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Global implications of a US-led currency war

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Abstract

Many US policymakers on both sides of the aisle, including President Trump, have called on the US Federal Reserve to cut interest rates to depreciate the US dollar. This paper uses an intertemporal general equilibrium model to explore what would likely happen if this policy was pursued. It shows that the general equilibrium effects of a depreciated real effective exchange rate brought about by lower US interest rates can result in a wide variety of unintended consequences. The paper explores what would happen if US trading partners were to retaliate by devaluing their currencies.

KEYWORDS

computable general equilibrium models, econometric modelling, international finance, international financial markets, international policy coordination, monetary policy, trade

1 | INTRODUCTION

Since he began his Presidential campaign in 2016, President Trump regularly accused China, Europe and other countries of keeping their currencies low to compete unfairly with the United States. He was critical of the US Federal Reserve for keeping interest rates—and thus the US dollar—higher than he would like. He proposed a simple solution to the problem: 'We should MATCH', he tweeted in July of 2019, 'or continue being the dummies who sit back and politely watch as other countries continue to play their games—as they have for many years!'.

It was not just rhetoric. Under the President's direction, the US Department of Commerce issued a proposal in May 2019 to impose sanctions on countries deemed to be hurting American exporters through currency manipulation. Five days later, the US Treasury lowered its threshold for what constitutes a competitive currency devaluation and expanded its surveillance to include any country with a trade surplus with the United States of $40 billion or more. On 5 August 2019, the US Treasury labelled China a 'currency manipulator' for the first time in twenty-five years, opening the door to sanctions and further trade restrictions.

President Trump was not alone. Senator Elizabeth Warren, who sought the Presidential nomination for the Democratic Party in 2020, said the US dollar should be actively managed to promote exports and domestic manufacturing. She proposed to 'work with other countries harmed by currency misalignment to produce a currency value that's better for our workers and our industries' (Warren, 2019). In July 2019, two senators, from either side of the aisle, co-sponsored a bill that would oblige the US Federal Reserve to prevent the dollar's value from harming US exports (Greeley, 2019).

A rise in tensions about currency valuation and monetary policy is perhaps not surprising in the current environment. Research from Olivier Blanchard (2016) and David Vines (2014) shows that the risk of economic tensions and the need for cooperation increases when countries have fewer macroeconomic tools than objectives. Since the global financial crisis, prior to the COVID-19 pandemic, many countries have been trying to achieve two objectives—full employment and reduced debt and deficits—using one macroeconomic tool—monetary policy. This policy strategy has produced exchange rate spillovers onto other countries, which, in the absence of a fiscal policy response, has produced what the IMF called a 'spillover-rich environment' (IMF, 2015).

Avoiding conflict in this environment requires cooperation between countries. But global macroeconomic cooperation has been in short supply since 2016. Macroeconomic cooperation was in abundance in the aftermath of the global financial crisis. G20 countries coordinated fiscal stimulus, subsequent fiscal consolidation, structural reform, global institutional reform, reforms to strengthen the global financial safety net, reforms to reduce global imbalances and commitments to improve monetary policy communication (see Triggs, 2018). But the rise of America First, Brexit and trade and technology wars have seen cooperation replaced with confrontation, solidarity with suspicion and multilateralism with bilateralism.

The most recent analysis from the International Monetary Fund (IMF) suggests that the US dollar overvaluation is between 6 and 12 per cent (IMF, 2019a, 2019b). This calculation means that the value of the US real effective exchange rate is between 6 and 12 per cent higher than suggested by the fundamentals of the US economy. Other economies are in the opposite position. Germany's exchange rate is assessed to be undervalued by between 8 and 18 per cent, making their exports relatively cheaper than those from the United States (IMF, 2019a, 2019b). Efforts to devalue the US dollar, while perhaps unwelcome by Germany, could be characterised as merely correcting an imbalance and restoring a level playing field, rather than being directed at some competitive purpose.

The reality, explored in this paper, is more complex. The impacts of a weaker US dollar would not be entirely negative for US trading partners, or entirely positive for the United States, and would involve diverse sectoral effects between trade-exposed and non-trade-exposed sectors, and between different cohorts of firms and households. Another complicating factor is how other countries would respond to such a change in policy from the United States. For US trading partners like Germany that have undervalued exchange rates, a weaker US dollar would potentially help both the United States and Germany move their exchange rates closer to their fundamental values. But for US trading partners like Canada that already have overvalued exchange rates, a weaker US dollar might only make their situation worse. In response, economies like Canada might be tempted to adopt the same policy as the United States and seek to push their currencies back down to their fundamental values. This response would presumably make it harder for the United States to achieve its objectives and would likely require an even more substantial adjustment from economies like Germany with undervalued exchange rates, which would need to remain passive in allowing their exchange rates to appreciate.

Even further complications arise in the euro area where Germany (assessed as having an undervalued real effective exchange rate) shares the same exchange rate as France and Italy (both assessed as having an overvalued real effective exchange rate). And all of this assumes that such a policy from the

United States would be feasible in the first place, both institutionally and economically. Institutionally, the US Treasury's Exchange Rate Stabilization fund has less than US$100 billion, with dollar holdings of just US$23 billion, and is unlikely to be large enough to achieve a sustained depreciation of the US dollar (Sevastopulo et al., 2019). This situation implies that cooperation between the US Treasury and the US Federal Reserve would be required. Economically, while US authorities may be able to reduce the value of the nominal exchange rate, achieving a sustained depreciation of the real effective exchange rate is a more complex exercise given the general equilibrium effects of such a policy on prices at home and abroad. These complexities suggest that international cooperation would also likely be required, perhaps in a way analogous to the Plaza and Louvre Accords of times passed. The nature of that agreement and its implications are uncertain.

The objective of this paper was to explore these issues. It starts by analysing the implications of a US Administration Policy to devalue the US dollar to bring it back to what the IMF assesses as its fundamental value. It explores the aggregate and sectoral impacts of such a policy for the US economy, the rest of the G20 and the rest of the world using a dynamic intertemporal general equilibrium model called the G-Cubed (G20) model. The paper then analyses potential responses from other major economies. It explores what would happen if other economies with overvalued exchange rates adopt the same policy and seek to reduce their currencies back to their fundamental values and the strategic incentives faced by different G20 economies.

The paper is structured as follows. Section 2 outlines the state of currency valuations and exchange rate frameworks across the G20 economies. Section 3 introduces the G-Cubed (G20) model and its key features. Section 4 models each of the above currency adjustment scenarios' implications. Section 5 concludes with a discussion of the policy implications for the United States and the rest of the G20.

2 | G20 EXCHANGE RATES: OVERVALUED, UNDERVALUED OR NEITHER?

An undervalued exchange rate makes a country's goods, services and assets relatively cheaper than those from other countries, boosting the country's trade balance with the undervalued exchange rate at the expense of the trade balances of other countries. For this reason, exchange rates can be politically sensitive. But this is by no means the whole story. As the following simulations demonstrate, an overvalued exchange rate, like that of the United States, has broader implications than just a reduced trade balance. An overvalued exchange rate also means cheaper imports, which is likely to lower the cost of consumption for households, benefiting poorer households the most, and is likely to benefit firms which rely on imports for their production processes. In the age of global production networks, a 'pro-export, anti-import' policy is particularly problematic given that many firms are importing components that are then re-exported along a global supply chain.

It is also important to understand why an exchange rate is assessed to be over- or undervalued in the first place. The IMF considers the exchange rate of a country to be undervalued if the exchange rate is lower than what it ought to be, based on an assessment of that economy's fundamental characteristics and the desirable policy settings in that economy (see IMF, 2019a, 2019b). An economy's fundamental characteristics include the factors that would legitimately be expected to impact the value of the exchange rate—such as how much that country trades with the world, how much foreigners invest in that country, how much domestic residents invest abroad, and the domestic rates of savings, consumption, investment and so on—and exclude the

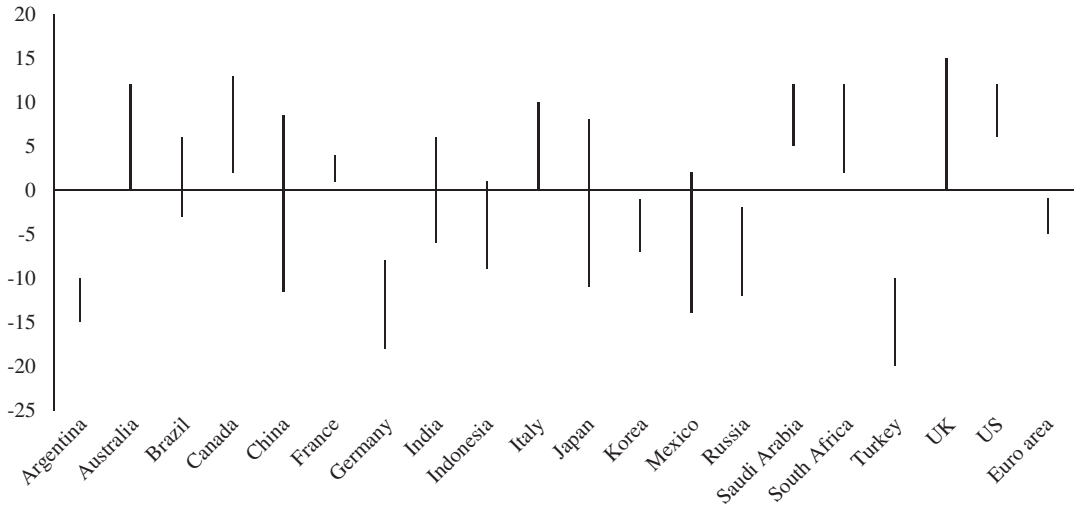

FIGURE 1 Exchange rates compared to IMF estimates of fundamental values, 2018. Interpretation: Lines represent the estimate range. A line above zero implies an overvalued exchange rate (e.g., Australia's exchange rate is estimated to be overvalued between 0 and 12 per cent). A line below zero implies an undervalued exchange rate (e.g., the euro area's exchange rate is undervalued by between −1 and −5 per cent). Source: IMF (2019a, 2019b)

impact on the exchange rate from factors such as policy distortions (where undesirable policies from the government are influencing the exchange rate), cyclical factors (such as temporary movements that alter the exchange rate) and the impacts of currency speculation (investors who purchase currencies to bet on changes in their value rather than to use the currency for transactions).

Of the G20 economies, nine economies were assessed by the IMF in 2018 as having overvalued exchange rates. Three countries had exchange rates that were broadly in-line with their fundamentals. Eight countries had undervalued exchange rates. Among other things, this shows that the United States is not alone in having an overvalued exchange rate. The United States is joined in having an overvalued exchange rate by Australia, Canada, France, Italy, Saudi Arabia, South Africa, the United Kingdom and more countries outside the G20 (Figure 1).

An important question is whether these exchange rate valuations were one-offs for 2018 or whether they were part of a broader trend. Figure 2 shows the same results looking from 2012 to 2018.[1] More than half the G20 countries stand out as consistently having overvalued exchange rates: Australia, Brazil, Canada, France, Italy, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom and the United States. Others have consistently undervalued exchange rates: the euro area,[2] Germany, Japan, Korea and Mexico. And others have been more mixed. China, for example, historically had an exchange rate that was undervalued by between 5 and 10 per cent. Still, its exchange rate has been broadly in-line with its fundamentals over the last five years.

An important consideration is the exchange rate and monetary policy frameworks that help produce these outcomes. These frameworks are important, but not conclusive in respect of whether a currency will be overvalued or undervalued. Having a floating exchange rate, for example, does not

[1]Argentina is omitted because the IMF only began assessing Argentina in 2019.

[2]While the euro area as a whole is estimated as having an undervalued exchange rate, it should be noted that many countries within the euro area (such as France and Italy) are assessed as having overvalued exchange rates. The euro area is included specifically because it is part of the G20 via the membership of the EU.

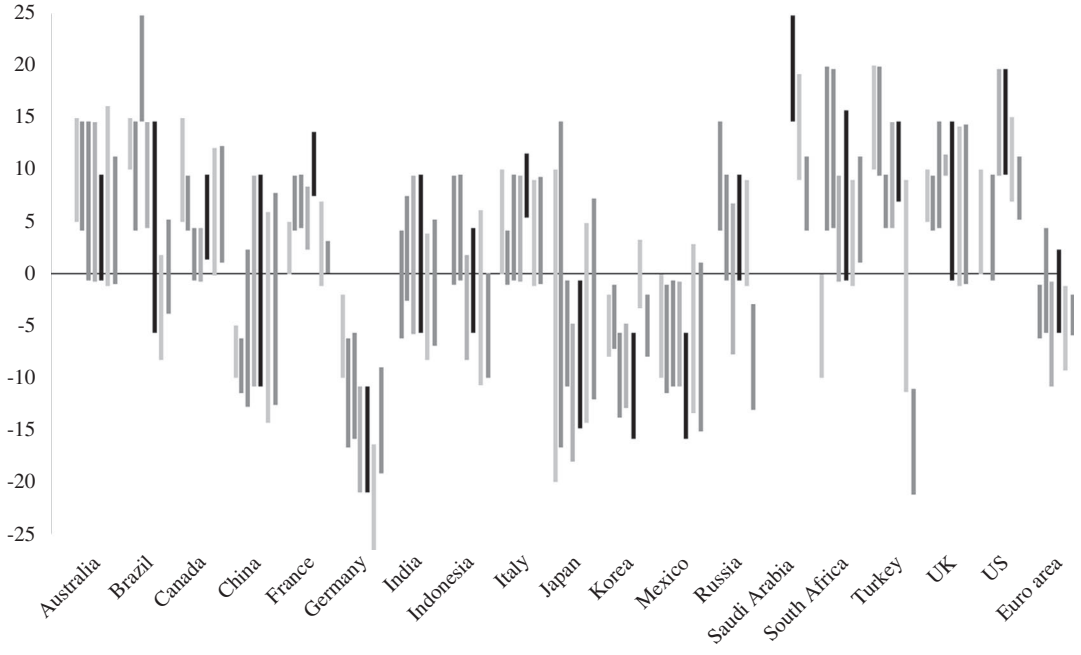

FIGURE 2 Exchange rates compared to IMF estimates of fundamental values, 2012–2018. Source: Data compiled from IMF external assessment reports from 2013 to 2019

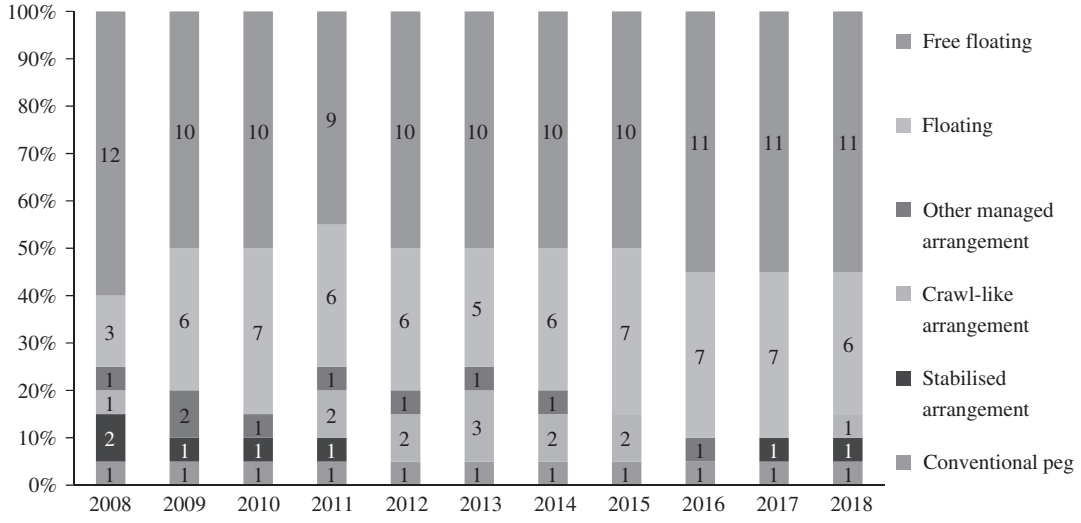

FIGURE 3 G20 exchange rate frameworks. Source: Data from the IMF Annual Reports on Exchange Arrangements and Exchange Restrictions, 2009 to 2019

necessarily mean an exchange rate will be consistent with its fundamentals, as illustrated by the United States, and having a non-floating exchange rate does not necessarily mean an exchange rate will be inconsistent with its fundamentals, as illustrated by China. In any event, the exchange rates among G20 economies are overwhelmingly market-determined and are becoming more market-determined over time, consistent with the commitments made by these countries in the G20 forum (Figure 3). In

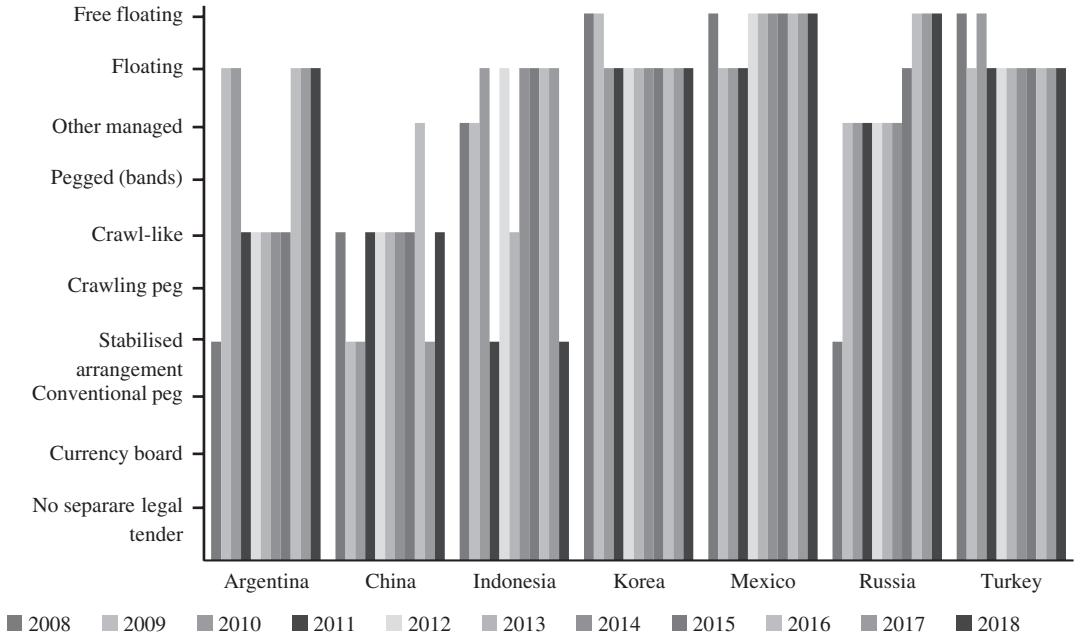

FIGURE 4 G20 countries whose IMF exchange rate classifications have changed since 2008. Source: Data from the IMF Annual Reports on Exchange Arrangements and Exchange Restrictions, 2009 to 2019

2018, 17 of the G20 economies had exchange rates which were classified by the IMF as being either free-floating or floating.[3] Only three have non-floating exchange rates: Saudi Arabia (a conventional exchange rate peg), Indonesia (currently assessed as having a stabilised arrangement) and China (assessed as having a crawl-like arrangement).

The story is more complicated for some G20 economies. Four G20 members—France, Germany, Italy and the European Union—share the same currency: the euro. The euro arrangement is classified as a floating currency by the IMF. But from the perspective of euro area members, it can act more like a fixed exchange rate because the shared currency dilutes the impact that any one member can have over the exchange rate. The common currency cannot, for example, respond to high unemployment in Greece (implying a depreciated exchange rate) while simultaneously responding to high inflation in Germany (implying an appreciated exchange rate). Discussed in the simulations below, this has critical implications for the fundamental values of exchange rates, helping to drive, in particular, the undervalued exchange rate of Germany.

Over time, the majority of G20 economies have not seen any changes in how their exchange rates are classified. The exceptions are the seven economies in Figure 4. Argentina and Russia have moved closer to floating exchange rates while Korea and Turkey have gone backward. The results for China, Indonesia and Mexico are more mixed, having changed classifications at different points in time but typically not deviating from their long-run classifications.

The key takeaway from this analysis is that the United States is not alone in having an overvalued exchange rate. This raises the possibility that should the United States decide to intervene and push down the value of its exchange rate to its fundamental level, so too might other economies which have overvalued exchange rates, including Australia, Brazil, Canada, France, Italy, Russia, Saudi Arabia,

[3]The difference between floating and free-floating is primarily determined by how often a country intervenes in foreign exchange markets. See IMF (2019a, 2019b) for an explanation of how each category is defined.

South Africa, Turkey and the United Kingdom. The cross-border spillovers from these policies are critical to shaping the incentives of different economies in how they respond to a change in exchange rate policy from the United States. Before considering these issues, it is useful to introduce the intertemporal general equilibrium model used in this analysis: the G-Cubed (G20) model.

3 | The G-CUBED (G20) MODEL

The G-Cubed (G20) model is a multi-country, multi-sector, intertemporal general equilibrium model. It is designed to bridge the gaps between three areas of research—computable general equilibrium modelling, international trade theory and modern macroeconomics—by incorporating the best features of each.

There are many versions of the model that have been developed over many years—each designed to address a particular question. The version presented in this paper is designed specifically to study the G20 and the implications of its policy agenda. Previous versions of G-Cubed have been used to study a range of policy areas, including macroeconomic cooperation, international trade, monetary policy, fiscal policy, tax reform and environmental regulation. Studies have shown the effectiveness of G-Cubed in explaining the adjustment process in many historical episodes, including Reaganomics, German reunification, European fiscal consolidation in the 1990s, the formation of NAFTA and the Asian financial crisis. G-Cubed has also proven successful in helping to explain the 'six major puzzles in international macroeconomics' highlighted in Obstfeld and Rogoff (2000). It has also proven useful in understanding the 2009 Global Financial Crisis.

The G-Cubed (G20) model represents the world as 24 autonomous blocks: one for each G20 economy (including the rest of the eurozone) and four regions which represent the world's non-G20 economies. These regions are as follows: the other economies of the OECD; the other economies of Asia; the other oil-producing economies; and a catch-all 'rest of the world' (Table 1). Each region in G-Cubed is represented by its own multi-sector computable general equilibrium model with highly disaggregated, multi-sectoral flows of goods and assets between them.

Each region has six industries, which correspond to the production of six goods: energy, mining, agriculture (including fishing and hunting), durable manufacturing, non-durable manufacturing and services. Each good in a region is an imperfect substitute for goods from other regions. Thus, there are effectively 144 goods.

Each country consists of 6 representative firms, a representative household and a government. The model also includes markets for goods and services, factors of production, money and financial assets (bonds, equities and foreign exchange). Finally, each country interacts through the flows of goods and assets. Some of the key features of the G-Cubed (G20) model are as follows:

- Specification of the demand and supply sides of economies.
- Integration of real and financial markets of these economies with explicit arbitrage linking real and financial rates of return.
- Intertemporal accounting of stocks and flows of real resources and financial assets.
- The imposition of intertemporal budget constraints so that agents and countries cannot borrow or lend forever without undertaking the required resource transfers necessary to service outstanding liabilities.
- Short-run behaviour is a weighted average of neoclassical optimising behaviour based on expected future income streams and Keynesian current income.
- The real side of the model is disaggregated to allow for the production of multiple goods and services within economies.

TABLE 1 Overview of the G-Cubed (G20) model

Countries (20)	Regions (4)
Argentina	Rest of the OECD
Australia	Rest of Asia
Brazil	Other oil-producing countries
Canada	Rest of the world
China	Sectors (6)
Rest of eurozone	Energy
France	Mining
Germany	Agriculture (including fishing and hunting)
Indonesia	Durable manufacturing
India	Non-durable manufacturing
Italy	Services
Japan	Economic Agents in each Country (3)
Korea	A representative household
Mexico	A representative firm (in each of the 6 production sectors)
Russia	Government
Saudi Arabia	
South Africa	
Turkey	
United Kingdom	
United States	

- International trade in goods, services and financial assets.
- Full short-run and long-run macroeconomic closure with macro-dynamics at an annual frequency around a long-run Solow–Swan–Ramsey neoclassical growth model.
- The model is solved for a full rational-expectations equilibrium (consisting of a mix of rational and rule of thumb agents) at an annual frequency from 2015 to 2100.

The rules for monetary and fiscal policies in the model are important for the results. Central banks in each economy follow a Henderson–McKibbin–Taylor rule with weights in different countries on output growth relative to trend, inflation relative to the target and in some case weights on nominal exchange rates relative to a target. The parameters are calibrated to vary across countries based on their observed monetary policy and exchange rate frameworks using data from the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (IMF, 2019a, 2019b). Some countries such as Saudi Arabia peg exactly to the $US, so the weights on inflation and output growth are zero, and the weight on the exchange rate is very large. Other countries such as China follow a crawling peg with some weight on inflation and the output gap but an additional weight on change in the Yuan/$US exchange rate. Within the eurozone, a single central bank sets monetary policy with weights on euro zone-wide output growth relative to the target and euro zone-wide inflation. The nominal policy interest rate is equal across Germany, France, Italy and the rest of the eurozone. The model documentation in McKibbin and Triggs (2018) contained further details.

The fiscal rules followed by each country are standardised across countries. Government spending is a constant share of baseline GDP with tax rates on households and firms and tariff rates of trade constant

at the rates in 2015. There is a lump-sum tax on households that changes in response to changes in the interest payments on government debt. The fiscal closure is called an incremental interest payments rule in McKibbin and Sachs (1991). Budget deficits are endogenous given these assumptions, but fiscal sustainability is assured by the fiscal rule which sets lump-sum taxes equal to the change in servicing costs on government debt. After a shock, in the long run, the stock of debt to GDP will stabilise at a level equal to the long-run primary fiscal deficit divided by the real growth rate of the economy. The fiscal closure assumption implies that a fall in productivity will lead to a permanently higher stock of government debt to GDP and a rise in productivity will lead to a permanently lower stock of debt to GDP. Alternative fiscal closures can significantly change the results in this paper. Future research will explore the interaction of the fiscal closure assumption and changes in productivity growth.

Unlike many macromodels, many of G-Cubed's parameters are determined by estimation rather than calibration. Estimating G-Cubed's parameters begins with constructing a consistent time series of input–output tables for the United States, based on the input–output transaction tables produced by the Bureau of Economic Analysis which are then converted into a standard set of industrial classifications, aggregated to six sectors. Prices for each good in each benchmark year were obtained from the output and employment data set constructed by the Office of Employment Projections at the Bureau of Labor Statistics. This allows for the model's parameters to be estimated for the United States. A lack of input–output data in the other regions and countries of the model make parameter estimation difficult for those regions. We therefore assume that substitution elasticities within each industry are the same across regions, with share parameters derived from input–output data taken from GTAP. Final demand parameters were estimated through the same approach: elasticities were estimated for the United States and share parameters were obtained from regional input–output tables. Trade shares were estimated using UN SITC data, and elasticities were drawn from the literature (see McKibbin et al., 1999).

The following simulations elaborate some of these key features of the model, and further details are available in McKibbin and Triggs (2018).

The above analysis showed that the US real effective exchange rate is estimated to be overvalued by between 6 and 12 per cent and ten other G20 economies are in the same position: Australia, Brazil, Canada, France, Italy, Russia, Saudi Arabia, South Africa, Turkey and the United Kingdom. This section simulates two scenarios. The first explores the implications of a new policy from US policymakers to push its real effective exchange rate back down to what its fundamentals suggest it should be. The second explores the implications of having the same policy adopted by the other G20 economies that have overvalued exchange rates.

3.1 | A forced depreciation of the US real effective exchange rate

Achieving a depreciated US real effective exchange rate is not straightforward. As discussed earlier, the US Treasury's Exchange Rate Stabilization Fund is less than US$100 billion, with dollar holdings of just US$23 billion. Selling dollars from this fund is unlikely to be enough to achieve a sustained reduction in the US dollar. ‘These dollar holdings might be sufficient to send a few warning shots, but they are not enough for a major campaign’, warned Mark Sobel, a former Treasury official, adding that the massive scale of the euro/dollar market and China's ability to exert control over the renminbi would likely stymie any US move (Sevastopulo et al., 2019).

Another option, assumed to be the case in the simulations below, is for the US Federal Reserve to take the lead. This policy involves the Fed agreeing to maintain low interest rates while tolerating higher inflation to achieve a sustained reduction in the value of the US dollar. Achieving this may be

more difficult at present given the relatively non-responsive Phillips Curve in the United States. But it is reasonably assumed that, with enough effort, the Fed is ultimately able to achieve this outcome. In the G-Cubed model, this is achieved by exogenously increasing the Fed's inflation target by the amount necessary to produce the desired reduction in the real effective exchange rate. With a higher inflation target, the Fed keeps interest rates lower than would otherwise be the case, resulting in a depreciated exchange rate as capital shifts out of the United States to seek higher returns abroad. Given the US dollar is assessed by the IMF to be between 6 and 12 per cent overvalued, the below simulation assumes the Fed seeks to depreciate the exchange rate by the midpoint of this estimate: 9 per cent.

Consider first the implications of this policy for the United States. As above, the Fed achieves its new higher inflation target (and the depreciation in the dollar) by pushing down interest rates. Short-term interest rates fall by 250 basis points (2.5 per cent) in the first year and inflation is permanently higher (Figure 5). As of 13 August 2019, the US Federal Funds Rate is at 2.25 per cent. The G-Cubed model therefore assumes that the US Federal Reserve is able to stimulate the economy through negative short-term interest rates. By way of context, a five per cent cut in interest rates is how much the US Federal Reserve normally reduces interest rates during an economic downturn. The consequence of this policy is that financial capital shifts out of the United States to enjoy higher interest rates overseas. As capital leaves the United States, it pushes down the exchange rate. This brings about the desired depreciation of the nominal exchange rate which falls 9 per cent (reflected in the model as a nominal appreciation in the exchange rates of US trading partners). The effect on the real effective exchange rate is more muted, falling by 3.5 per cent (Figure 6).

This depreciation in the real effective exchange rate is only temporary. The 3.5 per cent depreciation only lasts for the first year of the shock. In the second year, the real effective exchange rate is only 1 per cent below the baseline and then gradually returns to baseline over the following five years. The reason for this is straightforward. Recall that the real effective exchange rate is the nominal exchange rate multiplied by the ratio of prices in the United States and the prices prevailing overseas (weighted by how much those countries trade with the United States). Even though the nominal exchange rate is depreciating (acting to reduce the real effective exchange rate), US prices are also increasing due to permanently higher inflation (acting to increase the real effective exchange rate). Prices also adjust in the economies of US trading partners which, in many instances, further offset the nominal exchange rate depreciation. The fact that prices will eventually adjust reveals the first of three critical insights

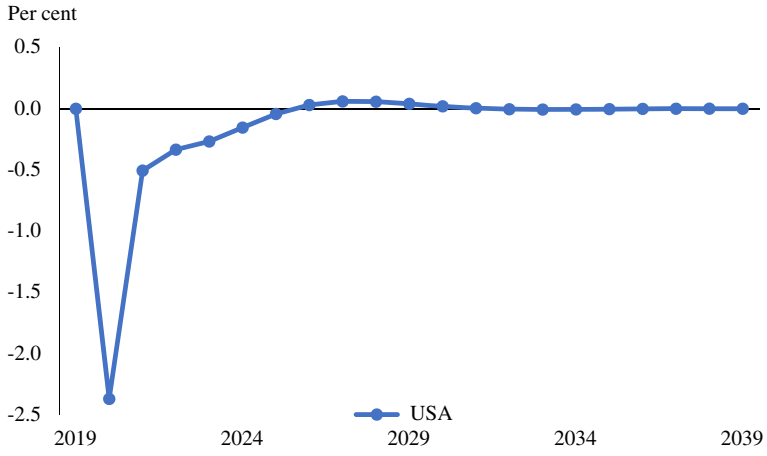

FIGURE 5 US depreciating alone: US short-term interest rates

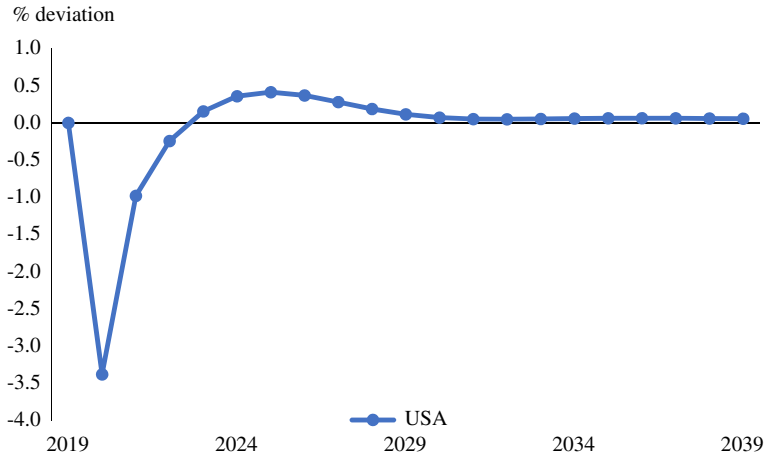

FIGURE 6 US depreciating alone: US REER

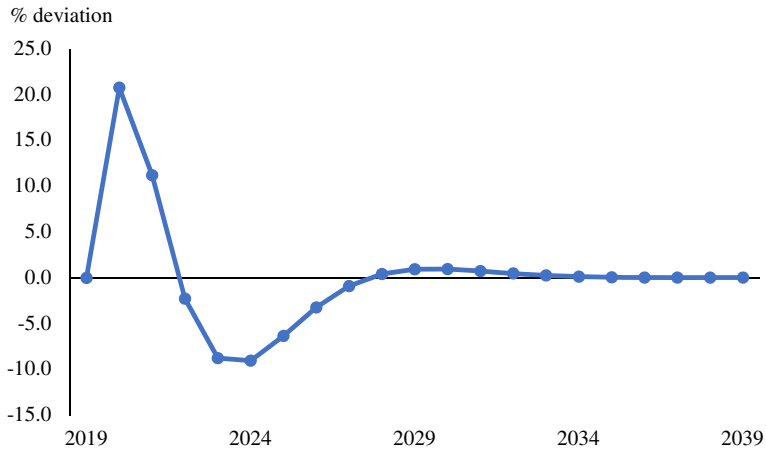

FIGURE 7 US depreciating alone: US investment

for the United States in deciding whether it should pursue this policy: that the effect of this policy in depreciating the real effective exchange rate is only temporary.

Lower interest rates also have substantial consequences for investment and consumption in the United States, but like the exchange rate, these effects are only temporary. US investment spikes by 20 per cent relative to the baseline in the first year as firms' borrowing costs fall and as they respond to higher domestic prices (brought about by the increase in inflation) and higher short-term growth (Figure 7). But the shock is temporary. While investment is still 10 per cent above the baseline in the second year after the shock, the growth in the US capital stock from the increase in investment is reversed when investment overshoots and is negative in the five years that follow as forward- and backward-looking investors respond to the adjustment in prices and interest rates. The US capital stock is only marginally larger as a result of the shock given the overshoot as the economy adjusts. Consumption similarly spikes by 3.25 per cent in the first year as lower interest rates reduce consumers' borrowing costs and reduce their incentives to save, encouraging them to bring forward consumption from the future (Figure 8). The spike in consumption is driven by backward-looking firms and households

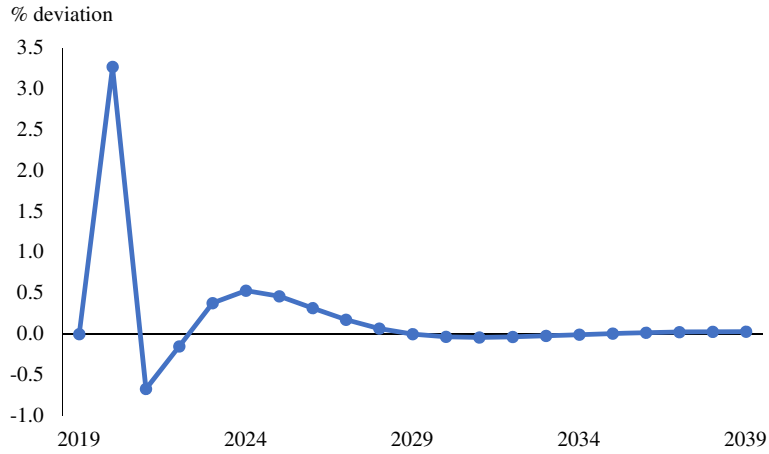

FIGURE 8 US depreciating alone: US consumption

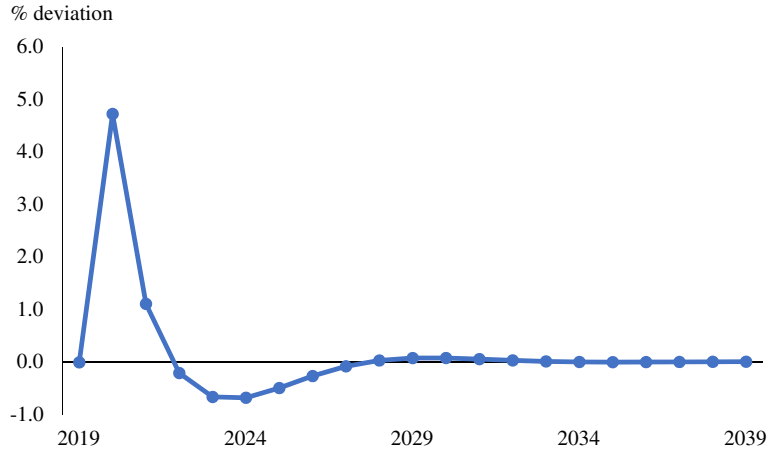

FIGURE 9 US depreciating alone: US GDP

whereas forward-looking firms and households correctly perceive the shock to be temporary. The spike in consumption quickly returns to baseline as backward-looking consumers adjust.

Given the large increases in the two biggest components of GDP—consumption and investment—US GDP unsurprisingly increases substantially in the first year, rising 4.8 per cent (Figure 9). But the story for investment, consumption and GDP is the same as the story for the real effective exchange rate: the shock is temporary. All these variables quickly return to baseline. GDP returns to baseline within 5 years, investment within 4 years and consumption in just 2 years. This reveals the second of the three critical insights for the United States: the real economic benefits of this policy are only temporary. Although it produces a large short-term sugar hit, the economy quickly adjusts to the shock and returns to baseline.

Perhaps the most interesting result is how these different variables influence the US trade balance. Many of the complaints from US policymakers about the high US dollar are in the context wanting the United States to export more goods and services to the world and the belief that a high US dollar is preventing this. But a critical finding from the G-Cubed model is that this policy results in a larger trade deficit for the United States, not a smaller one. Rather than improving the US trade balance,

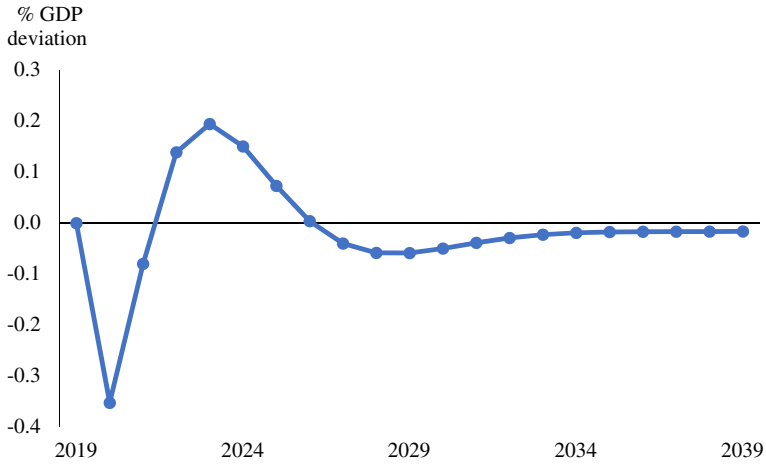

FIGURE 10 US depreciating alone: US trade balance

the model finds that the US trade balance weakens by 0.4 per cent of GDP in the first year and 0.1 per cent of GDP in the second year (Figure 10). Like investment, the impact on the trade balance is temporary—it overshoots and then settles back to baseline within 6 years with no substantial change in the long-term net external position.

This may be counterintuitive given the US real effective exchange rate depreciates in the first five years after the shock which, ordinarily, might imply an improving trade balance rather than a worsening trade balance. The reason for the worsened trade balance is that there are a variety of forces other than the real effective exchange rate which are impacting the trade balance, particularly consumption and investment. As earlier, although reducing US interest rates temporarily reduces the real effective exchange rate, it also substantially increases consumption and investment. As consumers increase their consumption, they increase their consumption of both domestic and imported goods, particularly favouring imported goods given the relative price effects through the increased price of domestically produced goods from higher inflation. Similarly for investment, some of the savings needed to finance the large increase in US investment comes from overseas which acts to moderate the capital outflows triggered by lower US interest rates. This reveals the third of the three critical insights for the United States: although the policy temporarily depreciates the real effective exchange rate, it does nothing to reduce the US trade balance. In fact, the consequences of this policy are to make the US trade deficit larger, not smaller, because of how this policy changes consumption and investment patterns. This shows that the belief that a depreciated nominal exchange rate will necessarily boost US exports is simplistic because it ignores what happens to the real effective exchange rate and the impacts of the policy mechanism that brings about that depreciation (lower interest rates) on consumption and investment.

The impacts of this policy for other countries typically follow the inverse pattern to the United States, with some notable exceptions given the differing exchange rate and monetary policy frameworks and other economic characteristics between countries. The changes in exchange rates are most substantial for the largest trading partners of the US (Figure 11). The real effective exchange rates of Canada and Mexico both appreciate by 2.75 per cent in the first year of the shock before returning to the baseline. The exchange rates of other countries appreciate by differing degrees depending on their trade and financial linkages to the United States. The exceptions are Saudi Arabia and China which both experience depreciated real effective exchange rates. This is because Saudi Arabia maintains a fixed peg against the US dollar and China maintains a managed exchange rate against a basket of international currencies, but heavily weighted towards the US dollar.

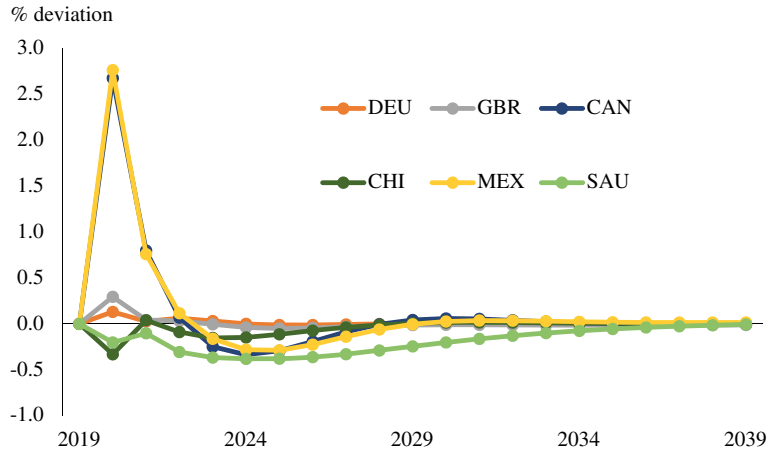

FIGURE 11 US depreciating alone: Exchange rates of other G20 economies

Recall from earlier that some G20 economies had undervalued exchange rates while some had overvalued exchange rates. For 5 of these 20 economies, a depreciated US dollar brings their exchange rates closer to their fundamentals: either increasing the value of undervalued exchange rates or reducing the value of overvalued exchange rates. But for 6 of these 20 economies, the shock makes their currency misalignments even worse. For the remaining 9 of these 20 economies, their exchange rate valuations are effectively unchanged.

These first-year results are summarised in Table 2. The first column provides the IMF's estimates of whether real effective exchange rates are overvalued (a positive number), undervalued (a negative number) or appropriately valued (equal to zero). The second column adjusts the IMF estimates for the impact of the shock: where the United States unilaterally devalues its currency. The third column shows the percentage point change: the difference between the IMF's initial estimate of the exchange rate valuation (Column (1)) and the exchange rate valuation after the unilateral devaluation from the United States (Column (2)).

The overvalued exchange rates of Australia, Brazil, Canada, France and the United Kingdom are made more overvalued by the shock, while the exchange rate of China is made more undervalued. This is the opposite of what many US policymakers say they want to see from China's exchange rate. For Argentina, Korea, Mexico, Saudi Arabia and the United States, their real effective exchange rates move closer to what their fundamentals imply their exchange rate should be. For Germany, India, Indonesia, Italy, Japan, Russia, South Africa, Turkey and the euro area, the effect is negligible, leaving the valuation of their real effective exchange rates broadly unchanged.

These exchange rate shocks, however, are temporary for all countries as prices and nominal exchange rates adjust to the shock. The US exchange rate returns to baseline within three years of the shock as with Mexico and Canada. The exchange rates of the United Kingdom and Germany return to baseline within two years. The only economies which take longer to adjust are those with more rigid exchange rate and monetary policy frameworks, most notably China and Saudi Arabia. If follows that the exchange rate shock to the rest of the world has the same characteristic as the exchange rate shock in the United States observed earlier: it is temporary.

There are similar effects on trade balances. The largest trading partners with the US—Canada, Mexico, Germany, the United Kingdom and Japan—benefit the most in the short-term, with their trade balances improving by up to 0.2 per cent of GDP (Figure 12). If the objective of a depreciated US

TABLE 2 How real effective exchange rate valuations change in the first year of the shock

	Over- or undervaluations of real effective exchange rates (IMF estimates, per cent)	Over or undervaluations of real effective exchange rates after US unilateral exchange rate devaluation (per cent)	Change (percentage points)
Argentina	−12.5	−11.9	+0.6
Australia	6	6.7	+0.7
Brazil	1.5	2.5	+1.0
Canada	7.5	10.2	+2.7
China	−1.5	−1.8	−0.3
France	2.5	2.6	+0.1
Germany	−13	−12.9	+0.1
India	0	0.4	+0.4
Indonesia	−4	−3.7	+0.3
Italy	5	5.1	+0.1
Japan	−1.5	−1.1	+0.4
Korea	−4	−3.5	+0.5
Mexico	−6	−3.2	+2.8
Russia	−7	−6.6	+0.4
Saudi Arabia	8.5	8.3	−0.2
South Africa	7	7.4	+0.4
Turkey	−15	−14.8	+0.2
UK	7.5	7.8	+0.3
United States	9	5.6	−3.4
Euro area	−3	−2.7	+0.3

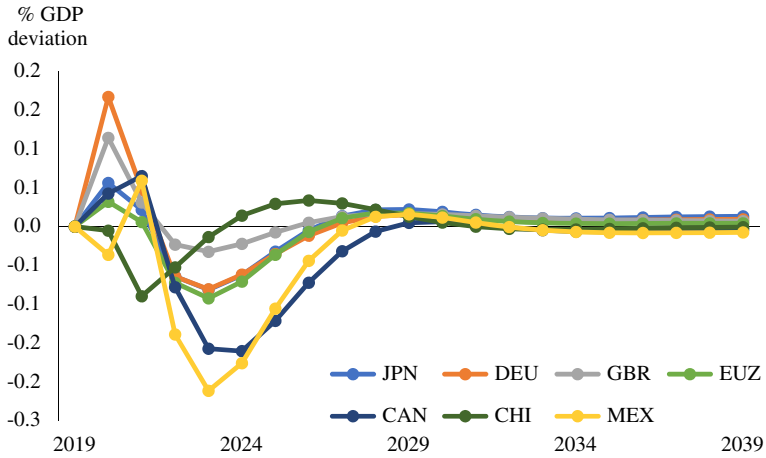

FIGURE 12 US depreciating alone: Trade balances of other G20 economies

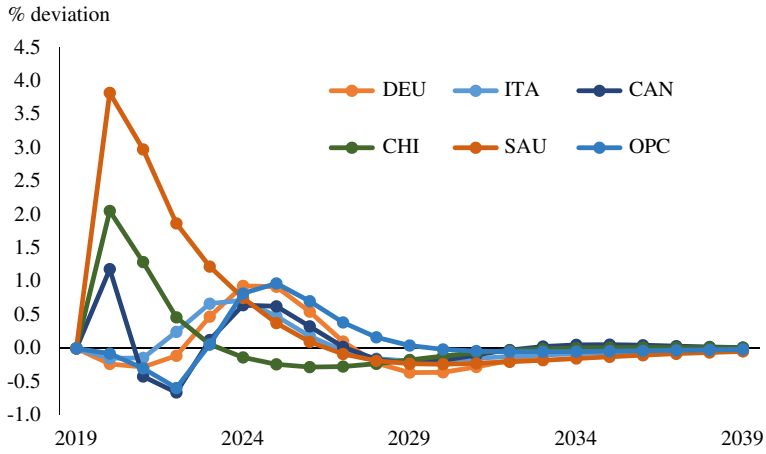

FIGURE 13 US depreciating alone: Investment in other G20 economies

real effective exchange rate was to claw back demand from other countries, these results, again, show that such as policy has the opposite effect in the short-run. The longer-run effect on these countries' trade balances is negative as prices, exchange rates and backward-looking consumers adjust, returning to baseline in less than 10 years. While the long-run cumulative effect is negative for most countries' trade balances, the short-term effect—perhaps of greater interest to policymakers—is positive.

The impacts on investment are more varied. Saudi Arabia and China see large increases in investment which, again, relates to their exchange rate frameworks. Both countries must push down their interest rates in order to maintain their exchange rates against the US dollar which, in turn, stimulates investment and consumption. But most other countries experience a fall in investment by up to 1 per cent as capital leaves their economies to finance the investment booms in the United States, China and Saudi Arabia (Figure 13).

The overall effect for the GDP of other countries is positive. For the reasons just discussed, the most substantial benefits are enjoyed by the largest US trading partners—Canada (a first-year increase

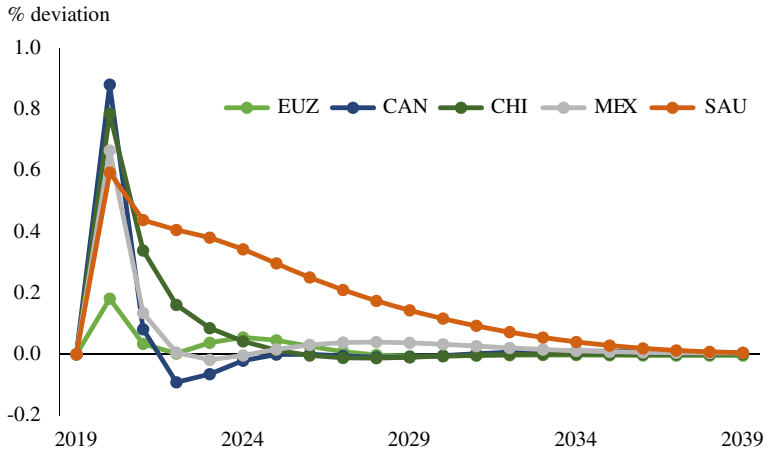

FIGURE 14 US depreciating alone: GDP of other G20 economies

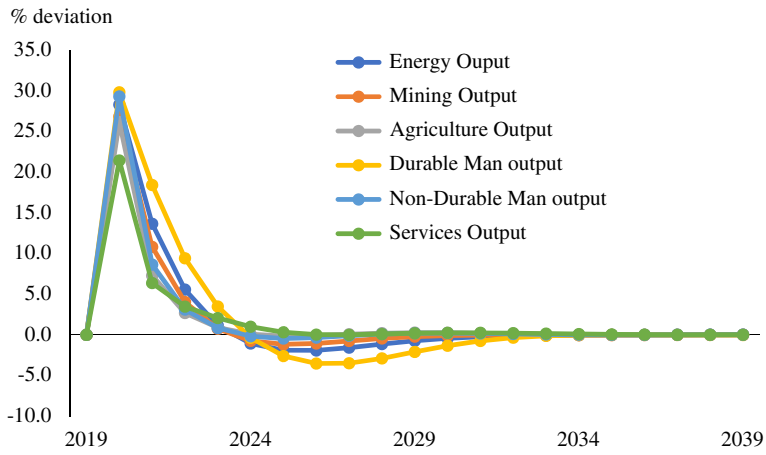

FIGURE 15 US depreciating alone: US sectoral effects

in GDP of 0.9 per cent), China (0.8 per cent) and Mexico (0.7 per cent). Like China, Saudi Arabia also benefits (0.6 per cent) due to its fixed exchange rates against the US dollar. Countries which export capital goods—such as Japan and Germany—also benefit significantly from increased exports of capital goods feeding into the investment boom (Figure 14). This is an important finding. It shows that the impact of a depreciated US dollar is not negative for other countries once the impacts of the mechanism that brings about the depreciation (i.e., lower US interest rates) are considered, particularly their impact on global trade and capital flows. It also reiterates the benefits of this policy to China, contradicting the stated aims of the Trump Administration.

But there are important sectoral effects to be considered, too. Just because the shock benefits a country does not mean those benefits are equally shared. In the United States, the impact of the shock is fairly uniform across sectors (Figure 15). But in Canada, Mexico and Australia, the shock disproportionately benefits the mining and energy sectors in the short-run because these sectors feed into the investment booms taking place in the United States and elsewhere (Figure 16). This shifts resources

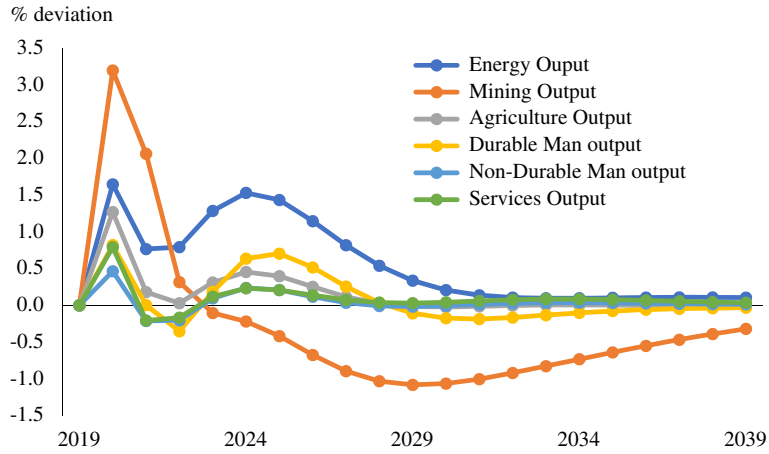

FIGURE 16 US depreciating alone: Australia sectoral effects

into those sectors through changes in relative prices, away from other sectors, such as services. The effects on labour and capital flows are significant, as changes in relative wages and prices shift labour and capital into the booming energy and mining sectors. These benefits are negated in the medium term as the investment boom contracts and demand for mining and energy resources falls. It takes 20 years for output to gradually return to baseline with a cumulative negative effect for both sectors.

3.2 | What if US trading partners retaliate?

Our above simulation shows that a number of economies see their already overvalued exchange rates made even more overvalued by this policy from the United States. These countries may, rightly, feel aggrieved. The question is what the implications would be if these economies—Australia, Brazil, Canada, Saudi Arabia and the United Kingdom[4]—were to retaliate and adopt the same policy as the United States.

First, consider what happens to real effective exchange rates. When the United States was acting alone, it was able to achieve (albeit temporarily) a depreciation in its real effective exchange rate of 3.5 per cent. But this is more difficult when other economies are undertaking the same policy. While the United States is trying to depreciate its exchange rate, we now assume plausibly that multiple other countries are now pushing it back up. The net effect for the United States is that, instead of depreciating by 3.5 per cent, it depreciates by only 2.9 per cent (Figure 17).

For the five other G20 countries who were also trying to depreciate their exchange rates (Australia, Brazil, Canada, Saudi Arabia and the United Kingdom), the results are more mixed. The United Kingdom and Australia are both able to depreciate their real effective exchange rates, by 2.6 and 1 per cent, respectively, albeit by less than they would like given that the simultaneous depreciations of the exchange rates of other G20 economies makes it more difficult. Brazil, Canada and Saudi Arabia fail to achieve a depreciation at all in the short-term—all three experience an appreciated exchange rate—it is not until three years after they shock they experience a moderate depreciation of around 0.5 per cent (Figure 18).

[4]France and Italy are not included because they share the euro which, according to the IMF, is undervalued.

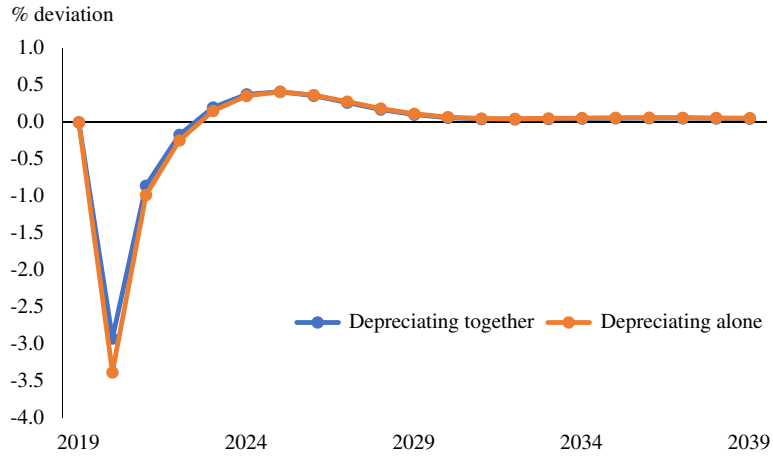

FIGURE 17 When other countries depreciate with the United States: US REER acting unilaterally compared to acting together

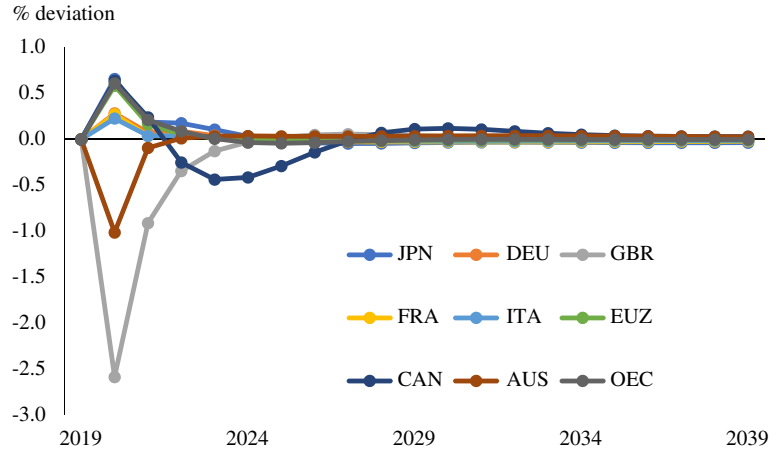

FIGURE 18 When other countries depreciate with the United States: REER of other G20 economies

Table 3 extends Table 2. It summarises the effects on the overall valuation of exchange rates for all G20 economies. It compares the IMF's original estimates for whether the real effective exchange rates of G20 economies were overvalued or undervalued (Column (1)) to what happens to that estimate when the United States depreciates its exchange rate alone (Column (2)) and what happens to that estimate when the other countries seek to depreciate their exchange rates at the same time as the United States (Column (3)). The real effective exchange rate of the United States, for example, was originally estimated to be overvalued by 9 per cent. When the United States seeks to depreciate its exchange rate with no change in the policies from other G20 economies, the US real effective exchange rate is overvalued by less: 5.6 per cent. But when other countries seek to devalue their exchange rates at the same time, the ability of the United States to devalue its exchange rate is marginally weaker so its exchange rate remains overvalued by a larger 6.2 per cent.

TABLE 3 How real effective exchange rate valuations change according to the shock

	Over- or undervaluations of real effective exchange rates (IMF estimates, per cent)	Over- or undervaluations of real effective exchange rates after US unilateral exchange rate devaluation (per cent)	Over- or undervaluations of real effective exchange rates after G20 countries respond to US unilateral exchange rate devaluation
Argentina	−12.5	−11.9	−11.7
Australia	6	6.7	5.0
Brazil	1.5	2.5	2.3
Canada	7.5	10.2	8.1
China	−1.5	−1.8	−1.7
France	2.5	2.6	2.8
Germany	−13	−12.9	−12.7
India	0	0.4	0.7
Indonesia	−4	−3.7	−3.5
Italy	5	5.1	5.2
Japan	−1.5	−1.1	−0.8
Korea	−4	−3.5	−3.3
Mexico	−6	−3.2	−3.1
Russia	−7	−6.6	−6.4
Saudi Arabia	8.5	8.3	8.6
South Africa	7	7.4	7.6
Turkey	−15	−14.8	−14.6
UK	7.5	7.8	4.9
US	9	5.6	6.2
Euro area	−3	−2.7	−2.4

Note: Devaluing economies are shaded.

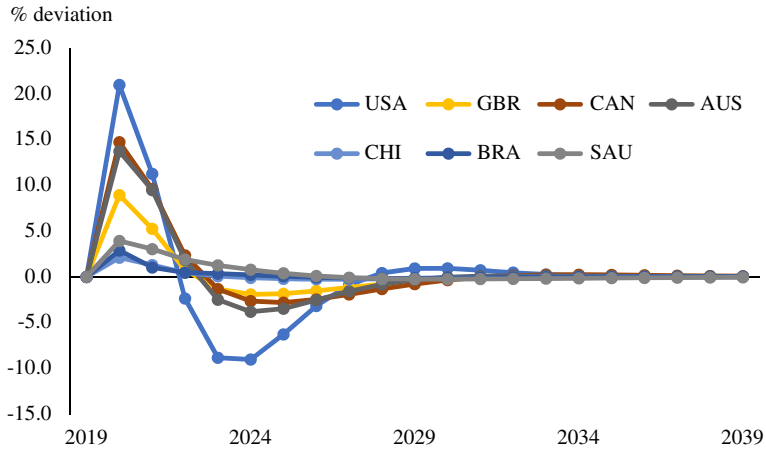

FIGURE 19 When other countries depreciate with the United States: Investment in other G20 economies

Consider the five other economies which seek to devalue their exchange rates in response to the United States. Australia, Brazil, Canada and United Kingdom all have overvalued exchange rates which are made more overvalued when the United States seeks to devalue its exchange rate. By retaliating and seeking to devalue their own exchange rates, Australia and the United Kingdom manage to fend off all of the impact of the US depreciation and more. Brazil and Canada manage to fend off at least some of the impact of the US depreciation.

The critical impact of having other countries with overvalued exchange rates implement this policy along with the United States is that it forces more adjustment onto the countries that have undervalued exchange rates which are not implementing this policy.

First, it makes their undervalued real effective exchange rates less undervalued. Argentina's exchange rate, for example, goes from being undervalued by 12.5 per cent to being undervalued by 11.7 per cent. The euro area's exchange rate goes from being undervalued by 3 per cent to be undervalued by only 2.4 per cent.

Second, it exacerbates the investment effects (Figure 19). Each of the economies seeking to depreciate their real effective exchange rate experience the same sharp increases in investment as the United States did in the previous section. But for non-depreciating economies, the negative investment effect (as capital leaves their economies to finance the investment boom in the depreciating economies) is now more severe. The only non-depreciating economy which experiences an increase in investment is China which, as earlier, is a result of its managed exchange rate regime.

The US trade balance remains negative to around the same degree as before. Australia also suffers a worsening trade balance. But the other economies—the United Kingdom, Canada and Saudi Arabia experience a slightly improved trade balance by up to 0.5 per cent of GDP (Figure 20). The overall effect on GDP for the depreciating economies is positive but temporary, as with the United States. The first-year boost in GDP ranges from 3.5 per cent for Australia and Canada (Figure 21). This reflects both how much they depreciated their exchange rates and the spillover effects from other economies. Non-depreciating economies also benefit, and more so than when only the United States was acting. China is again the largest beneficiary due to its exchange rate framework, followed by Mexico, as one of the largest US trading partners.

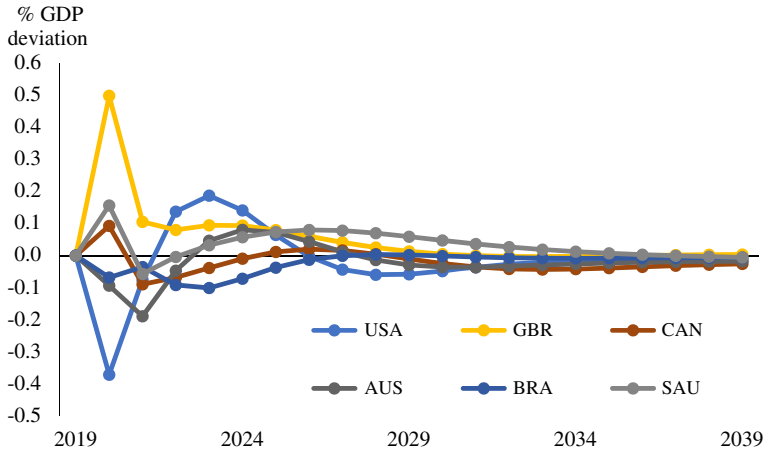

FIGURE 20 When other countries depreciate with the United States: Trade balances of other G20 economies

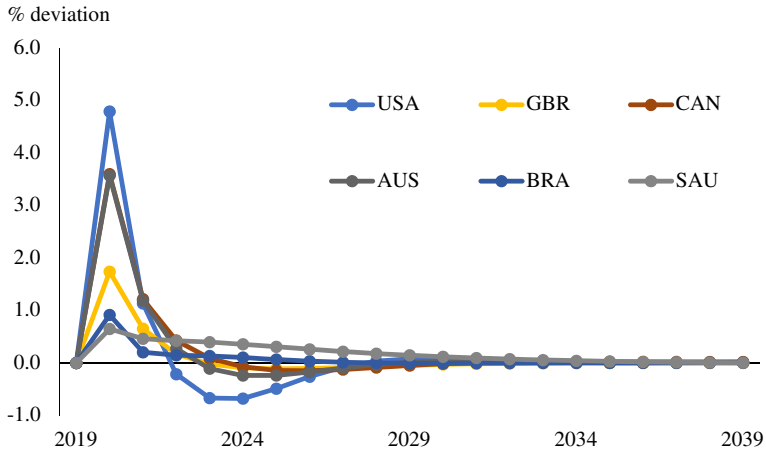

FIGURE 21 When other countries depreciate with the United States: GDP of other G20 economies

4 | CONCLUSION AND POLICY IMPLICATIONS

Many US policymakers on both sides of the aisle, including President Trump, have called on the US Federal Reserve to cut interest rates to depreciate the US dollar. This paper used an intertemporal general equilibrium model to explore what would likely happen if this policy was pursued. It explored what would happen if the US Federal Reserve aggressively cut interest rates and tolerated higher inflation in order to bring down the US real effective exchange rate which, according to analysis from the IMF, is overvalued by between 6 and 12 per cent. The paper then explored what would happen if other countries retaliated given that 11 of the G20 economies are in the same position as the United States in having overvalued exchange rates—including Australia, Brazil, Canada, France, Italy, Russia, Saudi Arabia, South Africa, Turkey and the United Kingdom—along with many more outside the G20 grouping.

The paper showed that pursuing a weaker US dollar could have a variety of unintended consequences.

First, it showed that many of the allegations that the governments of other countries are seeking to devalue their currencies for a competitive advantage are not substantiated. China, for example, historically had an exchange rate that was undervalued by between 5 and 10 per cent but has been assessed as being broadly in-line with its fundamentals over the last five years. Since 2012, most G20 countries are in the same position as the United States in having consistently overvalued exchange rates, including Australia, Brazil, Canada, France, Italy, Russia, Saudi Arabia, South Africa, Turkey and the United Kingdom. Others have consistently undervalued exchange rates—the euro area, Germany, Japan, Korea and Mexico—but there is no evidence of persistent one-sided interventions in foreign exchange markets, according to US Treasury assessments.

Second, a policy of lowering interest rates to devalue the US real effective exchange rate is only temporarily effective. Even though the policy brings about a sustained depreciation in the nominal exchange rate (acting to reduce the real effective exchange rate), it also causes US prices to rise due to permanently higher inflation (acting to increase the real effective exchange rate). As a result, the desired depreciation in the real effective exchange rate only lasts for the first year of the shock. In the second year, the real effective exchange rate is only 1 per cent below the baseline and then gradually returns to baseline over the following five years.

Third, the economic benefits of this policy are also temporary. Consumption and investment rise sharply as firms and households respond to lower interest rates and GDP improves. But the economy quickly adjusts. As a result, most of the benefits that flow from this shock have evaporated within the space of two or three years. This also assumes there is no increase in risk premia which, as investors became concerned by unpredictable exchange rate and monetary policy frameworks, would have a variety of negative consequences. Risk premia is an exogenous variable that and can enter the G-Cubed model in several ways, including for entire countries. An increase in country risk premia means that investors require an additional return if they are to hold assets in a country that they now judge to be relatively riskier. The change in country risk premia is given through the interest parity equation in the G-Cubed model where the rate of return for any country at any time is equal to the rate of return for the United States, plus any expected exchange rate changes between the two countries, plus the risk premium. Because the United States is the global numeraire, an increase in risk in the United States would be reflected in the model as a decrease in risk premia for the rest of the world.

Fourth, even though the real effective exchange rate is depreciated by this policy (albeit only temporarily), the US trade deficit is worsened, not improved. Rather than improving the US trade balance, the model finds that the US trade balance weakens by 0.4 per cent of GDP in the first year and 0.1 per cent of GDP in the second year. The reason for the worsened trade balance is that there are a variety of forces other than the real effective exchange rate which impact upon the trade balance, particularly consumption and investment. As consumers increase their consumption, they increase their consumption of both domestic and imported goods, particularly favouring imported goods given relative price effects through the increased price of domestically produced goods from higher inflation. Similarly, for investment, some of the savings needed to finance the large increase in US investment comes from overseas, which acts to moderate the capital outflows triggered by lower US interest rates. If reducing the US trade deficit is a goal of US policymakers, this paper suggests that sustained cuts to US interest rates could have the opposite effect.

Fifth, the paper shows that this policy results in China's real effective exchange rate becoming undervalued, the opposite of many US policymakers' stated objective for the Chinese currency. The paper also shows that the policy improves the trade balances of most US trading partners and boosts Chinese GDP. If the objective of a depreciated US real effective exchange rate was to claw back demand from other countries, these results, again, show that such as policy could have the opposite effect.

The paper finds that seven G20 economies see their already overvalued exchange rates made even more overvalued by this US policy. This means that, for many economies, the policy from the US worsens global currency misalignments rather than improves them. The paper therefore explores what would happen if these countries undertook the same policy as the United States.

A key insight from the simulations is that having countries retaliate makes it harder for the US to achieve its objective of a depreciated real effective exchange rate. While the United States is depreciating its nominal exchange rate against other countries, other countries now push it back up. The net effect for the United States is that it is unable to depreciate its exchange rate by the same amount. The same is true for the other economies seeking to do the same thing. Any of these countries could achieve their objective if they were acting alone, albeit temporarily. But when other countries are trying to do the same thing, the story is much more complex.

The critical impact of having other countries with overvalued exchange rates implement this policy along with the United States is that it forces more adjustment onto the countries that have undervalued exchange rates which are not implementing this policy. This means that countries like Germany have more substantial exchange rate adjustments forced upon them than when the United States is acting alone. The implications of having many countries acting at the same time causes even more turbulence for capital and trade flows, exacerbating the investment and consumption effects from when the United States acts alone.

In sum, this paper is a warning that the general equilibrium effects of a depreciated real effective exchange rate, and the mechanisms utilised to achieve that depreciation, can result in a wide variety of unintended consequences. If the objective of US policymakers is to worsen their trade deficit, only temporary devalue the US real effective exchange rate, boost the trade balances of US trading partners, support China's economy and undervalue China's real effective exchange rate, provide only a temporary sugar hit to the US economy, worsen global currency misalignments and provoke retaliation from their trading partners, then this policy will achieve those objectives. If these are not the objectives of US policymakers, then it would be wise to seek alternatives. One alternative policy would be a reversal of the substantial US fiscal stimulus which would lower the US government demand for global savings to finance rising US fiscal deficits. Dealing with the unsustainable expansion of US fiscal deficits would lead to a deprecation of the real effective exchange rate and a more sustained improvement in the US trade balance.

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DATA AVAILABILITY STATEMENT

Give the size of the model output, data will be made available upon request to the authors.

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