below we briefly discuss the experience of two resource rich countries, Nigeria and Uzbekistan, with forex shortages.

### *i. Uzbekistan*

Uzbekistan is a double landlocked country located in Central Asia. Its economy is dependent on primary exports, and it belongs to the IMF's group of 29 resource-rich developing countries (RRDCs) along with Papua New Guinea. In the years immediately after gaining independence from the Soviet Union in 1991, Uzbekistan depended on cotton production. In more recent years, however, gold and natural gas have become its main exports while wheat, meat, and most manufactured goods are imported. Until 2016, the government promoted an import-substitution strategy that was heavily driven by state investments. Credit was directly channeled to state-owned enterprises (SOEs.) The government imposed high import duties and excise taxes and imposed foreign exchange controls. The latter resulted in a significantly overvalued real exchange rate and the emergence of a parallel market where the dollar traded at a significant premium.

The negative economic impacts of these distortions, especially the overvalued exchange and exchange rate controls, eventually became visible when commodity prices began declining in

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2014. Economic growth decelerated, manufacturing exports declined, and current employment growth was too low to absorb the thousands of young people entering the labor market every year. In September 2017, the government of Uzbekistan unified the exchange rate, which led the Som, the national currency, to depreciate by about 50% from 4,210 to 8,100 per USD. This caused the immediate disappearance of the black-market premium. The exchange rate regime is now floating, *de jure*, but is *de facto* a stabilizing arrangement according to the IMF (2018). Effectively, there are no more restrictions on currency convertibility and the repatriation of profits, which is a boost to Uzbekistan's attractiveness from the viewpoint of foreign investors.

Following the exchange rate unification, the positive economic benefits were readily observed. Despite adverse weather impacts on agricultural output, GDP growth picked up and the now-available foreign exchange boosted investment growth. Trading activity also increased significantly. One year after the exchange rate unification and the depreciation, exports expanded by 22.5%, with food exports rising 45%. Imports rose even faster, by 40%. On the finance front, exchange rate liberalization promoted loan agreements worth more than USD 1 billion with the European Bank of Reconstruction and Development and several German banks, which were aimed at supporting infrastructure and small business projects (Tsereteli, 2018.) Anecdotally, economic activity also increased substantially in the non-tradable sector, with the emergence of numerous restaurants and shops in nation's capital, Tashkent.

#### ii. *Nigeria*

Nigeria is the most populous African country, and it also belongs to the IMF's group of 29 RRDCs. The economy is heavily dependent on petroleum exports, which are the source of up to 95% of foreign exchange earnings and 70% of government revenue. During the commodity price boom years up to 2014, annual GDP growth was robust ranging between 5-8%. The unemployment rate reached a low of 6.4% at the end of 2015. Nigeria did not adjust well to the end of the commodity price boom in 2014. GDP growth more than halved in 2015 before the economy entered a recession in 2016. In an attempt to counter the impact of falling crude oil prices, the government introduced a set of exchange rate restrictions in 2015. The official rate was pegged at 200 Naira per US dollar, while it was traded at a 50% discount in the parallel

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market. In mid-2016 the authorities allowed some depreciation in the Naira, which closed the gap between the official and parallel market exchange rates. At the same time, there was a move to a complicated multiple exchange rate system. While foreign reserves and inflation stabilized, imports contracted by 34% in 2016. In particular, the manufacturing sector struggled to import crucial raw materials and intermediate goods. Almost all sectors in the economy reported declining output levels. As a result, unemployment soared to over 13% in mid-2016. More recently the Central Bank of Nigeria allowed greater convergence among the various exchange rates. Nonetheless growth rates remained sluggish at below 2% in 2017 and 2018. Such low growth rates are insufficient to increase incomes on a per capita basis, given the fast population growth. This poor economic performance is reflected in the unemployment rate, which soared to over 23% in 2018. In the absence of strong structural reforms, including exchange rate unification and removal of FX restrictions, the medium-term outlook remains muted (IMF, 2019).

*Summary:* The key takeaway point from these examples is that persistent FX shortages have serious adverse economic impacts. The Uzbek experience demonstrates that the most efficient way to address foreign exchange shortages is to devalue to nominal exchange rate sufficiently. PNG should follow Uzbekistan's approach, rather than that of Nigeria. This would likely achieve an expansion of exports, and imports (as access to foreign exchange improves), foreign investment, and higher growth both now and into the future.

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## 18 Acknowledgements

The author gratefully acknowledges the following contributions: Marcel Schröder for the empirical analysis (Section 12.2), and for assistance with completing an earlier phase of this study (parts of Sections 6, 10, and 16); Paul Barker for numerous discussions, and helpful comments on various drafts of the study; John Fallon for helpful comments on various drafts of the study; Laura Nettuno for running the fiscal deficit - current account regression, proof reading the document, and for arranging the references; Iain Smith and Kryan Curry for helpful comments on earlier drafts of the study.



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Data

The data used in this study is from PNG Times Series Dataset assembled by the Development Policy Centre, Australian National University.