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Managing Guyana's Oil Wealth: Monetary and Exchange Rate Policy Considerations

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ABSTRACT: International oil producers have discovered commercially recoverable petroleum reserves of around 11 billion barrels that promise to transform Guyana's agricultural and mining economy into an oil powerhouse, while hopefully helping to diversify the non-oil economy. Oil production presents a momentous opportunity to boost inclusive growth and diversify the economy providing resources to address human development needs and infrastructure gaps. At the same time, it presents important policy challenges relating to effective and prudent management of the nation's oil wealth. This study focusses on one of these challenges: the appropriate monetary policy and exchange rate framework for Guyana as it transitions to a major oil exporter.

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WORKING PAPERS

Managing Guyana's Oil Wealth: Monetary and Exchange Rate Policy Considerations

Prepared by Rina Bhattacharya[1]

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Executive Summary

International oil producers have discovered commercially recoverable petroleum reserves of around 11 billion barrels. This discovery promises to transform Guyana's agricultural and mining economy into an oil powerhouse while hopefully helping to diversify the non-oil economy. Oil production presents a momentous opportunity to boost inclusive growth and diversify the economy by providing resources to address human development needs and infrastructure gaps. At the same time, it presents important policy challenges.

In particular, the high volatility of oil prices makes it especially challenging to maintain macroeconomic stability in the face of external and terms-of-trade shocks. Monetary and exchange rate policies can have a key role to play in terms of providing (i) a nominal anchor for controlling inflationary pressures and expectations, and (ii) an effective tool for adjusting to external shocks and balance-of-payments pressures.

The choice of an appropriate monetary policy framework and exchange rate regime serves to meet two key policy objectives: output stabilization / absorption of external shocks, and control of inflation (price stability). A careful study suggests that the current *de facto* monetary policy framework, focused on exchange rate stability, is most suitable for Guyana at this point in time. This is primarily because the exchange rate serves well as the nominal anchor for price stability. Moreover, the effectiveness of exchange rate flexibility as an instrument for absorbing shocks, including terms of trade shocks, is likely to be weak since Guyana is mostly a price-taker in international markets of its main exports—including oil—and most of Guyana's exports are priced in U.S. dollars. At the same time, the empirical evidence presented here suggests that Guyana's non-oil exports may be sensitive to movements in relative prices, both in the short-run and long-run. In addition, cross-country evidence suggests that the competitiveness channel of exchange rate depreciation tends to gain traction over time, making the nominal exchange rate a more effective shock absorber. These factors, among others, call for a detailed analysis of the type of framework that would best serve Guyana's needs in the future.

Guyana's projected rapid expansion of oil production and exports should provide adequate fiscal and external buffers to sustain a fixed exchange rate or an exchange rate peg for the foreseeable future, especially if the planned public investment expansion is done at a pace that does not generate macroeconomic imbalances and is accompanied by a strengthening of the medium-term fiscal framework. However, as Guyana becomes a major oil producer over the medium- to long-term, there is a strong case for revising the monetary policy and exchange rate framework since a gradual shift towards greater exchange rate flexibility will allow the economy to better withstand shocks and maintain competitiveness. This will require creating the necessary infrastructure, and establishing effective regulatory and supervisory frameworks, for the effective functioning of the interbank, domestic debt, and foreign exchange (FX) markets. In general, moving towards a more flexible *de facto* exchange rate regime should proceed in tandem with the development and deepening of domestic financial and foreign exchange markets and strengthening of the monetary policy transmission mechanism.

Given that the necessary infrastructure to support a flexible exchange rate regime takes time, issues of transition are also considered.

Finally, it is also important to note that this study does not look into the appropriate *level* of the exchange rate, nominal or real, and only elaborates on considerations relating to the appropriate exchange rate regime.

Section I: Introduction

International oil producers have discovered commercially recoverable petroleum reserves of around 11 billion barrels —the third largest in Latin America and Caribbean, and one of the highest levels per capita in the world. This promises to transform Guyana's agricultural and mining economy into an oil powerhouse. Indeed, the present value of oil reserves per capita is higher than, or comparable to, oil-producing Gulf countries such as Kuwait, the United Arab Emirates, and Saudi Arabia. Oil production presents a momentous opportunity to boost inclusive growth and diversify the economy by addressing human development needs and infrastructure gaps. At the same time, it presents important policy challenges.

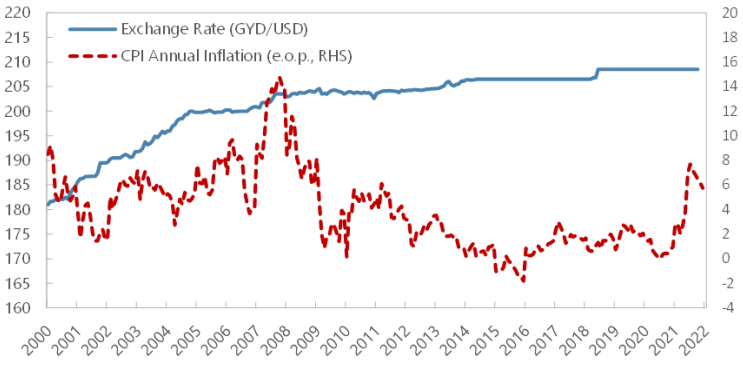
In particular, the high volatility of oil prices makes it especially challenging to maintain macroeconomic stability in the face of external and terms-of-trade shocks. Monetary and exchange rate policies have a key role to play in terms of providing:

- a nominal anchor for controlling inflationary pressures and expectations, and
- an effective tool for adjusting to external shocks and balance-of-payments pressures.

The choice of an appropriate monetary policy framework and exchange rate regime serves to meet two key policy objectives: output stabilization / absorption of external shocks, and control of inflation (price stability). Oil producers and exporters have adopted a range of exchange rate regimes, from floating (Norway, Colombia, Ghana) to a relatively hard peg (Gabon, Niger, and the Gulf Cooperation Council (GCC) countries) to a soft peg with periodic step adjustments (e.g. Trinidad and Tobago). In practice the choice of exchange rate regime is often based on political as well as economic considerations; for example, in 2003 the GCC countries pegged their exchange rate against the U.S. dollar as a step towards meeting their political objective of forming a common currency or a currency union by 2010, but this never materialized.

Guyana's *de jure* exchange rate regime is floating, but the *de facto* exchange rate regime is a stabilized arrangement, with foreign exchange interventions and capital controls aimed at addressing disorderly market conditions and at smoothing out short-term fluctuations in the nominal exchange rate when these are not related to fundamentals. As shown in Figure 1, there has been very little exchange rate flexibility in recent years.

Figure 1. Guyana Exchange Rate and CPI Inflation



Source: Haver and IMF staff calculations.

This study seeks to identify the most appropriate exchange rate regime(s) and monetary policy framework for Guyana as it goes through various stages of transition to a major oil producer and exporter. This study does not assess the appropriate *level* of the exchange rate for the Guyanese dollar, nominal or real, and only elaborates on considerations relating to the appropriate exchange rate regime. Section II elaborates on the arguments for maintaining a *de facto* stabilized exchange rate arrangement for the time being. Section III lays out the case for

adopting a more flexible exchange rate regime as it reaches a more mature stage of oil production over the medium-to long-term (when oil production has reached close to full capacity). This is followed in Section IV with a discussion of the main drawbacks and challenges of a more flexible exchange rate regime. Section V outlines a few key areas where further research is warranted, followed by Section VI which discusses issues related to the transitioning process moving from a less to a more flexible exchange rate regime. Section VII closes with a summary of the main policy conclusions.

Section II: The Case for Maintaining a Stabilized Exchange Rate Arrangement

The key argument for Guyana to have a stabilized exchange rate regime is that, at this point in time, the conditions do not seem to be ripe to abandon the exchange rate as the nominal anchor for price stability, as discussed in detail in Section IV below. This, however, could change over time as domestic financial markets and FX markets develop, the monetary policy transmission mechanism strengthens, and the central bank is able to maintain or enhance its credibility while moving to an alternative nominal anchor. As government spending financed by oil revenues increases over time, larger FX inflows will need to be sterilized by the central bank to avoid pressures on the exchange rate. These sterilization costs, or pressures on the exchange rate, in addition to external shocks, will require ever-greater management to maintain exchange rate stability. As such, greater exchange rate flexibility will facilitate the economic expansion and adjustment to oil price shocks while maintaining price stability and safeguarding foreign reserves.

Another key argument for maintaining a stabilized exchange rate arrangement is that Guyana's need for exchange rate flexibility to absorb shocks may lessen over time. Fiscal flexibility (fiscal policy space for addressing both domestic and external shocks and for meeting essential public spending needs) and strong FX reserve buffers are important to sustain a pegged exchange rate regime in the absence of the exchange rate instrument as a shock absorber. In the case of Guyana the projected rapid expansion of oil production and exports, with the overall fiscal and primary fiscal balances both projected to turn to surpluses from 2025 onwards as a result of rapidly rising oil revenues to the budget, should provide adequate fiscal and external (FX) buffers to sustain an exchange rate peg over the foreseeable future. Notably, Guyana is projected to accumulate significant savings into the Natural Resource Fund over the next few years.

Three more factors need to be taken into consideration in evaluating the case for maintaining a stabilized exchange rate regime at this juncture: trade and policy integration, the initial level of inflation, and external imbalances. As trade integration would likely grow over time with increasing oil exports, for a stable exchange rate arrangement to be sustainable: (i) inflation should not diverge too much from those of Guyana's main trading partners and (ii) external imbalances should be kept in check. Otherwise, resulting over- or under-valuation of the real exchange rate could harm growth by misallocating resources. In this event, an exchange rate peg may become unsustainable, making it preferable to shift towards a more flexible exchange rate arrangement, even if progress is slow towards meeting the essential preconditions for a successful move towards greater exchange rate flexibility.

Section III: The Role for a More Flexible Exchange Rate Regime

Over time, as Guyana rapidly becomes a major oil producer and exporter, it is likely to become increasingly exposed to terms-of-trade shocks (primarily large changes in oil prices), opening up the considerations for a more flexible exchange rate regime. The literature on optimal currency areas suggests that, in the face of real shocks (and especially those originating from external sources), the economy would benefit from exchange rate flexibility because such flexibility would ease adjustment costs in the presence of stickiness of wages and prices and/or lack of geographical and occupational mobility of labor and capital. By contrast, a preponderance of domestic nominal shocks, in particular to money demand, strengthens the case for a fixed exchange rate regime, allowing anchoring to a stable foreign country's price level (Table 1).

In **Annex I** we present the results from estimating a three-equation structural VAR that is used to model the joint behavior of real output, the CPI price index, and real money balances in response to three exogenous disturbances. In applying this approach various identifying restrictions are used so that these disturbances can be interpreted as aggregate supply (AS), goods market (IS), and money demand (MD) shocks. The principal objective of the exercise is to gauge the relative importance of these three shocks in explaining the variance of output in Guyana at different time horizons, and to look at the dynamic response of the economy to each type of shock. Estimation of the model over the period 2000 to 2019 suggests that aggregate supply shocks accounted for around 82 percent of the variance in output over an 18–24-month horizon.[1] Moreover, this proportion is likely to grow over time as the share of oil in Guyana's economy increases and the economy is increasingly exposed to real external (terms-of-trade) shocks.

As Guyana becomes a major oil producer, the case for greater exchange rate flexibility is likely to strengthen over time as domestic financial and FX markets develop, the monetary policy transmission mechanism strengthens, and the central bank is able to maintain or enhance its credibility while moving to an alternative nominal anchor. This will ensure that the monetary policy and exchange rate frameworks are well suited to the economy's needs, with greater exchange rate flexibility allowing the economy to better absorb external and terms-of-trade shocks and maintain competitiveness.

Another important factor to consider is the extent of diversification of the economy. Output / export diversification makes a country less vulnerable to terms-of-trade shocks and less likely to need exchange rate flexibility. By contrast, if production and exports are not diversified, this is an argument for avoiding a stable exchange rate regime. Guyana's export structure is highly concentrated and is likely to remain so until the benefits from the oil economy growth spill over to change the structure of the economy (Table 1).[2] Indeed, the UN export product concentration index for 2020 ranks Guyana's exports as being among the most highly concentrated in the world, with only 42 out of 218 countries having a more concentrated export structure,

[1] The sample for the empirical analysis includes data until end-2020, the year that oil production started, and therefore it does not include a structural break.

[2] Although there is no direct association between the exchange rate regime and economic diversification, a fixed exchange rate regime could impede economic diversification if it results in a significant misalignment of the real exchange rate and adversely affects export competitiveness.

among them seven in the Western Hemisphere.[3] Thus the argument for exchange rate flexibility would be even stronger if the Guyanese economy is unable to significantly diversify over time away from its dependence on commodities and natural resources.

Section IV: Drawbacks and Challenges of Adopting a More Flexible Exchange Rate Regime

That said, oil exporters like Guyana tend to have special features that severely limit the effectiveness of the exchange rate as a shock absorber (see Behar and Fouejieu, 2016). The price of oil is set in U.S. dollars in international markets and most producers face a perfectly elastic demand curve, with their production adjustments to price movements not being enough to influence the world market price of oil. In less diversified oil exporters, non-oil exports make a small contribution to the export basket and there is limited scope for the real exchange rate to affect export volumes. On the import side, as a small open economy, Guyana's import dependence and limited substitution possibilities reduce the responsiveness of import volumes to relative prices.

Empirical evidence suggests that, while the effects of exchange rate depreciation or devaluation on growth are similar for both small and larger economies, the transmission channels are in general quite different. More concretely, in small open economies, exchange rate depreciations / devaluations are more likely to affect demand by compressing expenditures rather than through expenditure-switching channels when compared with larger economies (see Acevedo et al, 2015). This is due to more adverse income and distribution effects, combined with limited scope for import substitution or a rapid scaling up of exports due to size-related constraints. Thus, as Guyana becomes increasingly reliant on hydrocarbon exports, and in the absence of significant diversification of the economy, the effectiveness of the exchange rate as a shock absorber is likely to diminish.

The monetary policy framework and exchange rate regime have policy implications, not only for the stabilization of output in the presence of various shocks to the economy, but also for the control of inflation. This is because the policy framework needs another nominal anchor in the absence of the exchange rate anchor, such as the money supply, to achieve some degree of domestic price stability. Several factors are relevant here (Table 1), including:

- *The extent of exchange rate passthrough to inflation*: A high rate of exchange rate passthrough to inflation makes it more difficult to control inflation through interest rates or monetary aggregates and makes the nominal exchange rate a more effective anchor to attain price stability.

  Annex II presents the results of staff estimates of exchange rate passthrough to inflation in Guyana. Standard estimation of a bivariate Auto Regressive Distributed Lag (ARDL) model, using monthly data, suggests that the exchange rate pass-through coefficient has increased significantly in Guyana over the past decade or so, from about -0.40 over the period 1995M1-2021M9 to about -0.55 over the period 2009M1-2021M9. This methodology, however, only looks at the relationship between the nominal effective exchange rate (NEER) and prices and may be subject to omitted variable bias. The

[3] Suriname, Venezuela, the Cayman Islands, the British Virgin Islands, Sint Maartin, Aruba, and the Falkland Islands.

use of a more model-based Vector Error Correction (VECM) model, which takes into account a simple monetary policy reaction function and allows for the simultaneous interaction of the endogenous variables, suggests that long-run exchange rate passthrough to CPI inflation is much lower, at around -0.24. Moreover, it is relevant to note that country cases, such as South Africa and Poland, show that exchange rate passthrough to inflation can fall significantly over time as the interest rate channel of monetary policy strengthens and inflation expectations become better anchored to the inflation target as the central bank succeeds in building credibility with the general public.

- The *degree of currency substitution*: The higher the degree of currency substitution, and the larger the holdings of foreign money in circulation, the more difficult it is for the monetary authorities to control the money supply if the exchange rate is allowed to vary (see Bhattacharya, 2003).

  Annex III presents the results of staff estimates of money demand equations for Guyana, again applying Auto Regressive Distributed Lag (ARDL) models, to examine the evidence for currency or asset substitution in Guyana. The empirical results provide no evidence that (expected) exchange rate movements have any impact on the demand for broad money, either directly (currency substitution) or indirectly by affecting expected rates of return on foreign assets (asset substitution or capital mobility).[4] This could, however, change over time as the oil industry develops and the amount of foreign currency circulating in the economy increases. On the other hand, as with exchange rate passthrough to inflation, it is important to note that currency substitution or dollarization can drop significantly over time if the central bank succeeds in raising its credibility with the public and inflation expectations become better anchored to the central bank's inflation target.

Although the empirical results presented here indicate no evidence of high exchange rate passthrough to CPI inflation in Guyana, or of strong currency / asset substitution, this could change over time as the economy undergoes structural changes as it evolves into becoming a major oil producer and exporter.

- *Financial market development*: The greater the degree of financial market development, the more feasible it is to implement a flexible exchange rate regime (see Duttagupta et al, 2004, and Ötker, Vávra et al, 2007).

- The *degree of capital mobility*: High capital mobility may constrain the feasibility of pegged rates and pegs within narrow bands. Greater exchange rate flexibility may also be an element of the optimal response to strong capital inflows, including by discouraging short-term speculative inflows due to greater degree of exchange rate uncertainty (see Al-Sadiq, Bejar and Ötker, 2021).

- The *strength of the monetary policy transmission mechanism*: An effective interest-rate based monetary policy framework would require establishing a strong institutional track record to anchor inflation and strong links between interest rates, monetary aggregates, and inflation, as well as the ability to monitor, forecast, and manage liquidity in financial markets.

[4] The empirical results for the estimated money demand functions presented in Annex III indicate that neither the inflation differential between the U.S. and Guyana, nor the U.S. Treasury Bill rate adjusted for the inflation differential, affect the demand for broad money (M2) in Guyana.

Additional empirical evidence suggests that the monetary policy transmission mechanism in Guyana would need significant strengthening if the authorities adopt an alternative nominal anchor to control inflation since the links between interest rates, monetary aggregates, and inflation appear to be weak at present. Preliminary results from a VAR estimation by staff suggest that movements in the key central bank policy rate have no significant impact on monetary aggregates or on CPI inflation—hardly surprising, given that the policy rate has been fixed at 5 percent since March 2013. Moreover, as the 2016 Financial Sector Stability Assessment (FSSA) notes, Guyana's domestic capital markets are underdeveloped and mostly provide short-term funding; both corporate and government bond markets are minuscule; there is no secondary market trading; and long-term investors mostly hold short-term securities which constrains their ability to generate reasonable returns and match long-term liabilities. Adopting an alternative anchor would also require developing deep, liquid, and efficient financial markets and foreign exchange markets, and putting in place systems to monitor, assess, regulate and manage foreign exchange exposures and related risks.[5]

Other considerations also suggest that the effectiveness of interest rates as a policy instrument for achieving price stability may be getting weaker over time for small, open economies such as Guyana (and many other Caribbean economies). Notably, Rey (2013) and others have strongly argued that growing integration of international financial markets have, for small, open economies, transformed the well-known monetary 'trilemma' into a 'dilemma': independent monetary policies are possible if and only if the capital account is managed directly or indirectly. In summary, whenever capital is freely mobile, the global financial cycle constrains national monetary policies in small, open 'periphery' economies regardless of the exchange rate regime. Thus, countries on the 'periphery' can only pursue an independent monetary policy if they impose capital controls. This point of view is not without its critics. Nevertheless, as Obstfeld (2015) notes, financial globalization has greatly intensified the trade-offs faced by policy makers, and in particular can generate an important trade-off between macro-economic stability and financial stability.[6]

Moreover, as Montiel and Pedroni (2019) argue, even if small, open economies are able to pursue an independent monetary policy and set domestic interest rates, they may not wish to do so. This is because greater financial integration significantly increases the magnitude of exchange rate movements caused by asymmetric monetary policy shocks in 'periphery' economies; that is, global financial integration significantly increases the exchange rate volatility associated with the pursuit of an independent monetary policy and greater autonomy in the setting of domestic interest rates.

It is also relevant to note that the short-term response of trade flows to exchange rate movements can be asymmetric, reducing imports but exerting little immediate effect on exports due to trade pricing in dominant currencies (Gopinath 2015, Adler et al, 2020). Also, the relationship between exchange rate adjustment and trade flows may have been weakened over time by the buildup of global value chains. Indeed, there is empirical evidence to suggest that dollar dominance has significantly weakened the effectiveness of exchange

[5] Note that a key objective of the Public Debt Policy 2021-2024 is to promote development of the domestic financial market, through the issuance of government securities across a range of tenors, which would provide benchmarks for use by private entities in the pricing of financial products.

[6] The financial policy trilemma, as formulated by Schoenmaker (2013), states that only two of the following three policy objectives can be attained simultaneously: (1) national control over financial policies and regulation of financial markets and institutions, (ii) financial integration with global capital markets, and (iii) financial stability.

rate flexibility as an instrument for absorbing shocks.[7] At the same time, the empirical evidence also shows that the competitiveness channel of depreciation gains traction over time and offsets any negative effects from balance sheet or financial channels.

These are issues that Guyana would need to consider in deciding on the choice of monetary policy framework and exchange rate regime going forward.

Section V: Key Areas for Further Research

Making an informed decision on the optimal exchange rate regime and monetary policy framework for Guyana in the medium- to long- term that would support Guyana's needs as a major oil producer, requires further information and analysis in at least following three key areas:

- How *flexible are nominal wages and relative prices, and how mobile is labor and capital* geographically and occupationally?

- How *price-sensitive are Guyana's exports and imports*?

  Annex IV presents staff estimates of export demand functions for Guyana's non-oil exports using a standard Error Correction Model (ECM). These empirical estimates provide some evidence that non-oil exports are sensitive to movements in relative prices, both in the short-run and the long-run.[8]

- How does the *monetary policy transmission mechanism* work in Guyana and how effective is it? How strong are the links between policy rates, lending / deposit rates, monetary aggregates, and inflation? How strong is the exchange rate passthrough to inflation? What is the extent of currency substitution?

More analysis and research in these three areas would be important before reaching a fully informed policy decision (Table 1). If there is evidence that nominal wages are flexible downward, as are relative prices, and that labor and capital are mobile geographically and occupationally, this would weaken the argument for the need to move to a more flexible exchange rate regime. By contrast, evidence that exports, and in particular non-oil exports, are responsive to movements in relative prices would suggest that the exchange rate may be an effective instrument for absorbing external shocks. More insight into the monetary policy transmission mechanism would inform whether the pre-conditions for moving to an interest-rate or monetary aggregate-based nominal anchor are in place; the policy measures needed to effectively move over time to such an anchor; and the speed at which this can be done.

[7] For example, during the East Asian crisis of 1997-1999, South Korea, Malaysia, and Thailand all experienced currency depreciations of 60 percent or more relative to the U.S. dollar and saw their export volumes stagnate or fall. With prices set in U.S. dollars, devaluations did not help their export competitiveness within the region. At the same time, demand for imports from elsewhere in the region–also priced in U.S. dollars–plunged.

[8] This is because the coefficients on the relative price index (the unit value index of Guyana's exports divided by the U.S. producer price index) in the estimated equations are highly statistically significant for both the long-run equilibrium level of non-oil exports and for the short-run non-oil export dynamics.

Section VI: Transitioning Towards a More Flexible Exchange Rate Regime

Many countries have used crawling peg and band regimes ('soft' pegs) as a step toward greater exchange rate flexibility. For example, countries such as Costa Rica, Kazakhstan, and Russia in the late 2000s to mid-2010s adopted crawling pegs within increasingly wider bands in their transition to floating exchange rate regimes as key preconditions for a successful floating exchange rate regime were put in place. For the latter group of countries more flexible forms of pegs (such as crawling bands) were seen as a way to allow markets to adjust to exchange rate fluctuations while continuing to use the exchange rate as a nominal anchor as the authorities worked to establish the necessary infrastructure for floating exchange rates and inflation targeting frameworks.

The experiences of these countries have important policy lessons for Guyana.

Al-Sadiq, Bejar and Ötker (2021), following a detailed study of the experiences of Angola, Costa Rica, Kazakhstan and Russia, show that gradually putting in place the tools needed to support or manage exchange rate flexibility helped to prepare markets for an eventual float and to address some of the 'fear of floating' concerns, thereby helping to ensure a successful move to a floating exchange rate regime.[9] They note that the experiences of these countries also underscore the importance of supporting policies and infrastructure to make the exit from an exchange rate peg sustainable and limit the risk of exchange rate overshooting. Finally, in the case of Kazakhstan, the fiscal space provided by abundant oil revenues and a large sovereign wealth fund also helped keep the overall fiscal position strong and limit financing and fiscal and external adjustment risks.

Assuming that a more flexible exchange rate down the road would best serve Guyana's needs, it would be advisable for the government to consider following the experiences of these countries in the transition and adopting a crawling peg or exchange rate band regime as an intermediate step, particularly since the necessary infrastructure to support a floating exchange rate regime and inflation targeting framework can only be developed gradually.

Section VII: Policy Conclusions

The choice of an appropriate monetary policy framework and exchange rate regime serves to meet two key policy objectives: output stabilization / absorption of external shocks, and control of inflation (price stability).

A careful study of the structural factors affecting the choice of monetary policy framework and exchange rate regime suggests that maintaining exchange rate stability in the form of a *de facto* stabilized exchange rate arrangement would best serve Guyana's needs for the time being, but that efforts to diversify the non-oil economy and deepen domestic financial and foreign exchange markets should be pursued in tandem to

[9] Including an alternative monetary policy framework with a credible anchor; strengthened monetary policy transmission with effective instruments; well-developed money and foreign exchange markets supported by appropriate regulations and risk management tools; well-functioning banking system; and effective foreign exchange market intervention mechanisms.

prepare for evolution in the regime down the road, as needed. At this point in time a stabilized exchange rate arrangement, either a fixed or pegged rate, crawling or within bands, appears the most suitable. Guyana's projected rapid expansion of oil production and exports, with the overall fiscal and primary fiscal balances both projected in surpluses from 2025 onwards due to rising oil revenues, should provide adequate fiscal and foreign exchange buffers to sustain a stabilized exchange rate arrangement over the foreseeable future; these buffers would help Guyana to absorb shocks while addressing infrastructure gaps and human development needs.

Nonetheless, the empirical evidence presented here suggests that Guyana's non-oil exports are sensitive to movements in relative prices, both in the short-run and long-run. In addition, cross-country evidence shows that the competitiveness channel of exchange rate depreciation tends to gain traction over time and offsets any negative effects emanating from balance sheet or financial channels. Both points argue in favor of moving to a more flexible regime over the medium-term or when conditions permit.

Indeed, the case for greater flexibility is likely to strengthen over time as efforts to develop domestic financial markets and FX markets bear fruit, the monetary policy transmission mechanism strengthens, and the central bank is able to maintain or enhance its credibility while moving to an alternative nominal anchor. This will ensure that the monetary policy and exchange rate framework is well suited for the economy's needs as Guyana becomes a major oil producer, with greater exchange rate flexibility allowing the economy to better absorb external shocks (including terms-of-trade shocks) and maintain competitiveness. The argument for exchange rate flexibility would be even stronger if the Guyanese economy is unable to significantly diversify over time away from its dependence on commodities and natural resources.

A move towards a more flexible exchange rate regime should, however, be conditional on preparing the steps needed to support such a regime, including the development and deepening of domestic financial markets and foreign exchange markets and strengthening of the monetary policy transmission mechanism. Shifting the regime to more flexibility would depend on the speed of progress in these areas, particularly given the small size of Guyana's economy, its shallow financial markets, and a weak monetary policy transmission mechanism. The very sound public finances now projected also support a measured approach in terms of timing. However, if the domestic inflation rate diverges significantly from those of Guyana's trading partners and external balances are not kept in check, there may still be a case for moving more quickly towards a flexible exchange rate regime to avoid significant over- or under-valuation of the real exchange rate, even if progress towards meeting the desired pre-conditions for a move towards greater exchange rate flexibility is slow.

Finally, given that the necessary infrastructure to support a floating exchange rate regime and inflation targeting framework can only be developed gradually, it would be advisable for Guyana to adopt a crawling peg or exchange rate band regime (a 'soft peg') as an intermediate step toward a floating exchange rate.

Table 1. Factors affecting choice of Exchange Rate Regime for Guyana

Output Stabilization / Absorption of external shocks	Guyana characteristics	Exchange Rate Regime Implications for Guyana
• Size of the economy	Small economy	Argues for a fixed exchange rate, or peg to a basket of currencies.
• Nature of output shocks	Empirical analysis by staff suggests that, over the period 2000 to 2019, aggregate supply shocks accounted for around 82 percent of the variance in output over an 18-24 month horizon. Increasing dependence on oil and oil-related exports would likely make the Guyanese economy more vulnerable to real / terms of trade shocks.	Main argument for moving towards a more flexible exchange rate regime.
• Diversification of exports / output	Guyana's exports are among the most highly concentrated in the world, with only 42 out of 218 countries having a more concentrated export structure.	Another key argument for moving towards a more flexible exchange rate regime.
• Openness	Guyana is a small, fairly open economy. This could argue for a fixed exchange rate or narrow narrow bands because of the potential cost to trade of frequent exchange rate adjustments. On the other hand, greater openness may also increase the economy's vulnerability to external shocks and require more frequent exchange rate adjustments, i.e. a more flexible exchange rate regime.	Guyana's dependence on commodity exports suggests that the latter argument, in favor of a more flexible exchange rate regime, is likely to predominate.
• Real wage and relative price flexibility	More information needed to make an assessment	
• Flexibility of labor markets	More information needed to make an assessment	
• Fiscal flexibility	Guyana is projected to enjoy a rapid expansion of oil production and exports, with the overall fiscal and primary fiscal balances both projected to turn to surpluses from 2024 onwards as a result of rapidly rising oil revenues to the budget.	Guyana's abundant oil and other natural resources should provide adequate fiscal and external (FX) buffers to sustain an exchange rate peg over the foreseeable future.
• Sensitivity of exports / imports to exchange rate movements	A priori Guyana's size and dependence on commodity exports, which are mostly priced in dollars, suggests that export earnings are unlikely to be responsive to exchange rate movements and that the Marshall-Lerner condition is unlikely to be satisfied, at least in the short-term, unless there is a significant declline in import volumes. However, staff empirical estimates provide some evidence that non-oil exports may be sensitive to movements in relative prices, both in the short-run and in the long-run.	The exchange rate instrument is unlikely to be effective as a shock absorber, at least in the short run, but empirical evidence suggests that its effectiveness is likely to be much higher over the medium to long term. Thus the benefits of moving towards a flexible exchange rate regime may be somewhat limited.

Table 1. Factors affecting choice of Exchange Rate Regime for Guyana (cont.)

Price stability / Choice of Nominal Anchor	Guyana characteristics	Exchange Rate Regime Implications for Guyana
• Financial market development	The greater the degree of development of domestic financial markets, the greater the feasibility and desirability to implement a flexible exchange rate regime. Guyana has a small and relatively underdeveloped domestic financial market, in terms of access and depth, with a financial development index of 0.162 in 2018 compared with an average of 0.324 for the 176 countries in the sample from all regions and income groups.	Guyana should allow limited movements of the exchange rate in the short run. If other considerations argue for a more flexible exchange rate regime over the medium to long term, this should be done gradually but steadily as financial markets develop and systems are put in place to monitor, assess, regulate, and manage FX exposures and related risks.
• Mobility of capital	More information needed to make an assessment	
• Strength of monetary policy transmission mechanism	Preliminary results from VAR regressions suggest that the monetary policy transmission mechanism in Guyana needs significant strengthening if the authorities are to adopt an alternative nomiinal anchor to control inflation, as the links between interest rates, monetary aggregates and inflation appear to be weak at present.	Adopting an alternative nominal anchor to the exchange rate in Guyana would require developing deep, liquid and efficient financial markets and FX markets, strengthening the monetary policy transmission mechanism, and putting in place systems to monitor, assess, regulate, and manage FX exposures and related risks.
• Exchange rate passthrough to inflation	A high rate of exchange rate passthrough to inflation makes it more difficult to control inflation through interest rates or monetary aggregates and makes the nominal exchange rate a more effective anchor to attain price stability. Staff estimates using a VECM model suggest that the exchange rate passthrough to inflation is relatively modest, at around 0.25-0.30 over 24-30 months.	Not a major consideration, as evidence from other countries suggest that exchange rate passthrough to inflation can significantly fall over time as the interest channel of monetary policy strengthens and inflation expectations become better anchored to the inflation target if the central bank succeeds in increasing its credibility with the general public.
• Currency / Asset substitution	The higher the degree of currency substitution, and the larger the holdings of foreign money in circulation, the more difficult it is for the monetary authorities to control the money supply if the exchange rate if allowed to vary. Moreover, a high degree of currency substitution implies that the exchange rate will be significantly volatile and responsive to credibility issues, thereby strengthening the case in favor of a fixed exchange rate. Staff estimation of money demand functions provide no evidence that (expected) exchange rate movements have any impact on the demand for broad money.	As in the case of exchange rate passthrough, it is important to note that currency substitution / dollarization can drop significantly over time if the central bank succeeds in increasing its credibility with the public and inflation expectations become better anchored to the central bank's inflation target.

Source: IMF Staff

Annex I. Structural VAR: Technical Details

In this Annex we discuss a three-equation structural VAR that is used to model the joint behavior of real output, the CPI price index, and real money balances in response to three exogenous disturbances. In applying this approach various identifying restrictions are used so that these disturbances can be interpreted as aggregate supply (AS), goods market (IS), and money demand (MD) shocks. The principal objective of the exercise is to get some idea of the relative importance of these three shocks in explaining the variance of output in Guyana at different time horizons, and to look at the dynamic response of the economy to each type of shock.

A preliminary step towards specifying the structural VAR model correctly is to investigate the long-run time-series properties of the macroeconomic variables involved, i.e. their degree of integration and the presence (or absence) of co-integrating relationships among the non-stationary variables. Augmented Dickey-Fuller and Phillips-Perron tests were carried out to test the null hypothesis of a unit root in *y, inf, and m-cpi-y,* where

y	=	log of (real) GDP
inf	=	CPI inflation
cpi	=	log of the CPI index
m	=	log of broad money (spliced series from national definitions of broad money and M2)

Unit root test results suggest that (Δy, *inf*, Δ(*m-cpi-y*)) is a covariance stationary process. The sample period is 1998Q1 to 2021Q4. The unit root test results are not presented in this paper for the sake of brevity but are available from the author on request. The results indicate that *y, cpi,* and *m-cpi-y,* i.e. the inverse of velocity), are all I(1), while Johansen maximum eigenvalue and trace tests for co-integration suggest that *m – cpi* is not co-integrated with *y.* Moreover, *m-cpi-y* appears to be I(1) (i.e. non-stationary) while Δ(*m-cpi-y*) is stationary.[1]

We next go on to estimate a structural VAR by introducing identifying restrictions to disentangle money demand (MD) shocks from aggregate supply (AS) and aggregate demand (IS) shocks.[2] Typical examples of supply shocks are exogenous changes in energy prices or the terms of trade, productivity shocks, or wage shocks. Demand shocks can be thought of as government spending shocks or shifts in investment and consumption functions. An implicit assumption of the SVAR approach, as noted by Gerlach and Smets (1995), is that different supply and demand shocks (e.g., oil price shocks versus productivity shocks, or changes in government spending as opposed to shifts in the consumption function) have similar effects on output, inflation, and real money balances, so that they can be aggregated into a "typical" aggregate supply or demand shock. Money demand shocks are any exogenous shocks to velocity arising, for example, from financial liberalization.

The three main economic assumptions that have been used to identify the model are:
No long-run effect of aggregate demand (IS) shocks on output;

[1] Checking the time series properties of the data, and for co-integration among the variables, is necessary to avoid 'spurious' regressions which suggest that two or more non-stationary variables are related to each other when, in fact, there is no theoretical or causal relationship between these variables, as highlighted by Granger and Newbold (1974).

[2] A structural VAR instead of a regular VAR is estimated as restrictions need to be imposed on the VAR to distinguish between aggregate supply, aggregate demand, and money demand shocks and to get a quantitative estimate of what proportions of the variation in real GDP over the sample period can be explained by each of these shocks.

No long-run effect of money demand (MD) shocks on output; and
No long-run effect of aggregate demand (IS) shocks on velocity (or on money balances as a proportion of nominal GDP).

The first two long-run restrictions are that aggregate demand and money demand disturbances have no permanent effect on the level of output. This assumption – that only supply shocks have long-run effects on output – is by no means uncontroversial. For example, changes in depreciation allowances or investment tax credits, or permanent increases in government spending, may affect the equilibrium real interest rate and hence the savings rate, and thereby the steady-state level of capital and output (see for example Buiter, 1980). However, this assumption is commonly used – by Blanchard and Quah (1989) for instance. Moreover, as argued in Blanchard and Quah (1989), even if such effects exist, the permanent output effects of demand shocks relative to the permanent output effects of supply shocks are likely to be small. The third long-run identifying restriction that is used is that money demand shocks have no permanent impact on velocity.

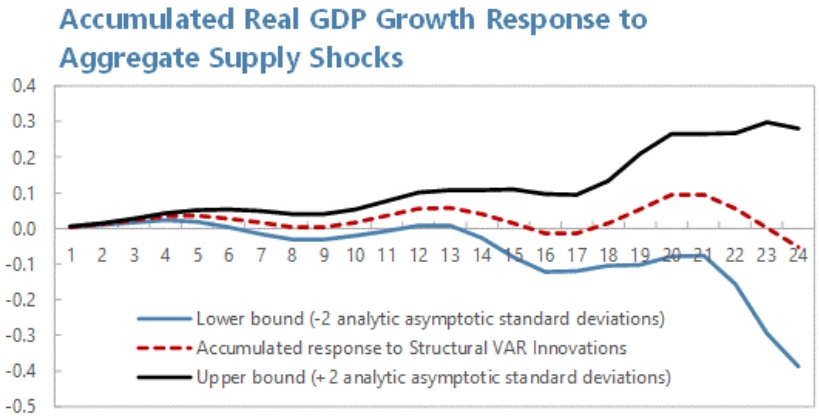
Table A1 reports the variance decomposition results for (changes) in real GDP for Guyana.[3] These results suggest that aggregate supply shocks have the strongest influence on real output in Guyana, accounting for around 82 percent of the forecast error variance in output over a 18–24-month horizon. Moreover, this proportion is likely to grow over time as the share of oil in Guyana's economy increases., The accumulated impulse response functions are plotted in Figure A1. These plot the cumulative responses of real GDP growth to a one standard deviation perturbation to each of the three structural shocks.

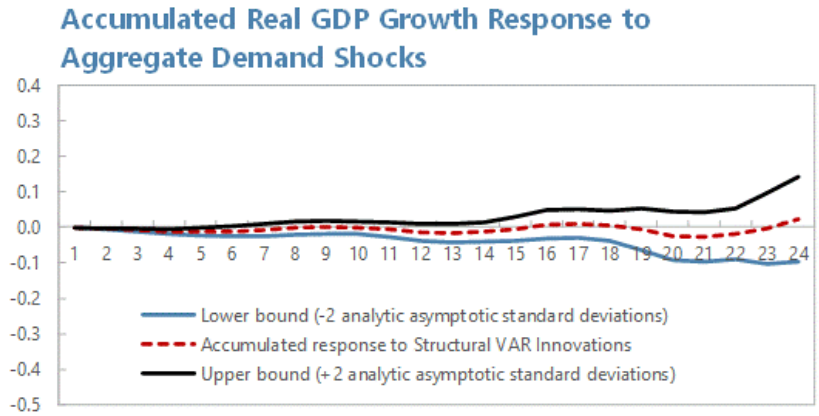
[3] Variance decomposition, or forecast error variance decomposition (FEVD), is used in econometrics to determine how much of the forecast error variance of each of the variables in the model can be explained by exogenous shocks to the other variables.

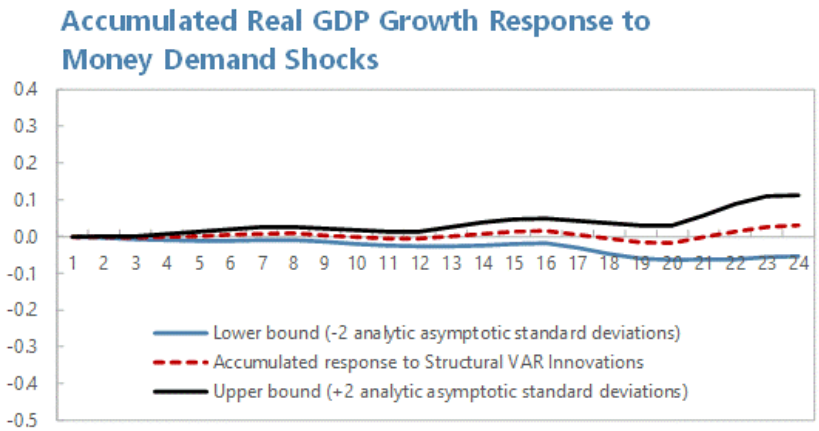
Table A1: Decomposition of Forecast Error Variance for (Change in) Real GDP

Period	Standard Error	AS shock	AD shock	MD shock
1	0.0049	82.6065	13.2418	4.1518
2	0.0100	88.9172	9.5838	1.4990
3	0.0149	89.4263	9.6777	0.8960
4	0.0188	88.0328	11.2724	0.6948
5	0.0191	85.2207	11.0834	3.6958
6	0.0206	84.5474	10.0364	5.4162
7	0.0242	84.3426	9.9136	5.7439
8	0.0280	83.3567	12.3316	4.3117
9	0.0284	80.9507	12.3293	6.7200
10	0.0315	81.9809	10.3887	7.6304
11	0.0373	83.6790	9.1929	7.1281
12	0.0433	84.0303	10.6314	5.3383
13	0.0439	81.8803	10.4762	7.6435
14	0.0477	82.0997	9.4204	8.4799
15	0.0551	82.8791	9.1120	8.0089
16	0.0628	82.5945	11.1999	6.2056
17	0.0637	80.2503	11.0420	8.7077
18	0.0705	81.1811	9.6295	9.1895
19	0.0816	82.6488	8.9811	8.3701
20	0.0931	82.6893	10.8272	6.4835
21	0.0944	80.3736	10.6427	8.9838
22	0.1039	81.0952	9.5139	9.3909
23	0.1184	82.3427	9.0667	8.5905
24	0.1336	82.0830	11.1163	6.8007
Structural VAR				

Figure A1: Impulse Response Functions for Real GDP Growth







Annex II. Exchange Rate Pass-Through to CPI Inflation

***Summary*:** Standard estimation of a bivariate Auto Regressive Distributed Lag (ARDL) model, using monthly data, suggests that the exchange rate pass-through coefficient has increased significantly in Guyana over the past decade or so, from about -0.40 over the period 1995M1-2021M9 to about -0.55 over the period 2009M1-2021M9. This is well above the estimated regional average of -0.38 for Central America and the Caribbean for the latter period, and is also quite high in comparison with other similar oil-exporting countries. This methodology, however, only looks at the relationship between the nominal effective exchange rate (NEER) and prices and may be subject to omitted variable bias. In particular, it does not model how monetary policy reacts to combat inflationary pressures. Using a more model-based VECM model, which takes into account a simple monetary policy reaction function and the monetary policy transmission mechanism, suggests that long-run exchange rate passthrough to CPI inflation is much lower, at around -0.24.

Model Details

Unit Root Tests

Unit root tests suggested the following variables were non-stationary, i.e. I(1):

LNCPI – log of the CPI index
LNNEER – log of the nominal effective exchange rate, period average
LNBASEMNY – log of broad money
LNCBPrate1 – log of (1 + the Central Bank Policy Rate (discount rate))

The Auto Regressive Distributed Lag (ARDL) Model

We first start by estimating a bivariate ARDL model, regressing (month-on-month) CPI inflation on (month-on-month) movements in the nominal effective exchange rate (NEER) and twelve lags of both variables. The results are presented in **Table A2** and suggest a significant rise in the exchange rate pass-through coefficient, from about -0.40 over the period 1995M1-2021M9 to about -0.55 over the period 2009M1-2021M9. Estimates for other countries in the region over the more recent period suggest that the exchange rate pass-through coefficient is among the highest in the Caribbean and Central America, and considerably higher than the regional average of -0.38. It is also quite high in comparison with other similar oil exporting countries (**Table A3**).

VECM Estimation

The ARDL model is simple to understand and execute. However, this methodology only looks at the relationship between the nominal effective exchange rate (NEER) and prices and may be subject to omitted variable bias. In particular, it does not model how monetary policy reacts to combat inflationary pressures.

Hence we now go on to use a more model-based VECM model, which allows for simultaneous interactions among several endogenous variables and takes into account the existence of long-run co-integrating relationships among them. In particular, we introduce the policy interest rate and base money into the system to model a monetary policy reaction function and the monetary policy transmission mechanism to inflation. The ordering of the variables in the estimated VECM is as follows:

LNNEER LNCBPrate1 LNBASEMNY LNCPI

and covered the period 2009M1 to 2021M4 (148 monthly observations). The lag length – two - was determined on the basis on the Hannan-Quinn information criterion for lag length selection. These results indicate that a 1 percent appreciation of the NEER has a cumulative (negative) impact on the CPI price level of around 0.24 percentage points after 12 months, with a long-run exchange rate pass-through co-efficient to CPI inflation of the same magnitude, around -0.24. The cumulative impulse responses are shown in **Figure A2.**

Table A2. Guyana: ARDL Estimate of Exchange Rate Pass-through to Inflation

Dependent Variable: DLNGUYCPI
Method: Least Squares
Date: 12/13/21 Time: 20:05
Sample: 2009M01 2021M09
Included observations: 153
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.1733	0.1026	1.6888	0.0937
DLNGUYCPI(-1)	-0.1211	0.1336	-0.9064	0.3664
DLNGUYCPI(-2)	-0.0473	0.0921	-0.5140	0.6081
DLNGUYCPI(-3)	0.0516	0.0817	0.6316	0.5288
DLNGUYCPI(-4)	-0.0357	0.0860	-0.4157	0.6783
DLNGUYCPI(-5)	0.0887	0.1160	0.7641	0.4462
DLNGUYCPI(-6)	-0.0163	0.0860	-0.1891	0.8503
DLNGUYCPI(-7)	0.1177	0.0755	1.5580	0.1217
DLNGUYCPI(-8)	0.1459	0.1000	1.4592	0.1470
DLNGUYCPI(-9)	0.0579	0.0910	0.6360	0.5259
DLNGUYCPI(-10)	0.1804	0.1117	1.6151	0.1088
DLNGUYCPI(-11)	0.0725	0.1061	0.6834	0.4956
DLNGUYCPI(-12)	-0.1245	0.0843	-1.4771	0.1421
DLNGUYNEER	-0.0189	0.0778	-0.2436	0.8079
DLNGUYNEER(-1)	-0.1439	0.0903	-1.5936	0.1135
DLNGUYNEER(-2)	0.0372	0.0844	0.4408	0.6601
DLNGUYNEER(-3)	0.0654	0.0765	0.8553	0.3940
DLNGUYNEER(-4)	-0.0790	0.0743	-1.0634	0.2896
DLNGUYNEER(-5)	-0.0413	0.0686	-0.6015	0.5486
DLNGUYNEER(-6)	-0.1430	0.0794	-1.8008	0.0741
DLNGUYNEER(-7)	0.0896	0.0687	1.3038	0.1947
DLNGUYNEER(-8)	-0.0936	0.0602	-1.5550	0.1224
DLNGUYNEER(-9)	0.0188	0.0558	0.3367	0.7369
DLNGUYNEER(-10)	0.0025	0.0606	0.0418	0.9668
DLNGUYNEER(-11)	0.0614	0.0776	0.7907	0.4306
DLNGUYNEER(-12)	-0.1024	0.0787	-1.3013	0.1955
R-squared	0.2170	Mean dependent var		0.1903
Adjusted R-squared	0.0628	S.D. dependent var		0.5998
S.E. of regression	0.5806	Akaike info criterion		1.9043
Sum squared resid	42.8181	Schwarz criterion		2.4192
Log likelihood	-119.6765	Hannan-Quinn criter.		2.1135
F-statistic	1.4076	Durbin-Watson stat		1.9157
Prob(F-statistic)	0.1129	Wald F-statistic		1.4167
Prob(Wald F-statistic)	0.1087			

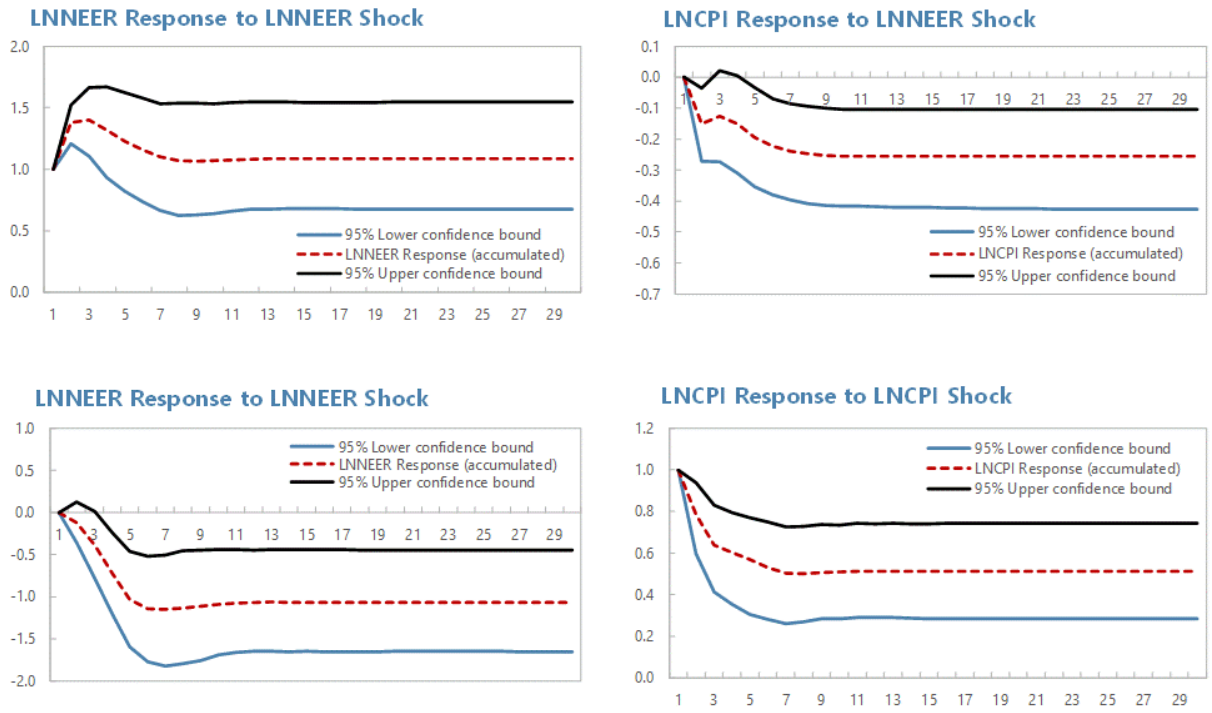
Table A3. Estimate Exchange Rate Pass-through to Inflation

Estimated exchange rate pass-through to inflation

	1995M1-2021M9	2009M1-2021M9
Central America and the Caribbean		
Guyana	-0.3898	-0.5508
Bahamas	-0.0827	-0.7705
Haiti	-0.4451	-0.6389
El Salvador	-0.9268	-0.5904
St Vincent and the Grenadines	-0.6516	-0.5829
Suriname	-0.6253	-0.5336
Barbados	0.3793	-0.4534
Dominican Republic	-0.6441	-0.4509
Jamaica	-0.8200	-0.4221
Nicaragua	-0.9425	-0.4100
Grenada	-0.4293	-0.3967
Honduras*	-0.6105	-0.3628
Trinidad and Tobago	-0.4646	-0.2549
St. Kitts and Nevis	-0.3525	-0.2399
Dominica	-0.3181	-0.1815
Costa Rica	-0.5577	-0.1431
Antigua and Barbuda	-0.1399	-0.1338
Panama	-0.2277	-0.1133
Guatemala	-0.2071	-0.0109
Regional Average	-0.4450	-0.3811
Comparable oil exporting economies		
Timor-Leste**	-0.5696	-1.5800
Suriname	-0.6253	-0.5336
Ecuador*	-0.3290	-0.4551
Angola***	-0.3187	-0.3634
Trinidad and Tobago	-0.4646	-0.2549
Kazakhstan	-0.1210	-0.1683
Ghana	-0.4724	-0.0823

* Base period: 2001M1-2021M9
** Base period: 2003M1-2021M9
*** Base period: 2005M1-2021M9

Figure A2. Guyana: Accumulated Impulse Responses to a one unit shock to the Nominal Effective Exchange Rate and to the Price Level



Annex III. Evidence for Currency Substitution in Guyana

This Annex estimates money demand equations for Guyana to examine the evidence for currency or asset substitution in Guyana. The data to estimate the equations were taken mainly from the website of the Bank of Guyana, Haver Analytics and from the IFS Statistics, except for the quarterly GDP series, which were interpolated from the annual data used for the structural VAR using the Denton methodology for interpolation. The equations were estimated with quarterly data over the period 2000: QI—2021: Q4.

Money demand is estimated to be a function of real output and of the domestic interest rate, taken for the purpose of this study to be the three-month Treasury Bill rate for Guyana. Other explanatory variables include the expected rate of depreciation and the expected rate of return on foreign financial assets. The CPI inflation differential with the United States is taken as a proxy for the expected rate of depreciation of the nominal exchange rate, following the approach for example in Ramirez-Rojas (1991) and Clements and Schwartz (1993). Two proxies are used for the expected rate of return on foreign financial assets: (i) the three-month US Deposit Rate adjusted for the expected rate of depreciation of the nominal exchange rate, and (ii) the three-month US T-bill rate, again adjusted for the expected rate of depreciation. The variables in the estimated equations are defined as follows:

LNM2	(Log of) M2 divided by the CPI index for Guyana
LNRGDP	(Log of) real GDP: quarterly interpolations from annual data using the Denton methodology
LN3MNTBILLRATE	(Log of) the three-month Guyana Treasury Bill rate
INFDIFF	Current period inflation differential between Guyana and the United States – proxy for expected depreciation of the Guyana dollar
LNROR6	(Log of) the three-month US Deposit Rate + INFDIFF
LNROR8	(Log of) the three-month US Treasury Bill rate + INFDIFF
S1, S2, S3	Seasonal quarterly dummies

Phillips-Perron unit-root tests on the variables show that real money (LNM2), real output (LNRGDP), and the three-month Guyana T-bill rate LN3MNTNBILLRATE are nonstationary, i.e., 1(1), at the five percent significance level, while the inflation differential (INFDIFF) and the two proxies for expected rates of return on foreign financial assets (LNROR6 and LNROR8) are stationary, i.e. I(0) (although the less powerful Augmented Dickey Fuller tests suggest that LNROR6 and LNROR8 are nonstationary). The Johansen maximum eigenvalue and trace tests for co-integration further indicate that the I(1) variables LNM2, LNRGDP, and LN3MNTBILLRATE are not co-integrated. The ARDL Bounds tests also provide no evidence of co-integration among the I(1) variables. These unit root test and co-integration results are not presented here for the sake of brevity but are available from the author on request.

Given lack of evidence of co-integration of the nonstationary variables, an Auto-Regressive Distributed Lag (ARDL) model with stationary variables was estimated. The dependent variable was taken to be the first difference of real money, D(LNM2). Explanatory variables included real GDP growth, D(LNRGDP), and the first difference of the domestic interest rate, D(LN3MNTBILLRATE). Other explanatory variables included the inflation differential with the US, INFDIFF, as a proxy for the expected rate of depreciation of the Guyanese

dollar against the US dollar. A proxy for the expected rate of return on financial assets, and seasonal dummies, were also included in the ARDL model. This model thus allows us to test whether expected depreciation affects money demand directly through INFDIFF (currency substitution), or indirectly through LNROR6 / LNROR8 (capital mobility or asset substitution), or both.

Note that expected exchange rate movements could have a negative or positive influence on money demand, depending on whether the 'wealth effect' or 'substitution effect' dominates. Since a depreciation of the domestic currency raise the domestic currency value of foreign assets, individuals could perceive this as an increase in their wealth and demand more domestic money. On the other hand, if the public expect further depreciation of the domestic currency, they are likely to adjust their asset portfolios, holding more foreign currencies and foreign currency-denominated assets and less domestic currency. Thus, exchange rate movements could have positive or negative effects on the demand for domestic money.

The results with LNROR6 are shown in Table A4 below, and provide no evidence for either currency substitution or asset substitution. Moreover, the CUSUM and CUSUMSQ plots, applied to the ARDL model with LNROR6, indicate no evidence of significant structural instability over the estimation period. The goodness of fit measures, R-squared and adjusted R-squared, are reasonable, particularly given that the dependent variable is estimated in first differences. Table A5 shows the results of estimating the same ARDL model but with LNROR8 instead of LNROR6. The results are very similar and have similar goodness of fit measures.

Thus, to summarize, the model estimates do not provide empirical support for the presence of either currency substitution or asset substitution in Guyana. However, the results need to be interpreted with caution. As Cuddington (1983) and Savastano (1990) point out, a major problem with this type of standard model is that the inclusion of the expected rate of depreciation in a money-demand equation does not generally suffice to distinguish the occurrence of currency or asset substitution from either imperfect capital mobility or a high elasticity of demand for all existing substitutes to domestic money.

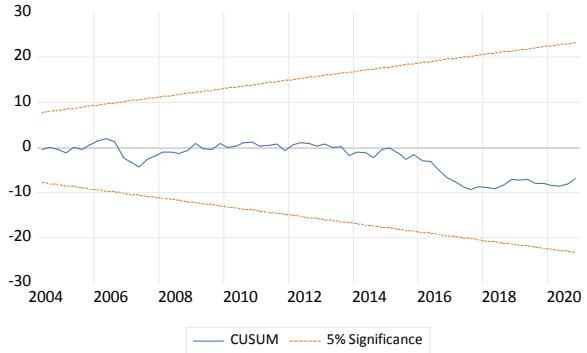
Table A4. ARDL Model of Money Demand in Guyana

Dependent Variable: D(LNM2)
Method: ARDL
Date: 07/21/22 Time: 20:15
Sample (adjusted): 2002Q1 2020Q4
Included observations: 76 after adjustments
Maximum dependent lags: 6 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (6 lags, automatic): D(LNRGDP) D(LN3MNTBILLRATE) INFDIFF LNROR6

Fixed regressors: S1 S2 S3 C
Number of models evaluated: 14406
Selected Model: ARDL(1, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(LNM2(-1))	0.0993	0.1252	0.7933	0.4304
D(LNRGDP)	0.1512	0.0865	1.7480	0.0851
D(LN3MNTBILLRATE)	-0.0532	0.0202	-2.6367	0.0104
INFDIFF	0.0033	0.0037	0.8913	0.3760
LNROR6	-0.2416	0.2381	-1.0145	0.3140
S1	0.0117	0.0079	1.4911	0.1406
S2	0.0082	0.0074	1.1071	0.2722
S3	0.0464	0.0073	6.3772	0.0000
C	-0.0058	0.0069	-0.8454	0.4009
R-squared	0.6259	Mean dependent var		0.0135
Adjusted R-squared	0.5813	S.D. dependent var		0.0248
S.E. of regression	0.0161	Akaike info criterion		-5.3124
Sum squared resid	0.0173	Schwarz criterion		-5.0364
Log likelihood	210.8702	Hannan-Quinn criter.		-5.2021
F-statistic	14.0147	Durbin-Watson stat		2.0260
Prob(F-statistic)	0.0000			

*Note: p-values and any subsequent tests do not account for model selection.



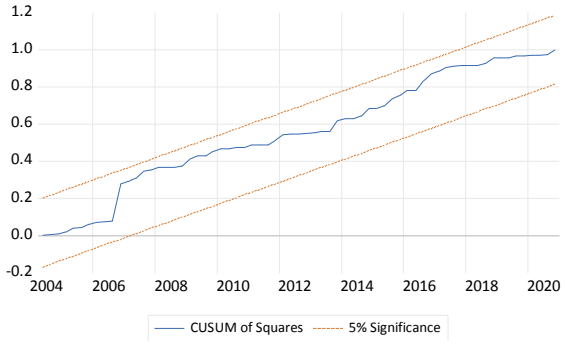


Table A5. ARDL Model of Money Demand in Guyana

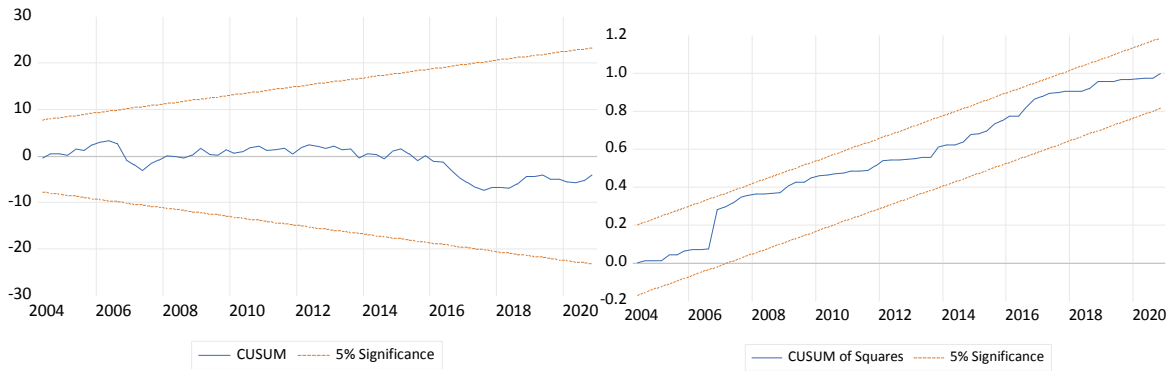
Dependent Variable: D(LNM2)
Method: ARDL
Date: 07/21/22 Time: 20:20
Sample (adjusted): 2002Q1 2020Q4
Included observations: 76 after adjustments
Maximum dependent lags: 6 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (6 lags, automatic): D(LNRGDP) D(LN3MNTBILLRATE) INFDIFF LNROR8

Fixed regressors: S1 S2 S3 C
Number of models evaluated: 14406
Selected Model: ARDL(1, 0, 0, 0, 0)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(LNM2(-1))	0.0846	0.1247	0.6788	0.4996
D(LNRGDP)	0.1719	0.0855	2.0112	0.0483
D(LN3MNTBILLRATE)	-0.0521	0.0202	-2.5814	0.0120
INFDIFF	0.0020	0.0027	0.7668	0.4459
LNROR8	-0.1442	0.1408	-1.0237	0.3097
S1	0.0111	0.0078	1.4162	0.1614
S2	0.0075	0.0073	1.0286	0.3074
S3	0.0460	0.0073	6.3277	0.0000
C	-0.0054	0.0069	-0.7795	0.4384

R-squared	0.6260	Mean dependent var	0.0135
Adjusted R-squared	0.5814	S.D. dependent var	0.0248
S.E. of regression	0.0161	Akaike info criterion	-5.3126
Sum squared resid	0.0173	Schwarz criterion	-5.0366
Log likelihood	210.8806	Hannan-Quinn criter.	-5.2023
F-statistic	14.0208	Durbin-Watson stat	2.0108
Prob(F-statistic)	0.0000		

*Note: p-values and any subsequent tests do not account for model selection.



Annex IV. Price Elasticity of Guyana's Exports

How sensitive are Guyana's exports to movements in relative prices? The results from estimating export equations using data for recent years did not find statistically significant effects of the CPI-based real effective exchange rate on exports of non-oil goods and services that were robust, stable, and plausible; better results were obtained using an export unit value index for Guyana deflated by the U.S. Producer Price Index, and these results are discussed and presented below.

Export equations for Guyana were estimated using annual data over the period 1996 to 2019. The variables are defined as follows:

LNXNOGDSR2	= (log of) Guyana's exports of non-oil goods and services, in US dollars, deflated by the unit value index for Guyana's exports
LNGDPPC	= (log of) an index of real GDP for Guyana's trading partner countries (export-weighted averages, constructed from GEE assumptions for Guyana)
LNPXR2	= (log of) the unit value index for Guyana's exports (in US dollars) deflated by the US Producer Price Index
D(x)	= first difference of the variable x

Data to estimate the export equations were taken from the WEO database (Guyana export values in US dollars and the Index of real GDP for Guyana's trading partner countries), the World Bank's World Integrated Trade Solution database (to construct the unit value index for Guyana's exports), and the US Bureau of Labor Statistics (US Producer Price Index).

Augmented Dickey-Fuller tests and Phillips-Perron tests for the stationarity of the variables used in the equations were carried out. The former indicated that all the variables used in the regression are non-stationary but the Phillips-Perron test results were more ambiguous In estimating the equations it was assumed that the export series is non-stationary in levels but stationary in first differences, i.e., 1(1). The Johansen co-integration test results indicate that the three variables LNXNOGDSR2, LNGDPPC, and LNPXR2 are co-integrated. The unit root tests and co-integration results are not presented here for the sake of brevity but are available from the author on request. Given the relatively short sample size it was decided to follow the Engle-Granger approach (rather than the Johansen procedure) in estimating the long-run price elasticity of exports of non-oil goods and services.

Tables A6 and A7 show the results from estimating a long-run relationship among the variables using Fully Modified OLS and Dynamic Least Squares. Both set of estimates show that Guyana's non-oil exports of goods and services are significantly and positively affected by stronger output growth in its main trading partners, and significantly and negatively affected by a higher relative price for its exports (as defined by LNPXR2). Tables A8 and A9 use the residuals from the estimated long-run equations – RES10 and RES12 respectively - to see how price-sensitive Guyana's non-oil exports are in the short-run. The results indicate that Guyana's exports are also price-sensitive, but not significantly affected by growth of output in its main trading partners, in the short run.

In summary, the empirical evidence presented here provide some support for the claim that non-oil exports of goods and services from Guyana are price-sensitive, both in the long-run and in the short-run.

Table A6

Dependent Variable: LNXNOGDSR2
Method: Fully Modified Least Squares (FMOLS)
Date: 07/21/22 Time: 20:31
Sample (adjusted): 1996 2019
Included observations: 24 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDPPC	0.8149	0.3675	2.2173	0.0378
LNPXR2	-0.8578	0.2176	-3.9423	0.0007
C	1.4564	1.2967	1.1232	0.2741
R-squared	0.6291	Mean dependent var		1.4691
Adjusted R-squared	0.5938	S.D. dependent var		0.3042
S.E. of regression	0.1939	Sum squared resid		0.7893
Long-run variance	0.0662			

Table A7

Dependent Variable: LNXNOGDSR2
Method: Dynamic Least Squares (DOLS)
Date: 07/21/22 Time: 20:42
Sample (adjusted): 1997 2018
Included observations: 22 after adjustments
Cointegrating equation deterministics: C
Fixed leads and lags specification (lead=1, lag=1)
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDPPC	1.0239	0.3694	2.7715	0.0159
LNPXR2	-0.8840	0.1935	-4.5688	0.0005
C	0.4693	1.3804	0.3399	0.7393
R-squared	0.8454	Mean dependent var		1.4820
Adjusted R-squared	0.7503	S.D. dependent var		0.3137
S.E. of regression	0.1568	Sum squared resid		0.3195

Table A8

Dependent Variable: DLNXNOGDSR2
Method: Least Squares
Date: 07/21/22 Time: 20:45
Sample (adjusted): 1997 2019
Included observations: 23 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0419	0.0482	0.8709	0.3947
DLNGDPPC	-0.7960	1.2718	-0.6258	0.5389
DLNPXR2	-1.2076	0.0781	-15.4690	0.0000
RES10(-1)	-0.3076	0.0742	-4.1472	0.0005
R-squared	0.8947	Mean dependent var		0.0081
Adjusted R-squared	0.8781	S.D. dependent var		0.2669
S.E. of regression	0.0932	Akaike info criterion		-1.7518
Sum squared resid	0.1650	Schwarz criterion		-1.5543
Log likelihood	24.1456	Hannan-Quinn criter.		-1.7021
F-statistic	53.8326	Durbin-Watson stat		1.4576
Prob(F-statistic)	0.0000	Wald F-statistic		79.9162
Prob(Wald F-statistic)	0.0000			

Table A9

Dependent Variable: DLNXNOGDSR2
Method: Least Squares
Date: 07/21/22 Time: 20:48
Sample (adjusted): 1998 2019
Included observations: 22 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0526	0.0358	1.4676	0.1595
DLNGDPPC	-0.4771	0.9563	-0.4989	0.6239
DLNPXR2	-1.3043	0.1020	-12.7896	0.0000
RES12(-1)	-0.2479	0.2306	-1.0751	0.2965
R-squared	0.8100	Mean dependent var		-0.0245
Adjusted R-squared	0.7784	S.D. dependent var		0.2215
S.E. of regression	0.1043	Akaike info criterion		-1.5210
Sum squared resid	0.1956	Schwarz criterion		-1.3226
Log likelihood	20.7311	Hannan-Quinn criter.		-1.4743
F-statistic	25.5863	Durbin-Watson stat		1.3261
Prob(F-statistic)	0.0000	Wald F-statistic		64.3065
Prob(Wald F-statistic)	0.0000			

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