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Working Paper

The path to Kina convertibility: An analysis of Papua New Guinea's foreign exchange market

ADB Economics Working Paper Series, No. 663

Provided in Cooperation with:

Asian Development Bank (ADB), Manila

Suggested Citation: Davies, Martin; Schröder, Marcel (2022) : The path to Kina convertibility: An analysis of Papua New Guinea's foreign exchange market, ADB Economics Working Paper Series, No. 663, Asian Development Bank (ADB), Manila, <https://doi.org/10.22617/WPS220228-2>

This Version is available at:

<https://hdl.handle.net/10419/264378>

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THE PATH TO KINA CONVERTIBILITY

AN ANALYSIS OF PAPUA NEW GUINEA'S
FOREIGN EXCHANGE MARKET

Martin H. Davies and Marcel Schröder

NO. 663

June 2022

ADB ECONOMICS
WORKING PAPER SERIES

ADB Economics Working Paper Series

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No. 663 | June 2022

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We thank Paul Barker and Stephen Howes for helpful discussions and suggestions. We are also grateful to seminar participants at ADB, Australian National University, Papua New Guinea Institute of National Affairs, and the University of Papua New Guinea. We would like to acknowledge Laura Nettuno and Nedelyn M. Ramos for excellent research assistance.



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ISSN 2313-6537 (print), 2313-6545 (electronic)
Publication Stock No. WPS220228-2
DOI: <http://dx.doi.org/10.22617/WPS220228-2>

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ABSTRACT

Papua New Guinea (PNG) has faced a foreign exchange (forex) shortage since 2015. To protect reserves, the Bank of PNG has resorted to forex rationing that led to a large backlog of orders and import compression. This paper surveys the structure of PNG's forex market and analyzes recent market conditions. We argue that the various policy proposals being discussed currently in PNG are inadequate to restore currency convertibility. For this, a real exchange rate depreciation is required instead. We develop a forex market model that features a backlog of unmet orders, which suggests that a frontloaded depreciation is preferred to an often-favored gradual adjustment. Empirical results indicate that the government's large budget deficits have contributed to the forex shortage, which highlight the need for greater fiscal restraint. In the longer term, we argue for more exchange rate flexibility and forex allocation through competitive auction.

Keywords: foreign exchange shortage, foreign exchange rationing, currency convertibility, Papua New Guinea

JEL codes: F31, O23, Q32

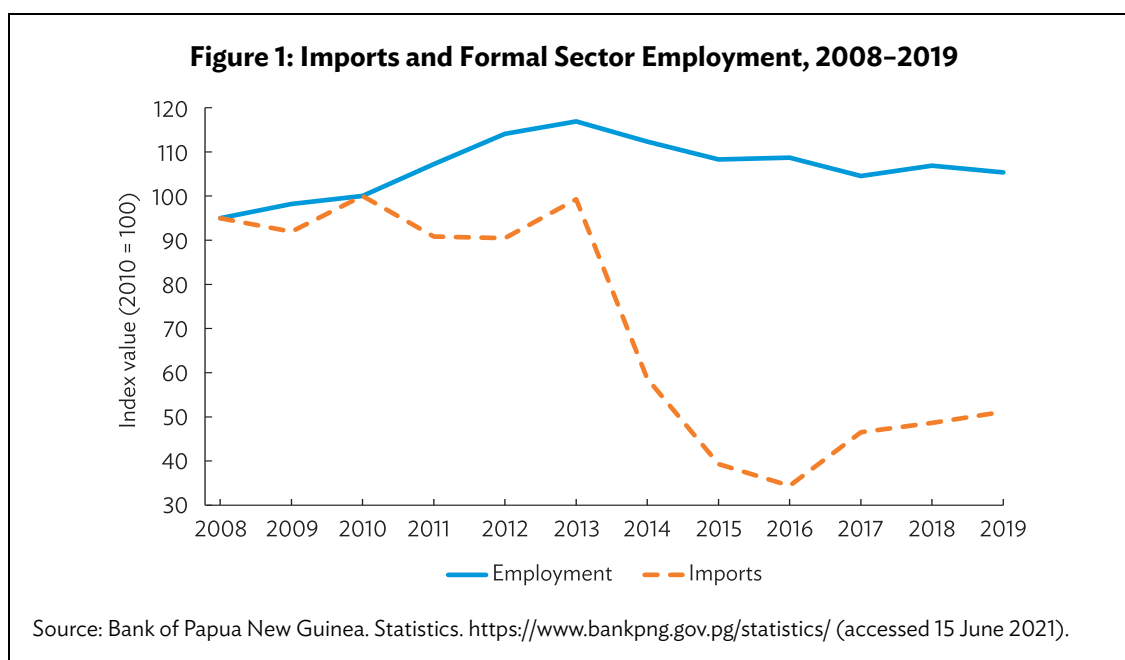
I. INTRODUCTION

Foreign exchange (forex) shortages have beset the economy of Papua New Guinea (PNG) since the end of the commodities supercycle in 2014. The central bank, the Bank of Papua New Guinea (BPNG), has allowed some nominal depreciation, but has resisted full adjustment in the real exchange rate (RER), and instead managed the shortage by rationing forex that led to large backlog of unmet forex orders. Although this backlog has waxed and waned over time, it has remained a constant feature of the forex market.

Despite the swing in the current account from deficit to surplus of about 25% of gross domestic product (GDP) since around 2015 starting with liquefied natural gas (LNG) shipments from the PNG LNG project, the economy continues to experience a shortage of forex. The reasons behind this are offsetting financial outflows associated with initial PNG LNG investments, declining government take from the resource sector—the ratio of fiscal resource revenue to resource output—and other factors such as a deterioration in the government’s budget balance that is, in part, driven by a substantial rise in the salary bill.

The BPNG has rationed the market’s access to forex through guidance to the commercial banks to protect forex reserves, giving priority to transactions for goods deemed necessities, while discouraging others such as profit repatriation. There has been some relaxation in this guidance over time, as estimates of the backlog declined from K4.5 billion in 2015 to about K1.0 billion in 2019. As a result of the coronavirus disease (COVID-19) pandemic, the backlog has increased again and is estimated at about K2 billion in 2021. However, the backlog is likely to be underestimated at any time. This is because firms and households are holding assets on their balance sheets that they would like to convert into forex but do not bring to market, and have latent demand for imported goods and foreign assets. This part of the backlog is not visible in the banking system.

The rationing of forex is one of the major factors that has contributed to import compression (Figure 1) which reduces growth and investment, diminishing productive capacity to reap future export



opportunities. It also reduces the variety and availability of goods for domestic consumers which has a welfare cost to households. Formal sector employment has been on the decline also since 2014. Given these dire consequences, returning the kina to full convertibility should be a high priority.

The objective of this paper is to analyze PNG's forex market and recommend adjustments to policy and forex market arrangements to facilitate the return to currency convertibility. We describe the underlying characteristics of PNG's forex market, and discuss the factors on the supply and demand sides that have caused the chronic forex shortage. We then analyze the policy proposals that have circulated in PNG policy circles to remedy the forex shortage. These include imposing requirements for state-owned enterprises (SOEs) and other businesses to remit their profits back to PNG instead of holding them overseas or seeking forex through concessional finance. We argue that these proposals, either implemented on their own or in concert, are not suitable to restore kina convertibility because they do not fundamentally address the structural supply-demand mismatch in the forex market.

A sustainable return to currency convertibility requires restoring internal and external balance in the PNG economy. To illustrate this point, we use the internal-external balance model of Davies and Schröder (2021) which accounts for key features of resource-rich developing countries (RRDCs) such as PNG.¹ They use their model to guide the empirical estimation of PNG's equilibrium real exchange rate (ERER) and find that the RER is overvalued by 14%–26% in 2019. On this basis, we recommend a real depreciation of about 20%, i.e., the midpoint of their estimates, in order to bring about internal and external balance.

However, implementing this real depreciation is not straightforward as ongoing rationing has led to a pent-up demand for forex. There is also counterbalancing stock of forex being held outside PNG waiting to be converted into kina when the market price and conditions are right. The holders of this stock include foreign investors who are postponing their investments in PNG to avoid a capital loss because they expect the kina to depreciate. It also includes domestic firms that hold a stock of forex offshore to avoid the shoe-leather costs associated with negotiating and queuing for forex that they would have to incur for their future overseas purchases.² These accumulated stock imbalances are significant features of the forex market and must be resolved for convertibility to be reestablished.

We formally model this backlog situation in PNG's forex market. The model suggests that overseas holders of the forex stock will not enter the market until the exchange rate has adjusted to ensure that the expected depreciation is equivalent to the asset return differential of PNG relative to foreign assets, adjusted for shoe-leather costs. This implies that restoring forex market equilibrium requires a swift and frontloaded exchange rate depreciation to entice the holders of the forex stock to enter the market and clear the accumulated stock imbalances.

The rest of the paper is organized as follows. Section II analyzes PNG's forex market in terms of its structure, recent conditions, and factors that have led to the shortage. Section III analyzes the proposals that are currently circulating in PNG policy circles. Section IV makes the case for a real

¹ The IMF (2012) defines RRDCs as those low- or lower middle-income countries (GDP per capita less than \$4,000) whose exhaustible natural resource exports amount to at least 20% of total exports. Based on these criteria, the following 29 countries belong to this group: Angola, Bolivia, Cameroon, Chad, Democratic Republic of Congo, Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Guinea, Guyana, Indonesia, Iraq, the Lao People's Democratic Republic, Liberia, Mali, Mauritania, Mongolia, Niger, Nigeria, Papua New Guinea, Sudan, Syria, Timor-Leste, Turkmenistan, Uzbekistan, Viet Nam, Yemen, and Zambia.

² Shoe-leather costs include the waiting time in the forex queue before a transaction clears and resources expended in interacting with forex dealers (domestic banks) and the central bank to negotiate the completion of the transaction.

depreciation in PNG using the internal and external balance model of Davies and Schröder (2021), and develops a model of the PNG forex market that features a backlog of unmet orders. Section V outlines the policy recommendations in relation to the exchange rate and fiscal policy following from the analysis. Section VI concludes.

II. THE FOREIGN EXCHANGE MARKET IN PAPUA NEW GUINEA

This section describes the forex market in PNG.³ We describe the market structure and recent market conditions before analyzing the factors that have led to the forex shortage. We examine the twin deficit hypothesis in the case of PNG to gauge the extent to which the government's budget deficits have contributed to the forex shortage.

A. Structure and Recent Conditions

There is a continuous daily demand for foreign currency to facilitate the purchases of imported goods and services for consumers, businesses, and the government. 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—capital goods, intermediate inputs, and final consumption goods—for household and business use.

On the other hand, the supply of forex arrives in larger discrete bundles. The main sources are receipts from primary exports and payments from resource companies such as royalties. To a lesser extent, there is income from foreign investments, remittance of profits from private companies, and quarterly or biannual remittances of dividends and profits by SOEs. Foreign direct investment (FDI) inflows to the resource sector have been, at times, a large contributor to forex inflows; for example, when a resource project is in the construction phase such as PNG LNG during 2010–2013. The issue of sovereign bonds, commercial loans, support from the International Monetary Fund (IMF), the World Bank, the Asian Development Bank (ADB), and grants have also contributed to the supply of forex, but many of these are one-off occurrences.

Because of the timing mismatch between the forex demand and supply side transactions—a continuous stream of smaller transactions versus a discrete and intermittent number of larger transactions—it is necessary to have a market-making institution such as the BPNG to smoothen the supply of forex to match the daily demand. Without an institution taking on this function, there would be longer periods of excess demand for forex that will lead to exchange rate depreciation 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 businesses, and households to deal with exchange rate risk, it is a preferable for the BPNG to limit the private sector's exposure to this risk by

³ Unless indicated otherwise, information in this section is sourced from interviews with private and public forex market participants that the authors conducted in 2020. An earlier version of this section appears in Davies (2021).

stabilizing the exchange rate. In acknowledgement of the BPNG's role in the forex market, the IMF classifies PNG's exchange rate regime as a *de facto* crawl-like arrangement (since 2014).⁴

In terms of market structure, the BPNG accounts for the major share of the supply. While the domestic commercial banks, such as Kina Bank, the Bank South Pacific, and Westpac, can match exporter and importer trades to some degree, they have insufficient forex on net and must resort to purchases from the central bank. Currently, the BPNG is selling about \$75 million per month to the domestic banks. Rather than distribute this to the banks according to competitive auction, this intervention is grandfathered to the banks based on their share of domestic banking activity; for example, the Bank South Pacific takes the largest share of about 45% on this basis. The forex market is one-sided, meaning that the BPNG only quotes a price for forex sales because the commercial banks never have surplus forex.

In terms of recent market conditions, the non-resource sector has faced a chronic forex shortage since about 2014. Since around 2015, in the face of this shortage, the BPNG has rationed the market's access to forex, rather than allowing the exchange rate to depreciate. This has led to a backlog of unmet orders, with estimates having ranged between K1.0 billion and K4.5 billion over time (Business Advantage PNG 2015, Fox et al. 2017, Davies and Schöder 2021). There are also delays in the processing of forex orders, currently estimated at 3–12 weeks (James 2021). Despite these conditions, a parallel market has not developed in PNG, in contrast to most other developing economies facing forex shortages.⁵

Figure 2 shows the RER and nominal exchange rate (kina per United States [US] dollar) in PNG over 2000–2019. PNG experienced a resource boom with sustained high commodity prices over 2002–2008 which caused the RER to appreciate. This was followed by an investment boom triggered by the PNG LNG project's construction phase during 2010–2013. The associated FDI inflows pushed up the kina's value vis-à-vis the US dollar as the BPNG's interventions were limited, which led to RER appreciation that culminated in 2012. In 2014, the commodities supercycle came to an end as the price of oil and other commodities declined by more than 50%. At this point, it would have been natural for the RER to depreciate, but the authorities resisted this adjustment process (Fox and Schröder 2018). Since 2012, the RER has remained almost constant, as the yearly nominal depreciations of 3%–5% were offset by higher inflation in PNG relative to its trading partners. These recent developments and forex market conditions suggest that PNG's economy has moved away from external balance, i.e., loss of currency convertibility, and internal balance because the non-resource sector has experienced negative or low growth and formal sector employment has been falling (see Figure 1). In short, the RER appears substantially overvalued.

⁴ A *de facto* crawl-like arrangement means that the exchange rate remains within a margin of 2% relative to a statistically identified trend for 6 months or more.

⁵ In 2016–2017, there was a small-scale black market in which the Australian dollar traded at a 15% premium (Fox et al. 2017), but it seems to have disappeared since then.

Figure 2: Real Exchange Rate and Nominal Exchange Rate, 2000–2019

Note: An increase in real exchange rate denotes appreciation.

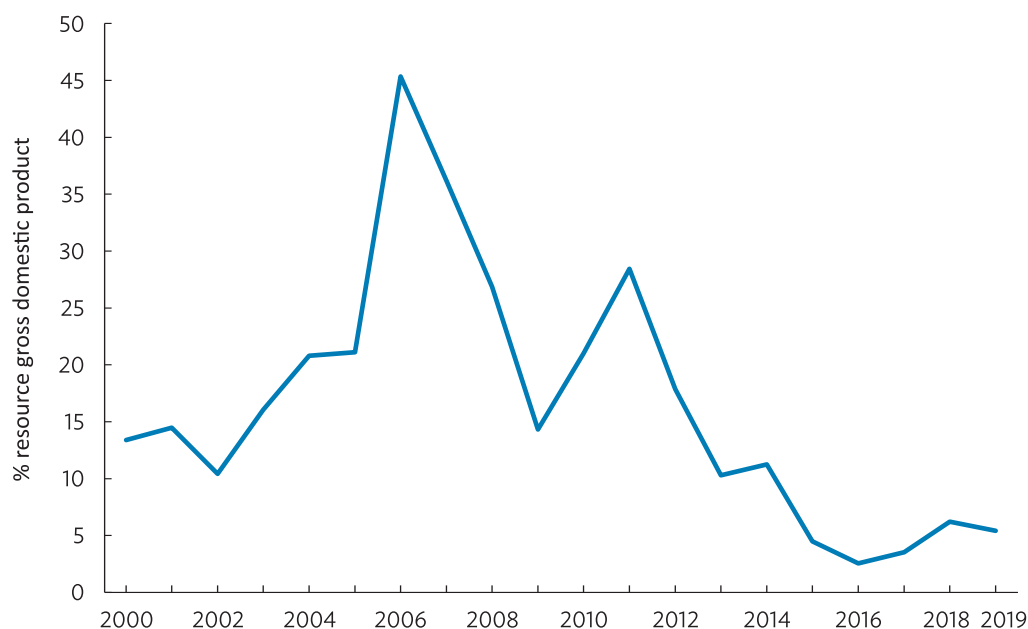
Sources: International Monetary Fund. International Financial Statistics. <https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b> (accessed 15 June 2021); World Bank. World Development Indicators. <https://databank.worldbank.org/source/world-development-indicators> (accessed 15 June 2021).

B. Reasons Behind the Foreign Exchange Shortages

The cause of the forex shortage is a prolonged supply-demand mismatch. The reasons for the decreased supply include:

- (i) **Low government take from resource projects.** The government's receipts from the resource sector have been on the decline since about 2011 because of various factors. First, the fall in commodity prices played a key role as it meant that the amount of taxable resource rents declined. Second, the massive PNG LNG project has been in the early phase of its lifecycle during which revenue accrual to the government is naturally low as initial investments are still being recovered. This explains why, despite the swing in the current account from deficit to a large and persistent surplus of about 25% of GDP from mid-2014 with the start of LNG shipments, the economy continues to experience a shortage of forex, as the financial outflows associated with PNG LNG investments offset the current account inflows. Third, the Government of PNG granted several tax incentives to the PNG LNG consortium, e.g., accelerated depreciation arrangements, which led to further back-loading of fiscal resource revenues.

Figure 3 shows the variation in government take—defined as the fiscal revenue from resource projects as a percentage of total resource GDP—over 2000–2019. It is clear that government take has been low since about 2015, well below the long-term average of 20%. It plummeted from about 30% in 2011 to 5% in 2019. This has significantly lowered forex inflows.

Figure 3: Government Take from Resource Projects, 2000–2019

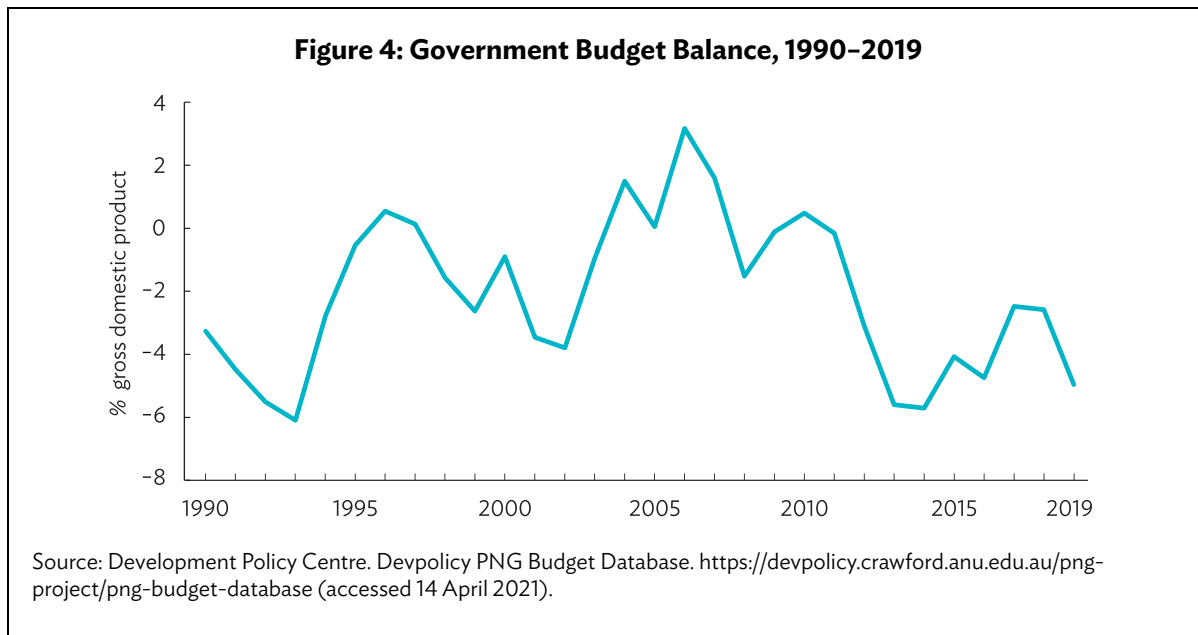
Source: Adapted from Martin H. Davies and Marcel Schröder. 2021. “A Simple Model of Internal and External Balance for Resource-Rich Developing Countries.” ADB Economics Working Paper No. 660. Asian Development Bank, Manila. (Figure 2).

- (ii) **Fall in the terms of trade.** Over the period 2011–2019, PNG’s terms of trade fell by about 27%. This was not just driven by the decline in commodity prices, but also in agricultural exports such as palm oil and coffee. The price of the latter roughly halved between the second half of 2014 and 2015, and continued to decline until the first half of 2019. These developments reduced export revenues and thus the forex supply.
- (iii) **Expectation of a depreciation.** Given the ongoing imbalances in the forex market and the large backlog, foreign investors, exporters, and others wishing to invest or repatriate funds to PNG have the expectation that the exchange rate will eventually depreciate. The model developed in Section IV.B argues that forex holders will not enter the market because of this expectation until a sufficiently large depreciation occurs.⁶
- (iv) **Backlog of forex orders.** Related to the above, PNG-based businesses are well aware that their forex orders are either delayed or unmet. This means that exporting businesses have little incentive to repatriate forex to PNG. Although there are surrender requirements in place, PNG lacks an effective system to enforce these (Fox et al. 2017). By leaving funds abroad, exporters avoid joining the forex queue the next time overseas payments need to be made. Thus, the paradoxical side effect of the rationing policy is that it lowers the supply flow of forex, which hampers the BPNG’s reserve accumulation.

⁶ Interviews with market participants indicate that the funds are indeed held offshore, and that some investors have postponed their investment projects in PNG because of their fear of capital loss. Estimates of how much these funds and investment projects amount to are not available.

Reasons for the increased demand include:

- (i) **High propensity to import by the private sector.** As mentioned, businesses need to import specialized capital equipment and intermediate inputs because these are not produced in PNG. Similarly, households in PNG consume imported durable and nondurable items such as household appliances, medical supplies, and food that are also not produced in PNG.
- (ii) **Fiscal policy settings and high propensity to import of government spending.** A high proportion of government spending falls on imports. Informal estimates put the import content of government spending at about 60%–70%. Since about 2013, the government has run a sequence of fiscal deficits that are large by historical standards (Figure 4). A large contributor to these deficits has been the government's salary bill, which increased by 43% between 2013 and 2019 and now represents 45% of its total revenue (Howes 2020). Below, we examine the twin deficits hypothesis in PNG to shed more light on the extent to which fiscal deficits contribute to the forex shortage.



C. The Twin Deficits Hypothesis in Papua New Guinea

The twin deficits hypothesis postulates that a government's budget deficit causes a higher current account deficit, which in turn requires either offsetting financial inflows, running down reserves if the exchange rate is fixed, or nominal depreciation if the exchange rate is floating. In this section, this link in PNG is not clear-cut. On the one hand, it could be strong, given the high import content of government spending (Garnaut and Baxter 1983, and Duncan et al. 1998).⁷ On the other hand, the net factor income and net unilateral transfer terms represent sizable components in PNG's current account balance which may dilute it. Because of the procyclicality of fiscal policy in PNG, net factor

⁷ Duncan et al. (1998) show a negative correlation between government expenditure and the current account balance. This was a motivating factor behind the hard kina policy, which was in place from the period of independence to the mid-1990s.

income and the government's budget balance tend to move in opposite directions. During years of economic expansion, the budget balance improves while foreign investors repatriate their higher profits. Since 2015, two factors are likely to have further weakened this link. First, LNG exports boosted the current account to surplus, while the budget deficit was rising (Figure 4). Second, the BPNG's forex rationing has led to import compressing which lowered the current account deficit.

With this discussion in mind, we begin by regressing the current account (CA) on the budget deficit (BD , the difference between tax revenue and expenditure):

$$\frac{CA_t}{GDP_t} = \alpha + \beta \frac{BD_t}{GDP_t} + \delta Rationing_t + u_t$$

where subscript t refers to the year and u is a stationary mean-zero error term. The coefficient of interest is β which indicates by how much the current account changes in response to an increase in the budget deficit. We also control for the forex rationing years through the dummy variable, *Rationing*, that is equal to 1 over 2015–2019 and 0 otherwise. The coefficient attached to *Rationing* is expected to be positive. We obtain observations on CA and BD from the PNG Budget Database of the Development Policy Centre at the Australian National University. The data are available over 1989–2019 which represents the sample period.

Table 1 presents the results. The point estimate of β is positive (0.34) but insignificant (column 1), confirming the idea that the canonical twin deficit hypothesis does not hold in PNG. As argued, one reason is the net factor income term, which is strongly negatively correlated with the budget balance at -0.71 .⁸ Removing the net factor income and net unilateral transfers terms, and thus using the trade balance (TB) as the dependent variable instead, the coefficient on the budget deficit increases in magnitude (1.11), but remains insignificant (column 2). In a next step, we net LNG exports out of the trade balance.⁹ As mentioned, LNG exports have been large—about 16% of GDP in 2019—and are not sensitive to changes in domestic economic conditions and have not added to the forex supply. The point estimate of β further increases to 1.35 and is significant at the 10% level (column 3). This suggests that a 1 percentage point increase in the budget deficit worsens the non-LNG trade balance by 1.35 percentage points. In comparison, Bluedorn and Leigh (2011) find that, for a set of 17 Organisation for Economic Co-operation and Development (OECD) countries, the same effect worsens the current account by only 0.6 percentage points on average.¹⁰ We rationalize the result for PNG with the high import content of government spending and a high marginal propensity to consume which combined seem to push the magnitude of β above 1. Overall, these results suggest that the large budget deficits in recent years have substantially contributed to PNG's forex shortages via a worsening in the non-LNG trade balance.

⁸ The correlation is significant at the 1% level.

⁹ LNG export data are retrieved from BPNG's Quarterly Economic Bulletin Statistical Table 8.2.

¹⁰ Note that, since the net factor income and net unilateral transfer terms are typically small components and there are no significant resource exports in OECD countries, the regressions in Bluedorn and Leigh (2011) and ours in column 3 are comparable.

Table 1: Regression Results—Twin Deficits Hypothesis in Papua New Guinea

	(1)	(2)	(3)
Independent Variables	Current Account	Trade Balance	Trade Balance excl. LNG
Budget deficit	0.340 (0.689)	1.107 (0.810)	1.348* (0.748)
Rationing period	0.212*** (0.0272)	0.200*** (0.0306)	0.0574* (0.0302)
Observations	30	30	30
R-squared	0.550	0.426	0.148

LNG = liquefied natural gas.

Notes: ***, **, * denote the level of statistical significance at 1%, 5%, and 10%. Standard errors in parentheses. The dependent variable in column 1 is the current account balance, in column 2 the trade balance, and in column 3 the trade balance excluding LNG exports.

Source: Authors' calculations using data from Development Policy Centre. Devpolicy PNG Budget Database. <https://devpolicy.crawford.anu.edu.au/png-project/png-budget-database> (accessed 14 April 2021).

III. PROPOSED POLICY ACTIONS TO ADDRESS THE SHORTAGE

In this section, we analyze some of the proposals that have been discussed in PNG policy circles to address the forex shortages.¹¹ As elaborated on below, in our view, none of these policy actions, implemented on their own or in concert, are adequate to sustainably restore kina convertibility.

A. Require State-Owned Enterprises and Other Businesses to Remit All Revenues Back to Papua New Guinea

According to this proposal, forex revenues held overseas by SOEs and other businesses should be returned to PNG, unless there is a compelling reason to hold them offshore. These revenues would indeed contribute to the forex supply and thus reduce the shortage. An additional benefit of this requirement is increasing SOEs' transparency, which makes it more difficult for them to conceal earnings from the government.

However, as noted, one of the reasons why SOEs and private enterprises do not return forex earnings to PNG is because, by holding them offshore, they avoid queuing for forex in the future. Although there has been a surrender requirement in place since 2015 that requires repatriation of forex proceeds in excess of foreign liabilities within 3 months, the level of compliance by exporters is unclear in light of the state's limited enforcement capacity. Increasing the latter would be costly and further strain limited administrative resources. And as we understand from various discussions, while SOEs' forex revenues held offshore are nontrivial, they are not large enough on their own to address the forex supply–demand mismatch and fill the backlog in forex orders. Therefore, despite its merits, this proposal is not a viable course of action.

¹¹ A complete list of these policy proposals is available in Davies (2021).

B. Maximizing Concessional Finance

Concessional finance may provide temporary relief, but the fundamental problem is that the structural imbalance in the forex market would remain. This can be illustrated by using PNG's recent experience with forex borrowing. In 2018 and 2019, PNG issued sovereign bonds (\$500 million), took out a commercial loan (\$180 million), and loans from the World Bank and ADB (\$250 million). Although there was an improvement in convertibility by reducing the backlog of forex orders initially in early 2019, the backlog began to rise again by late-2019 (IMF 2020). The cost of this temporary improvement is that debt in foreign currency increased and resolving the structural imbalance in the forex market was pushed to the future. Foreign currency-denominated debt carries an exchange rate risk which is particularly problematic when the RER is overvalued, which could trigger concerns about the country's creditworthiness and adversely affect borrowing terms.

Concessional finance could be considered if there was a high degree of certainty that forex supply will increase within a short time horizon; for example, with the start of a new resource project or if revenue streams of existing resource projects ramp up soon. In case of the PNG LNG project, the timing of higher fiscal revenues is unclear and likely to be in the distant future.¹² In terms of forthcoming resource projects, despite earlier optimism, the likelihood of the signing of new resource projects has been reduced considering the COVID-19 pandemic's repercussions.

IV. THE CASE FOR REAL EXCHANGE RATE DEPRECIATION

This section analyzes current macroeconomic conditions by using an internal–external balance model tailored to RRDCs such as PNG to argue that a real depreciation is needed to restore kina convertibility. We then develop a forex model that features a backlog of unmet orders, as is the case in PNG, to help guide the optimal timeline of the RER depreciation.

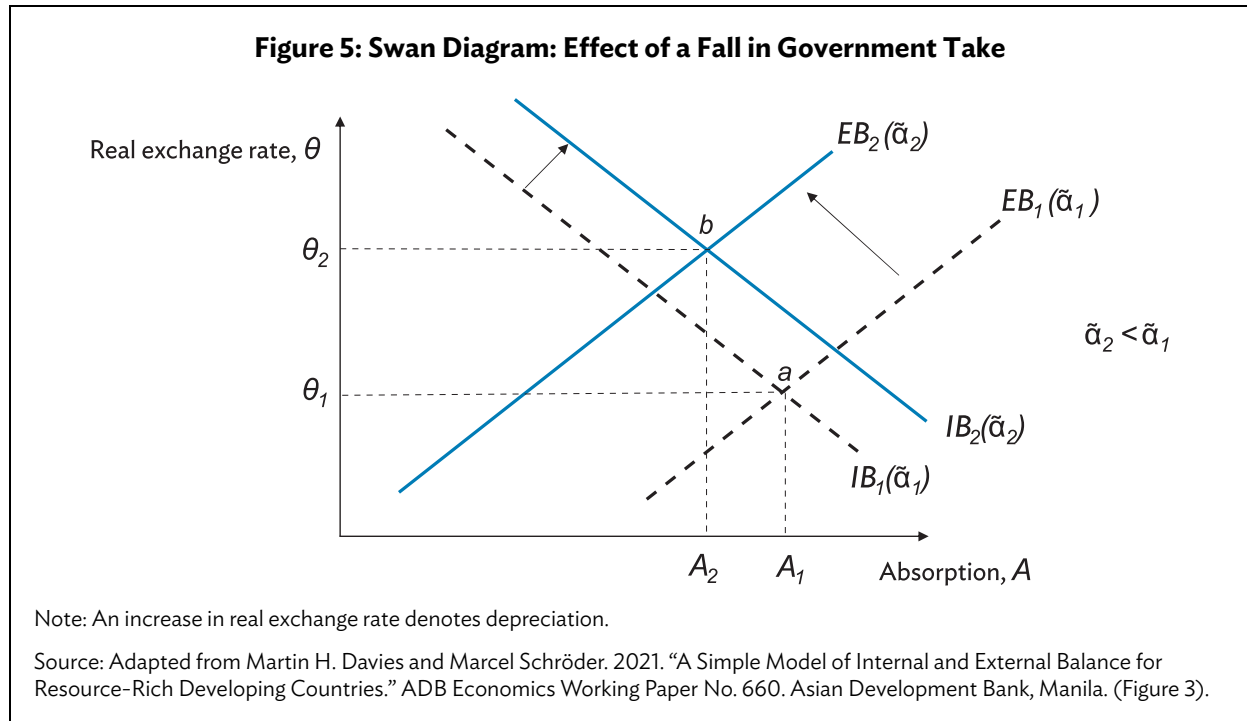
A. Analysis Based on an Internal–External Balance Model Tailored to Papua New Guinea

Currency convertibility implies that the economy needs to be in external balance, while the overall macroeconomic equilibrium requires internal balance to hold as well. We follow Garnaut and Baxter (1983) and define external balance 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.” Internal balance refers to a situation of full utilization or full employment of resources in the domestic economy. In an economy like PNG with a large informal sector, “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” (Garnaut and Baxter 1983).

¹² Estimates of the date when increased revenue from the PNG LNG project accrues to the government have varied over time, currently ranging between 5 and 15 years.

Davies and Schröder (2021) present an internal–external balance model tailored to key characteristics of RRDCs to understand the determination of the EER in these economies. The model distinguishes between production in the resource and non-resource sectors and features the Salter–Swan policy framework as in the dependent economy model, or the “Australian model” as it is also known (Salter 1959, Swan 1960, Corden 1960, Dornbusch 1974, Schmitt-Grohé and Uribe 2021). Their model accounts for three observations in RRDCs: (i) the resource sector is large relative to the overall economy; (ii) the resource sector operates as an enclave, i.e., there are almost no linkages to the non-resource sector; and (iii) the resource sector is largely foreign owned, both in terms of factors of production and equity shares. Davies and Schröder (2021) show that incorporating these features affect both the internal and external balance conditions. The model’s key result is that changes in the government take from resource projects require adjustments to both the RER and absorption to maintain internal and external balance.

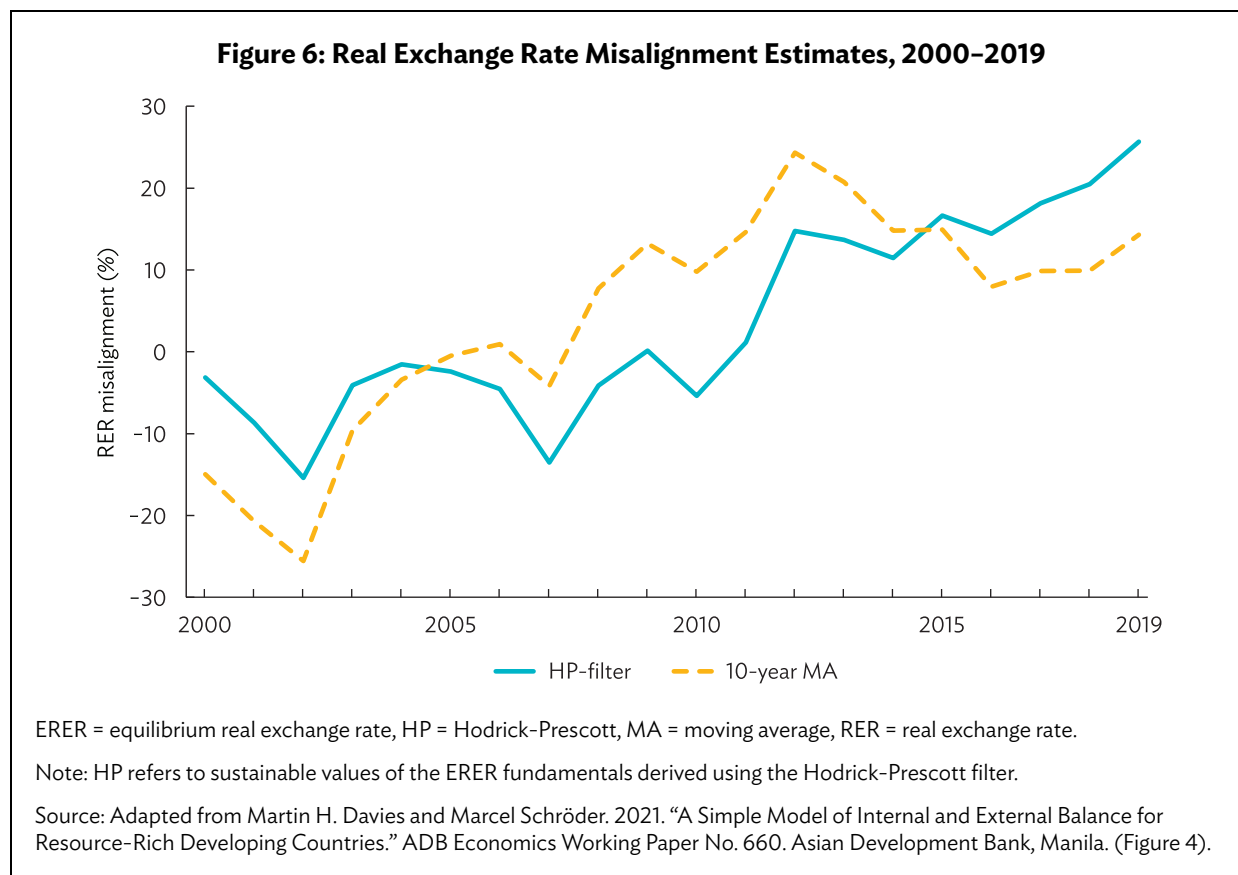
Figure 5 is a Swan diagram showing the impact of a fall in government take as experienced by PNG since 2011 (see Figure 3). Initially, the economy is in equilibrium at point a with absorption at A_1 and the EER at θ_1 . A fall in government take shifts the external balance schedule to the left as the current account worsens.¹³ This requires a real depreciation to θ_2 that boosts non-resource exports to restore external balance. The lower government take also shifts the internal balance schedule to the right because the decrease in national income results in a fall in domestic expenditure pushing non resource output below the full-employment level. As can be seen in the diagram, the impact of a fall in government take is relatively larger on the external than internal balance schedule. This implies that the real depreciation required to restore external balance increases non-resource exports to an extent that pushes non-resource output above its full-employment level. Therefore, a decrease in absorption from A_1 to A_2 is also needed to bring about internal balance.¹⁴ The economy then adjusts to the new equilibrium at point b .



¹³ In the model, a fall in government take translates to a deterioration of the net factor income balance.

¹⁴ This result goes back to the resource sector which is operating as an enclave. If it were fully integrated with the rest of the economy, a real depreciation would suffice to maintain internal and external balance as in a standard dependent economy model.

The current position of the PNG economy in Figure 5 is likely somewhere below point *b* and, given the above discussions about the budget deficit and falling employment, to the right of *A*₂ but below the *IB*₂ schedule. That is, the RER is overvalued and absorption is above the equilibrium value, which is known as the “unemployment-deficit” quadrant in the Swan diagram. Davies and Schröder (2021) estimate PNG’s ERER as a function of government take, the terms of trade, and other macroeconomic variables over 1989–2019. The results suggest that the RER is overvalued by 14%–26% in 2019 (Figure 6). They also estimate that a 10-percentage point increase in government take appreciates the ERER by about 9%. This implies that the current low level of government take of 5% explains about half of this misalignment, taking the long-run average of 20% as the benchmark.



Overall, the analysis here corroborates that the main reasons behind the PNG’s RER overvaluation include (i) the precipitous fall in government take from about 30% in 2011 to only 5% in 2019 (Figure 3), (ii) the sequence of increases in government spending and associated large fiscal deficits since 2013 (see Figure 4).

B. Model of a Foreign Exchange Market with a Backlog of Orders

The ongoing rationing in PNG’s forex market has led to a pent-up demand for forex. As a result, there is a large backlog or stock of kina seeking conversion into forex. As noted above, part of this stock is visible in the domestic banking sector and can be measured, while part of it is hidden in the balance sheets of domestic businesses and households. Interviews with forex market participants indicate that the latter part is likely to be substantial.

There is also a counterbalancing stock of forex being held outside the country waiting to be converted into kina when the market price and conditions are right.¹⁵ The holders of this stock include two groups. First, there are investors interested in financing projects in PNG from overseas using forex. There is a set of investment opportunities which have accumulated over time because investors have refrained from acting on them to avoid a capital loss. This is so because their expected depreciation in the kina exceeds the extra returns they would make on the PNG investments over foreign assets adjusted for the shoe-leather costs.¹⁶ Second, there are domestic firms that hold forex to avoid the shoe-leather costs they would incur when converting kina into forex to make overseas purchases.

These accumulated stock imbalances are significant features of the forex market and must be resolved for kina convertibility to be reestablished. Understanding the behavior of both the kina and forex stockholders is key to the design of exchange rate policies that achieve kina convertibility.

For simplicity, in this analysis, we equate the nominal and RERs by setting the domestic and foreign price levels equal to one, with an appropriate choice of units. We define F_D as the backlog of unmet orders for forex, which is the cumulative excess demand over the period during which forex has been rationed. This comprises the desired purchases of imports and desired capital outflows (purchases of foreign assets, remittances of profits, and repayment of foreign loans). Since the group of agents with unmet orders, F_D , have kina which they desire to convert to forex, we refer to them as the kina stockholders. On the other side of the market, we define the cumulative excess supply of forex as F_S . This is the sum of export receipts and desired capital inflows (FDI inflows, for example) that have been held offshore in foreign currency because of the ongoing exchange rate misalignment. We refer to the holders of F_S as the forex stockholders.

(1) Exchange Rate Expectations

Long periods of non-convertibility, particularly in the absence of any parallel market activity as in PNG, mean a loss of market-based signals on which to condition the true or shadow value of the domestic currency.¹⁷ While there is little doubt among market participants that a depreciation is required, the extent is unclear. Further, with forex rationing, shoe-leather costs become increasingly influential in determining market participants' behavior. These include the time one must wait in the forex queue before a transaction clears and resources expended in interacting with forex dealers (usually domestic banks) and the central bank to negotiate the transaction. While current shoe-leather costs are directly observed, future shoe-leather costs, which will vary with the availability of forex, also influence market participants' behavior.¹⁸ We incorporate both current and future shoe-leather costs in our model below.

Agents in the forex market base their exchange rate expectations on their beliefs about the ERER, that is, the RER that is consistent with full employment, internal balance, currency convertibility, and external balance. Differences among agents' expectations arise because of alternative views about

¹⁵ This paragraph is based on information obtained during interviews with forex market participants.

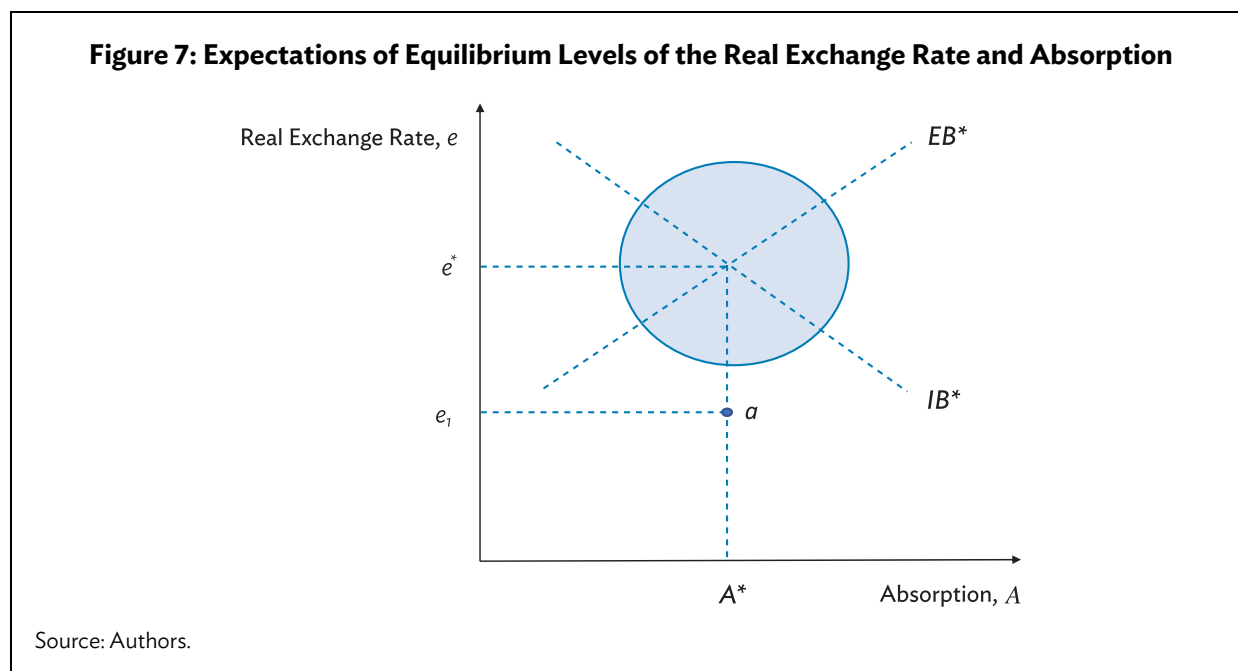
¹⁶ Competition for these projects ensures that investors will act quickly once forex market conditions normalize.

¹⁷ As noted in Gray (2020), even when a parallel market exists and while the observed exchange rate represents a market-clearing rate, it still may not be the market clearing rate.

¹⁸ For example, foreign currency loans by development partners and government bond sales to overseas investors can improve the availability of forex, like what happened in PNG in 2019. The central bank may rank forex purchase transactions by priority. For example, imports of food staples have high priority, while dividend payments and profit repatriation are lower down the queue. Under such regime, shoe-leather costs will vary based on the transaction type. Further, the identity of the forex buyer may also matter. In PNG, there is anecdotal evidence that exporters face fewer restrictions than importers. This is perhaps an implicit bargain with the central bank to encourage the ongoing conversion of their export receipts back into kina.

the structure of the underlying model and the long-run sustainable levels of fundamentals that determine the ERER.¹⁹

We assume that agents' expectations of the ERER, e , and the equilibrium level of absorption, A , are jointly and uniformly distributed on the circle, centered around point (A^*, e^*) with radius r as illustrated in Figure 7. The imposition of the circular distribution reflects that expectation of both the ERER and equilibrium absorption have equal dispersion. The position and dispersion of the distribution of expectations are determined by the central point (A^*, e^*) and radius r .²⁰



The assumption of uniformity is made in the interest of analytical tractability, as is a further assumption that each agent, whether a holder of the forex of kina or the stock of forex, has an equal share of that particular stock.²¹

(2) Demand for Foreign Exchange

The spot demand for foreign currency, D_{FC} , is made up of imports, IM , capital outflows, K_O , and the fraction of the backlog of unmet orders that is being brought to the market in the current period, $\gamma(e_0, e^*, r, \delta, \sigma_0)F_D$, where the function $\gamma(\cdot) \in [0, 1]$ determines this fraction. The demand for forex is:

¹⁹ These include international indebtedness, government spending, the terms of trade, productivity differentials between PNG and its trading partners, and the government take.

²⁰ These values may be conditioned or anchored by expert actors (BPNG, private sector consultancies, and academics) through their influence on agents' views of the underlying model and the values of the sustainable levels of fundamentals. For example, the announcement of an estimate of equilibrium values for e and A by an actor that was deemed by market participants to be credible could alter the position (A^*, e^*) and lower the dispersion (r) of the distribution of expectations.

²¹ For example, given that the stock of kina is F_D and there are n_D individual holders of this stock, then each individual holds F_D/n_D kina. Similarly, for the individual holders of forex, this is F_S/n_S . As can be seen in the Online Appendix (<http://www.adb.org/publications/survey-analysis-png-foreign-exchange-market>), these assumptions mean that the functions $\gamma(\cdot)$ and $\tau(\cdot)$ may be simply calculated from the cumulative marginal density function for exchange rate expectations.

$$D_{FC} = IM + K_O + \gamma(e_0, e^*, r, \delta, \sigma_0)F_D$$

where e_0 is the prevailing spot rate, and e^* and r determine the position and dispersion of the distribution of exchange rate expectations for the kina and forex stockholders. The parameters δ and σ_0 measure, respectively, the cost of delaying a transaction until the next period and the shoe-leather costs in the current period.

The holders of the stock of kina are primarily domestic firms seeking to access forex to buy foreign goods, repatriate profits and dividends, and repay forex loans. In the current period without convertibility, they incur shoe-leather costs when seeking forex. These are modelled as iceberg costs, so in order to have one kina to convert into forex an agent must pay $(1 + \sigma_0)$ kina, where $\sigma_0 > 0$.²²

Alternatively, the kina stockholders can delay the transaction until the next period when the currency has returned to convertibility. However, doing so is costly because agents are impatient and additional pecuniary and non-pecuniary costs are associated with delay. These could include loss of reputation with their foreign suppliers for delayed invoice payments or their parent companies for nonpayment of dividends and loans, loss of domestic sales opportunities, or penalties imposed by foreign lenders for late or deferred payments on loans. We model these costs using the discount factor δ , which reflects both the impatience and these additional costs.

Domestic firms compare the shoe-leather costs against the costs of deferring the transaction until a later period when the kina has depreciated and is convertible. An agent is indifferent between conversion now or later when the expected depreciation is just offset by the difference between the shoe-leather costs and the costs of delay.²³ This is expressed as:²⁴

$$\frac{\Delta e^e}{e_0} = \frac{e_1^e - e_0}{e_0} = \sigma_0 - \delta$$

When the expected depreciation (which depends both on the agent's expected exchange rate, e_1^e , and the current spot rate, e_0) exceeds this difference, as is currently the case in PNG's forex market, agents will choose to accept the shoe-leather costs and convert now.

(3) Supply of Foreign Exchange

The supply of foreign currency, SFC, consists of exports, EX , capital inflows, K_I , and the fraction of the stock of outstanding kina orders which is being brought to the market in this period, $\tau(e_0, e^*, r, \Delta i, \sigma_1) F_S$.

$$S_{FC} = EX + K_I + \tau(e_0, e^*, r, \Delta i, \sigma_1) F_S$$

where $\Delta i = i - i^*$ is the differential between the rates of return on PNG and foreign assets. The function $\tau(.) \in [0,1]$ determines the fraction of the forex stock that is being brought to the market in the current period.

To motivate the behavior of the forex stockholders, we derive the shoe-leather cost-adjusted interest parity condition. An investor considers the rate of return on international assets against the

²² This increases the amount of kina required to buy a unit of forex, and so has an effect similar to a depreciation of the kina.

²³ By assumption, all agents face the same shoe-leather costs and have the same discount factor. However, they differ in their expectations of the equilibrium exchange rate.

²⁴ This condition is derived in the Online Appendix available at <http://www.adb.org/publications/survey-analysis-png-foreign-exchange-market>.

rate of return on PNG assets and the expected change in the exchange rate over the period of their investment. In addition, when a foreign investor seeks to repatriate profits, they may incur the shoe-leather costs in that future period.²⁵ The shoe-leather-adjusted interest parity condition is:

$$\frac{\Delta e^e}{e_0} = \Delta i - \sigma_1$$

where σ_1 is the shoe-leather cost expected in the next period (footnote 24). Intuitively, this condition determines the expected depreciation that just offsets the differential on rates of return adjusted for shoe-leather costs.

While the interest parity condition is motivated from the perspective of foreign investors, it may also be interpreted for domestic firms whose propensity to convert forex back into kina is tempered by the shoe-leather costs they must incur when making the opposing conversion. Holding excess forex allows them to avoid shoe-leather costs on both anticipated and unanticipated future overseas purchases. For this group, the Δi term may be interpreted as the additional benefit of being able to hold their funds in kina over forex, which includes a reduction in the risk of having inadequate funds to cover domestic expenses and more simplified balance sheet management.

(4) Determining the Foreign Exchange Demand and Supply Schedules

Given that the stocks F_D and F_S are likely to be large relative to the flows (IM , EX , K_t , and K_o), and to simply the analysis to focus attention on the resolution of the stock imbalances, we assume that the flow components are zero.²⁶ Then, the demand and supply of foreign currency may be expressed as:

$$D_{FC} = \gamma(e_0, e^*, r, \delta, \sigma_0) F_D$$

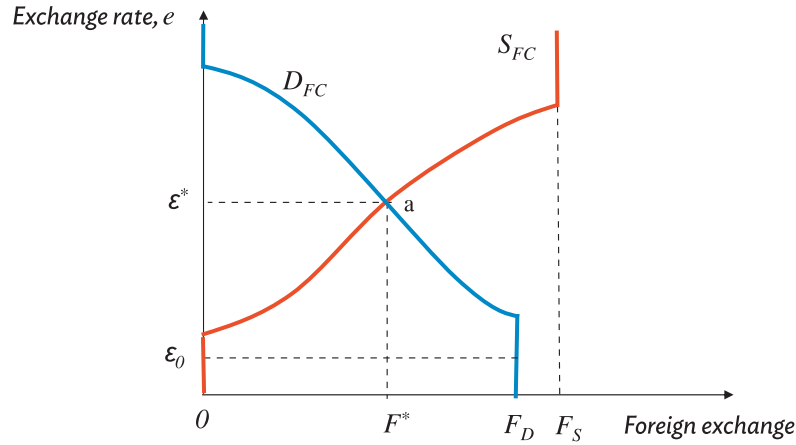
$$S_{FC} = \tau(e_0, e^*, r, \Delta i, \sigma_1) F_S$$

The functions $\gamma(e_0, e^*, r, \delta, \sigma_0)$ and $\tau(e_0, e^*, r, \Delta i, \sigma_1)$ are calculated using the marginal distribution of exchange rate expectation (footnote 24). The forex supply and demand curves are illustrated in Figure 8.

For the demand curve, as the spot rate, e_0 , increases—holding the distribution of exchange rate expectations fixed (e^* and r constant)— $\gamma(\cdot)$ falls because the magnitude of the expected depreciation declines, lowering forex demand and giving the curve a negative slope. Conversely, $\tau(\cdot)$ increases as e_0 rises, giving the supply curve a positive slope. Higher current shoe-leather costs, σ_0 , will shift the demand curve downward, while an increase in the cost of delaying transactions, δ , will shift it upward. For the supply curve, an increase in the asset return differential, Δi , will shift it downwards and an increase in next period's shoe-leather costs, σ_1 will shift it up.

²⁵ The imposition of shoe-leather costs is asymmetric in the sense that they are incurred only in one direction, that is, in the conversion of kina to forex.

²⁶ Resource exports, especially LNG, are large but, as mentioned, these have not contributed much to PNG's forex supply.

Figure 8: Foreign Exchange Market with a Backlog of Orders, Supply and Demand Schedules

Source: Authors.

(5) Moving to a Foreign Exchange Market Equilibrium

Equilibrium in the forex market occurs where the forex supply and demand curves intersect; that is, $\gamma(\varepsilon^*, e^*, r, \delta, \sigma_0)F_D = \tau(\varepsilon^*, e^*, r, \Delta i, 0)F_S$. Currently, in PNG, the spot rate is at a level such as ε_0 in Figure 8. The expectations of a large depreciation ensure that the fraction of the forex stock entering the market is close to zero and the fraction of the kina stock entering the market is close to 1. For emphasis, in Figure 8 we have drawn the current spot rate ε_0 so that $\gamma(\cdot) = 1$ and $\tau(\cdot) = 0$, so then $D_{FC} = F_D$ and $S_{FC} = 0$. That is, all of the kina stock is seeking conversion to forex and all of the forex stock is being withheld from the market. As a result, the excess demand for forex is F_D .

Moving to equilibrium under these circumstances requires a rise in the spot rate, which is both immediate and of adequate size to entice a sufficient fraction of the forex stock into the market to meet demand. From Figure 8, the exchange rate must increase from its current level, ε_0 , to ε^* .

Under these circumstances, an approach of gradual adjustment will not work. The key to achieving equilibrium is engaging the forex stockholders to trade in the forex market. Given the size of the expected depreciation and the burden of shoe-leather costs, forex stockholders will not enter the market under a pre-announced path of depreciation until the spot rate falls to a level that is consistent with their equilibrium estimates of it (adjusted for the rate of return differential and shoe-leather costs). While a commitment to a path of depreciation reduces the uncertainty about convertibility being achieved, it will be delayed until the exchange rate has depreciated sufficiently.²⁷

²⁷ Alternatively, the central bank could raise interest rates to engineer a large interest rate differential ($\Delta i > 0$) to offset the effect of the anticipated depreciation on forex stockholders. However, this is unlikely to be an option in practice since the rate hike would have to be high in light of PNG's low capital mobility.

V. POLICY IMPLICATIONS

This section provides policy recommendations with respect to the exchange rate and fiscal policy based on the previous analysis.

A. Exchange Rate Policy in the Short Run

The primary issue in the forex market is the chronic imbalance between demand and supply. This must be addressed foremost. As discussed, the policy proposals outlined in Section III are not adequate and a real depreciation is needed instead. Davies and Schröder (2021) find that the RER is overvalued by 14%–26% in 2019. On this basis, we recommend a 20% real depreciation, i.e., the midpoint of their estimates. Given that the pass-through to domestic prices is about 40%, a 33% depreciation of the nominal exchange rate (kina per US dollar) will be required to restore kina convertibility.²⁸ At the same time, current prices incorporate the shoe-leather costs. These will be dissolved once kina convertibility is restored which could reduce the pass-through.

The forex market model in Section IV.B suggests that a quick and sharp nominal exchange rate depreciation is preferable to a gradual approach:

- (i) Given the large backlog of forex orders, a frontloaded depreciation would stimulate forex inflows from overseas investors. They are currently withholding trades into kina until the exchange rate is in closer alignment with their expectations to avoid capital loss associated with a depreciation.

Other benefits include:

- (ii) It provides a credible signal to market participants that the government is serious about finally addressing the imbalances in the forex market. The expectation of improved access to forex will lead to an increase in business confidence and stimulate economic activity in the non-resource sector, especially in export- and import-competing industries. An often-stated concern in PNG policy circles is that the non-resource sector is not responsive to exchange rate depreciation, e.g., Bank of Papua New Guinea (2021). However, there is evidence that smallholders in PNG reap market opportunities as observed in the aftermath of the kina depreciation in the late 1990s (Allen, Bourke, and McGregor 2008; Fox et al. 2017).
- (iii) An immediate and frontloaded depreciation kick-starts the necessary adjustment process in the real economy. Relative to its trading partners, PNG has higher inflation, with a differential of 3%–5% per annum. Thus, to bring about an adjustment of an appropriate magnitude in the RER, a large nominal depreciation is required. While this will cause a redistribution of income from urban to rural households, some of the falls in urban income will be moderated by the increase in non-resource sector activity. In short, there will be winners and losers, but on net, this policy will improve economic outcomes in PNG.

²⁸ Sampson et al. (2006) find a pass-through of 50%. However, current commentary suggests that the pass-through is more likely in the neighbourhood of 30%, given the depressed state of the economy. In this case, a nominal depreciation of 28.6% is required for a 20% RER depreciation.

B. Exchange Rate Policy in the Medium Run

Over the medium run, once kina convertibility is restored, we recommend the creation of an interbank market and a daily auction to enhance the efficient allocation of forex to the market. Under this proposal, commercial banks and other forex market participants would bring their net forex positions to the market, allowing those with deficit positions to bid for surplus forex. This ensures currency convertibility, and that forex is allocated to the highest bidder. It provides (i) market participants transparency about the scarcity of forex in the market; and (ii) BPNG a better grasp of the level of intervention that is necessary to achieve their exchange rate objectives.

Under the current circumstances of forex scarcity, the BPNG's desire to control both the price (the nominal exchange rate) and quantity of forex will undermine the success of a move to an interbank market system. A market maker can only choose to control either the price or quantity. As long as the BPNG attempts to control both, it remains in a position where scarce forex must be distributed to market participants based on some non-price mechanism as is currently the case.²⁹

In the longer term, more flexibility in the adjustment of the nominal exchange rate should be allowed. Given the time mismatch of demand and supply transactions in PNG's forex market, some management of the exchange rate by the BPNG will still be necessary. However, given the large and frequent shocks to government take and the terms of trade that PNG experiences, there needs to be more flexibility in the exchange rate to allow adjustment to these shocks. Otherwise, large and persistent RER misalignments will be recurrent issues in PNG.

C. Fiscal Policy

As shown in Section II.C, the large government budget deficits since 2013 have contributed significantly to the structural imbalance in the forex market. The existence of a strong link between government spending and the forex market in PNG suggests the need for fiscal restraint to support the exchange rate regime, and the convertibility of the kina. Fiscal rules can provide guidance and PNG already has some of these in place. For example, the Medium-Term Debt Management Strategy puts a limit on the government debt to GDP ratio (currently 35%), which the Medium-Term Fiscal Strategy mandates the government to keep its salary bill constant in nominal terms over the next 2 years. There needs to be greater commitment and adherence to these existing rules.³⁰

Finally, we reiterate the recommendations of Davies and Schröder (2021) in relation to government take. A decrease in this variable—as observed in PNG since 2011—requires a dual adjustment in both the RER and absorption to maintain internal and external balance. In import-dependent economies such as PNG, real depreciations are unpopular because they lower the real incomes of urban dwellers that typically hold most of the political capital. Reducing absorption implies painful fiscal spending restraints that are also difficult to implement. To remedy these issues, aiming for more stability in the government take should be on the government's agenda. This can be achieved

²⁹ As a practical example of what we describe above, one of the domestic banks we interviewed 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 nonbank foreign exchange market participants—Puma Oil, with a high valuation of forex—would outbid the entire market which would push down the value of the kina, and keep foreign exchange from the banks.

³⁰ In countries with large resource wealth like PNG, fiscal rules should be in place to guide the allocation of resource wealth over time. An example is the permanent income hypothesis (PIH), which specifies 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).

through greater reliance on more stable fiscal revenue flows such as production levies or royalties on sales instead of profit-based tax instruments such as the corporate income tax. Similarly, tax incentives for foreign multinationals attract investment in the resource sector, but this is at the expense of government take stability because they lead to back-loaded fiscal resource revenues. Thus, such incentives should be granted less generously in the future.

VI. CONCLUSIONS

This paper has surveyed the PNG forex market where a shortage has prevailed since the end of the commodities supercycle in 2014. The BPNG has only allowed enough nominal exchange rate depreciation to keep the RER constant but has resisted full RER adjustment. To navigate the shortages, the BPNG has rationed forex which has led to a large backlog of unmet orders in the market that resulted in import compression and a substantial fall in formal sector employment. Various policy proposals are being discussed in PNG policy circles to restore kina convertibility; for example, greater reliance on concessional finance. This paper argues that these policy actions will not address the structural supply–demand mismatch in the market. Using the internal–external balance model and empirical results of Davies and Schröder (2021), we argue that a real depreciation in the neighbourhood of 20% is needed instead to bring about kina convertibility.

We develop a forex market model that features a backlog of unmet orders. The key result is that a return to forex market equilibrium requires a frontloaded real depreciation instead of an often-favoured gradual adjustment. On the fiscal policy front, empirical results indicate that the government’s large budget deficits, in part driven by the surge in the salary and wage bill, have contributed to the forex shortages, which highlights the need for greater fiscal restraint. Finally, another important reason for the forex shortages is the precipitous fall in government take from the resource sector since 2011. The Government of PNG should seek to stabilize government take over time by putting greater emphasis on upfront payments from resource projects to promote macroeconomic stability in the future.

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The Path to Kina Convertibility

An Analysis of Papua New Guinea's Foreign Exchange Market

Due to the foreign exchange (forex) shortage in Papua New Guinea (PNG) since 2015, the central bank rationed forex that led to a large backlog of orders and import compression. Through surveys of the structure of PNG's forex market and analysis of recent market conditions, this study finds that the policy proposals discussed in the country are inadequate to restore currency convertibility. Instead, a real exchange rate depreciation is required. A frontloaded depreciation is preferred to an often-favored gradual adjustment. Furthermore, over the medium term, more exchange rate flexibility and forex allocation through competitive auctions are recommended.

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