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Keywords

Econometric modelling, Computable general equilibrium models, productivity, monetary policy, fiscal policy, international trade and finance, globalization

JEL Classification

C5, C68, D24, E2, E5, E6, E62, F1, F2, F3, F4, F6

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1. Introduction

Many things bring displeasure to the 45th president of the United States. One of them is a high U.S. dollar. Since he began his Presidential campaign, Trump has regularly accused China, Europe, and other countries of keeping their currencies low to compete unfairly with the United States. He has been highly critical of the U.S. Federal Reserve for keeping interest rates—and thus the U.S. dollar—higher than he would like. He proposes 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 is not just rhetoric. Under the President's direction, the U.S. 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 U.S. Treasury lowered its threshold for what constitutes a competitive currency devaluation and expanded its surveillance to include any country that has a trade surplus with the U.S. of $40 billion or more. And on 5 August 2019, the U.S. Treasury labeled China a "currency manipulator" for the first time in 25 years, opening the door to sanctions and further trade restrictions.

Nor is President Trump alone. Presidential hopeful, Senator Elizabeth Warren, says the U.S. dollar should be actively managed to promote exports and domestic manufacturing. She has 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 U.S. Federal Reserve to prevent the value of the dollar from harming U.S. 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. Many countries since the global financial crisis 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. G-20 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 the trade and technology war has seen cooperation replaced with confrontation, solidarity with suspicion, and multilateralism with bilateralism.

Does President Trump have a point? The most recent analysis from the International Monetary Fund (IMF) suggests that the U.S. dollar overvaluation is between 6 and 12 percent (IMF, 2019). This calculation means that the value of the U.S. real effective exchange rate is between 6 and 12 percent higher than suggested by the fundamentals of the U.S. economy. Other economies are in the opposite position. Germany's exchange rate is assessed to be undervalued by between 8 and 18 percent, making their exports relatively cheaper than those from the United States (IMF, 2019). Efforts to devalue the U.S. dollar, while perhaps unwelcome by Germany, could be characterized 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 U.S. dollar would not be entirely negative for U.S. 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 U.S. trading partners like Germany that have undervalued exchange rates, a weaker U.S. dollar would potentially help both the United States and Germany move their exchange rates closer to their fundamental values. But for U.S. trading partners like Canada that already have overvalued exchange rates, a weaker U.S. 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 U.S. 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 U.S. Treasury's Exchange Rate Stabilization fund has less than $100 billion, with dollar holdings of just $23 billion, and is unlikely to be large enough to achieve a sustained depreciation of the U.S. dollar (Sevastopulo et al., 2019). This situation implies that cooperation between the U.S. Treasury and the U.S. Federal Reserve would be required. Economically, while U.S. 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 is to explore these issues. It starts by analyzing the implications of a policy from the U.S. administration to devalue the U.S. 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 U.S. economy, the rest of the G-20, and the rest of the world using a dynamic intertemporal general equilibrium model called the G-Cubed (G20) model. The paper then analyzes 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 G-20 economies.

The paper is structured as follows. Section 2 outlines the state of currency valuations and exchange rate frameworks across the G-20 economies. Section 3 introduces the G-Cubed (G20) model and its key features. Section 4 models the implications of each of the above currency adjustment scenarios. Section 5 concludes with a discussion of the policy implications for the United States and the rest of the G-20.

2. G-20 exchange rates: Overvalued, undervalued, or neither?

President Trump's complaints about the exchange rates of other economies have a common theme: that other countries are enjoying a competitive advantage over the United States. Is he correct?

An undervalued exchange rate makes a country's goods, services, and assets relatively cheaper than those from other countries, boosting the trade balance in the country 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, 2019). 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. Fundamental characteristics exclude the impact on the exchange rate from issues 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 G-20 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 G-20 (Figure 1 in Appendix A).

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.[4] More than half the G-20 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,[5] 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 percent but 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 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 G-20 economies are overwhelmingly market-determined and are becoming more market-determined over time, consistent with the commitments made by these countries in the G-20 forum (Figure 3). In 2018, 17 of the G-20 economies had exchange rates which were classified by the IMF as being either free-floating or floating.[6] Only three have non-floating exchange rates: Saudi Arabia (a conventional exchange rate peg), Indonesia (currently assessed as having a stabilized arrangement) and China (assessed as having a crawl-like arrangement).

The story is more complex for some G-20 economies. Four G-20 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

[4] Argentina is omitted because the IMF only began assessing Argentina in 2019.
[5] 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.
[6] The difference between floating and free-floating is primarily determined by how often a country intervenes in foreign exchange markets. See IMF (2019) for an explanation of how each category is defined.

rate). Discussed in the simulations below, this has key implications for the fundamental values of exchange rates, helping to drive, in particular, the undervalued exchange rate of Germany.

Over time, the majority of G-20 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. The 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, 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—econometric general equilibrium modeling, 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 G-20 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 G-20 economy (including the rest of the eurozone) and four regions which represent the world's non-G-20 economies. These regions are: the other economies of the OECD; the other economies of Asia; the other oil-producing economies; and a catch-all "rest of the world" (Figure 5). Each region in G-Cubed is represented by its own multi-sector econometric 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.

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	
Rest of eurozone	**Sectors (6)**
France	Energy
Germany	Mining
Indonesia	Agriculture (including fishing and hunting)
India	Durable manufacturing
Italy	Non-durable manufacturing
Japan	Services
Korea	
Mexico	**Economic Agents in each Country (3)**
Russia	A representative household
Saudi Arabia	A representative firm (in each of the 6 production sectors)
South Africa	Government
Turkey	
United Kingdom	
United States	

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:

- 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.
- Inter-temporal accounting of stocks and flows of real resources and financial assets.
- The imposition of inter-temporal budget constrains so that agents and countries cannot borrow or lend forever without undertaking the required resource transfers necessary to service outstanding liabilities.
- Short-run behavior is a weighted average of neoclassical optimizing behavior 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.
- 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. Some countries such as Saudi Arabia peg exactly to the U.S. dollar 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/U.S. dollar 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 standardized 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 stabilize 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.

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

4. Modeling a G-20 currency war

The above analysis showed that the U.S. real effective exchange rate is estimated to be overvalued by between 6 and 12 percent and ten other G-20 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 the U.S. administration 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 G-20 economies that have overvalued exchange rates.

A forced depreciation of the U.S. real effective exchange rate

Achieving a depreciated U.S. real effective exchange rate is not straightforward. As discussed earlier, the U.S. Treasury's Exchange Rate Stabilization Fund is less than $100 billion, with dollar holdings of just $23 billion. Selling dollars from this fund is unlikely to be enough to achieve a sustained reduction in the U.S. 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 under Barack Obama, adding that the massive scale of the euro/dollar market and China's ability to exert control over the renminbi would likely stymie any U.S. move (Sevastopulo et al., 2019).

Another option, assumed to be the case in the simulations below, is for the U.S. Federal Reserve to take the lead. This policy involves the Fed abiding by the wishes of President Trump, Elizabeth Warren, and those who sponsored the bipartisan bill in the U.S. Senate discussed earlier, by agreeing to maintain low interest rates while tolerating higher inflation to achieve a sustained reduction in the value of the U.S. 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. Given the U.S. dollar is assessed by the IMF to be between 6 and 12 percent overvalued, the below simulation assumes the U.S. seeks to depreciate the exchange rate by the midpoint of this estimate: 9 percent.

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

This depreciation in the real effective exchange rate is only temporary. The 3.5 percent depreciation only lasts for the first year of the shock. In the second year, the real effective exchange rate is only 1 percent 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), U.S. prices are also increasing due to permanently higher inflation (acting to increase the real effective exchange rate). Prices also adjust in the economies of U.S. 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

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 U.S. but, like the exchange rate, these effects are only temporary. U.S. investment spikes by 20 percent 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). Consumption spikes by 3.25 percent 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). Both the spike in investment and consumption are driven by backward-looking firms and households whereas forward-looking firms and households correctly perceive the shock to be temporary.

Given the large increases in the two biggest components of GDP—consumption and investment—U.S. GDP unsurprisingly increases substantially in the first year, rising 4.8 percent (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.

But perhaps the most interesting result is how these different variables influence the U.S. trade balance. Many of President Trump's complaints about the high U.S. dollar are in the context of him wanting the U.S. to export more goods and services to the world and his belief that a high U.S. 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 U.S. trade balance, the model finds that the U.S. trade balance weakens by 0.4 percent of GDP in the first year and 0.1 percent of GDP in the second year (Figure 10).

This may be counterintuitive given the U.S. 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 U.S. 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 favoring 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 U.S. investment comes from overseas which acts to moderate the capital outflows triggered by lower U.S. 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 U.S. trade balance. In fact, the consequences of this policy are to make the U.S. 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 U.S. 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 U.S. (Figure 11). The real effective exchange rates of Canada and Mexico both appreciate by 2.75 percent 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 US. 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 U.S. dollar and China maintains a managed exchange rate against a basket of international currencies, but heavily weighted towards the U.S. dollar.

Recall from earlier that some G-20 economies had undervalued exchange rates while some had overvalued exchange rates. For 5 of these 20 economies, a depreciated U.S. 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 results are summarized in Table 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 the Trump

administration says it wants 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.

Table 2. How real effective exchange rate valuations change according to the shock

	Original IMF estimate of real effective exchange rate valuations	Real effective exchange rate valuations for G20 countries, adjusted for the impact of a US unilateral exchange rate devaluation	Change
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
US	9	5.6	-3.4
Euro area	-3	-2.7	+0.3

There are similar effects on trade balances. The largest trading partners with the U.S.—Canada, Mexico, Germany, the United Kingdom and Japan—benefit the most, with their trade balances improving by up to 0.2 percent of GDP (Figure 12). If the objective of a depreciated U.S. real effective exchange rate was to claw back demand from other countries, these results, again, show that such as policy has the opposite effect.

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 U.S. dollar which, in turn, stimulates investment and consumption. But most other countries experience a fall in investment by up to 1 percent 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 U.S. trading partners—Canada (a first-year increase in GDP of 0.9 percent), China (0.8 percent) and Mexico (0.7 percent). Like China, Saudi Arabia also benefits (0.6 percent) due to its fixed exchange rates against the U.S. 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 U.S. dollar is not negative for other countries once the impacts of the mechanism that brings about the depreciation (i.e., lower U.S. 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 U.S., the impact of the shock is fairly uniform across sectors (Figure 15). But in Canada, Mexico, and Australia, the shock disproportionately benefits the energy and mining sectors because these sectors feed into the investment booms taking place in the U.S. and elsewhere (Figure 16). This shifts resources into those sectors through changes in relative prices, away from other sectors, such as services. The effects on labor and capital flows are significant, as changes in relative wages and prices shift labor and capital into the booming energy and mining sectors.

What if U.S. 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[7]—were to retaliate and adopt the same policy as the United States.

First, consider what happens to real effective exchange rates. When the U.S. was acting alone,

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

it was able to achieve (albeit temporarily) a depreciation in its real effective exchange rate of 3.5 percent. But this is more difficult when other economies are undertaking the same policy. While the U.S. is trying to deprecaite 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 percent, it depreciates by only 2.9 percent (Figure 17).

For the five other G-20 countries who were also trying to deprecaite 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 percent, respectively, albeit by less than they would like given that the simultaneous depreciations of the exchange rates of other G-20 economies makes it more difficult. Brazil, Canada, and Saudi Arabia fail to achieve a depreciation at all (Figure 18).

Table 3 extends Table 2. It summarises the effects on the overall valuation of exchange rates for all G-20 economies. It compares the IMF's original estimates for whether the real effective exchange rates of G-20 economies were overvalued or undervalued (column 1) to what happens to that estimate when the U.S. 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 U.S. (column 3). The real effective exchange rate of the U.S., for example, was originally estimated to be overvalued by 9 percent. When the U.S. seeks to depreciate its exchange rate with no change in the policies from other G-20 economies, the U.S. real effective exchange rate is overvalued by less: 5.6 percent. But when other countries seek to devalue their exchange rates at the same time, the ability of the U.S. to devalue its exchange rate is marginally weaker so its exchange rate remains overvalued by a larger 6.2 percent.

Consider the five other economies which seek to devalue their exchange rates in response to the US. Australia, Brazil, Canada, and United Kingdom all have overvalued exchange rates which are made more overvalued when the U.S. seeks to devalue its exchange rate. By retaliating and seeking to devalue their own exchange rates, Australia and Canada manage to fend-off much of this effect. Brazil and Canada, on the otherhand, fail to do so. The effects of the U.S. and other countries seeking to devalue their currencies dominates the attempts by Brazil and Canada to devalue their own currencies due to their trade and investment linkages across the G-20.

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

	Original IMF estimate of real	Real effective exchange rate	Real effective exchange rate

	effective exchange rate valuation	valuation when US depreciates alone	valuation when multiple countries depreciate
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

The critical impact of having other countries with overvalued exchange rates implement this policy along with the U.S. 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 percent to being undervalued by 11.7 percent. The euro area's exchange rate goes from being undervalued by 3 percent to be undervalued by only 2.4 percent.

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 U.S. 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 U.S. 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 percent of GDP (Figure 20). The overall effect on GDP for the depreciating economies is positive but temporary, as with the U.S. The first-year boost in GDP ranges from 3.5 percent 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 U.S. was acting. China is again the largest beneficiary due to its exchange rate framework, followed by Mexico, as one of the largest U.S. trading partners.

5. Conclusion and policy implications

"Other countries around the world doing anything possible to take advantage of the United States, knowing that our Federal Reserve doesn't have a clue!" tweeted the President of the United States. "They raised rates too soon, too often, & tightened, while others did just the opposite.... Our most difficult problem is not our competitors, it is the Federal Reserve!"

This paper explored what would happen if President Trump and others, such as Presidential hopeful Elizabeth Warren, were delivered this wish. It explored what would happen if the U.S. Federal Reserve aggressively cut interest rates and tolerated higher inflation in order to bring down the U.S. real effective exchange rate which, according to analysis from the IMF, is overvalued by between 6 and 12 percent. The paper then explored what would happen if other countries retaliated given that 11 of the G-20 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 G-20 grouping.

The analysis reveals several insights, and warnings, for the U.S. administration.

First, it shows that many of the allegations from the U.S. administration about the currencies of other economies are not substantiated. China, for example, historically had an exchange rate that was undervalued by between 5 and 10 percent but has been assessed as being broadly in-line with its fundamentals over the last five years. Since 2012, most G-20 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 U.S. Treasury assessments.

Second, a policy of lowering interest rates to devalue the U.S. 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 U.S. 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 percent 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.

Fourth, even though the real effective exchange rate is depreciated by this policy (albeit only temporarily), the U.S. trade deficit is worsened, not improved. Rather than improving the U.S. trade balance, the model finds that the U.S. trade balance weakens by 0.4 percent of GDP in the first year and 0.1 percent 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 favoring 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 U.S. investment comes from overseas which acts to moderate the capital outflows triggered by lower U.S. interest rates. If reducing the U.S. trade deficit is a goal of the Trump administration, this paper suggests that sustained cuts to U.S. interest rates will have the opposite effect.

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

policy has the opposite effect.

The paper finds that seven G-20 economies see their already overvalued exchange rates made even more overvalued by this U.S. policy. This means that, for many economies, the policy from the U.S. worsens global currency misalignments rather than improves them. The paper therefore explores what would happen if these countries undertook the same policy as the US.

Another insight from the simulations is that having countries retaliate makes it harder for the U.S. to achieve its objective of a depreciated real effective exchange rate. While the U.S. 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 U.S. 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 U.S. 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 U.S. acts alone.

In sum, this paper is a warning that the general equilibrium effects of a depreciated real effective exchange rate, and the mechanisms utilized to achieve that depreciation, can result is a wide variety of unintended consequences. If the objective of the U.S. administration is to worsen their trade deficit, only temporary devalue the U.S. real effective exchange rate, boost the trade balances of U.S. trading partners, support China's economy and undervalue China's real effective exchange rate, provide only a temporary sugar-hit to the U.S. 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 the U.S. administration, then it would be wise to seek alternatives. One alternative policy would be a reversal of the substantial U.S. fiscal stimulus which would lower the U.S. government demand for global savings to finance rising U.S. fiscal deficits. Dealing with the unsustainable expansion of U.S. fiscal deficits would lead to a deprecation of the real effective exchange rate and a more sustained improvement in the U.S. trade balance.

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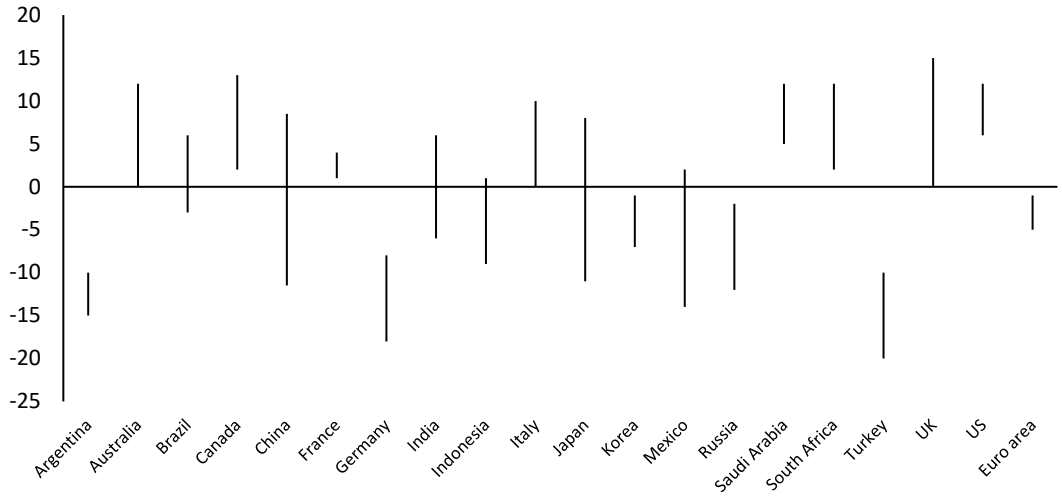
Appendix A - Figures

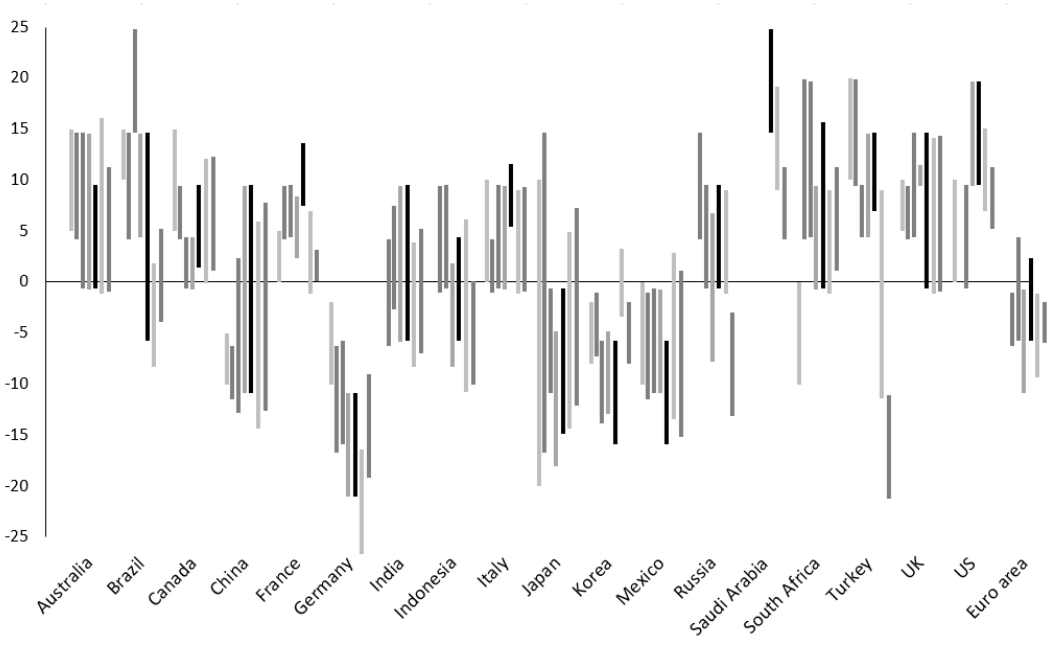
Figure 1 Exchange rates compared to IMF estimates of fundamental values, 2018



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 percent). A line below zero implies an undervalued exchange rate (e.g. the euro area's exchange rate is undervalued by between -1 and -5 percent).

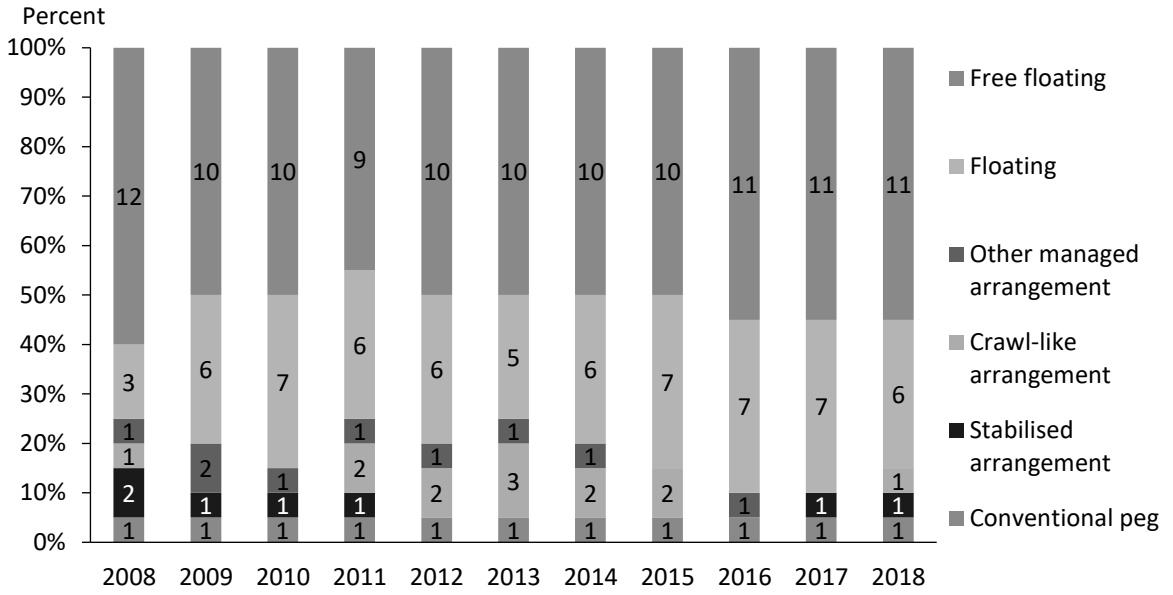
Source: IMF (2019).

Figure 2 Exchange rates compared to IMF estimates of fundamental values, 2012-2018



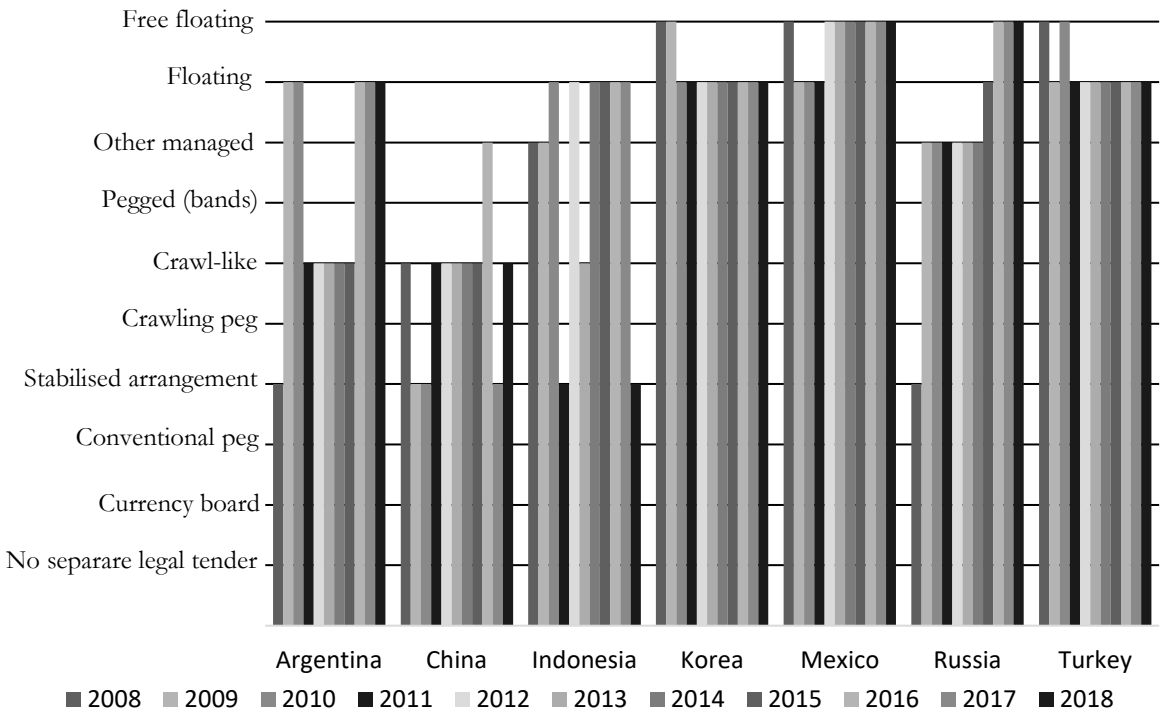
Source: Data compiled from IMF external assessment reports from 2013 to 2019.

Figure 3 G20 exchange rate frameworks



Source: Data from the IMF Annual Reports on Exchange Arrangements and Exchange Restrictions, 2009 to 2019

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

Figure 5 U.S. depreciating alone: U.S. short-term interest rates

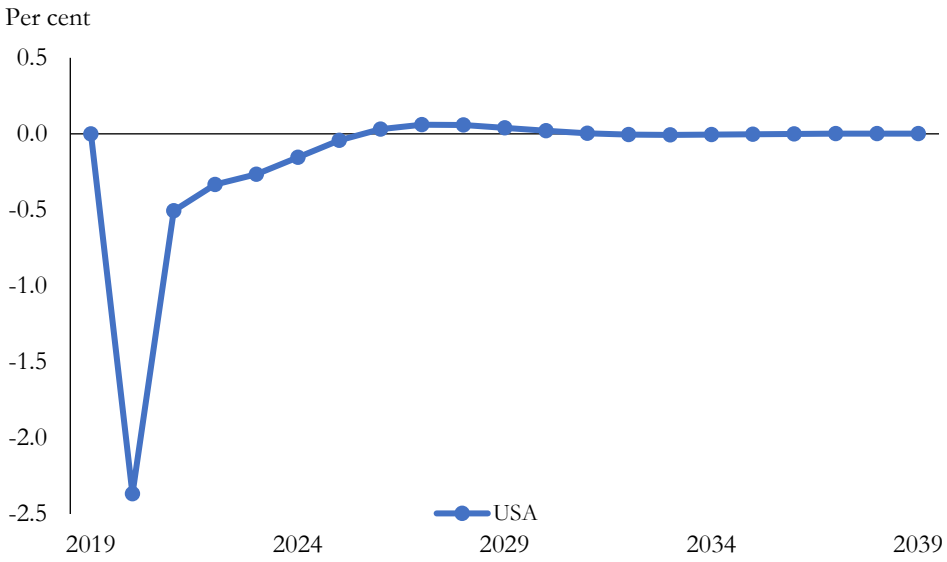


Figure 6 U.S. depreciating alone: U.S. REER

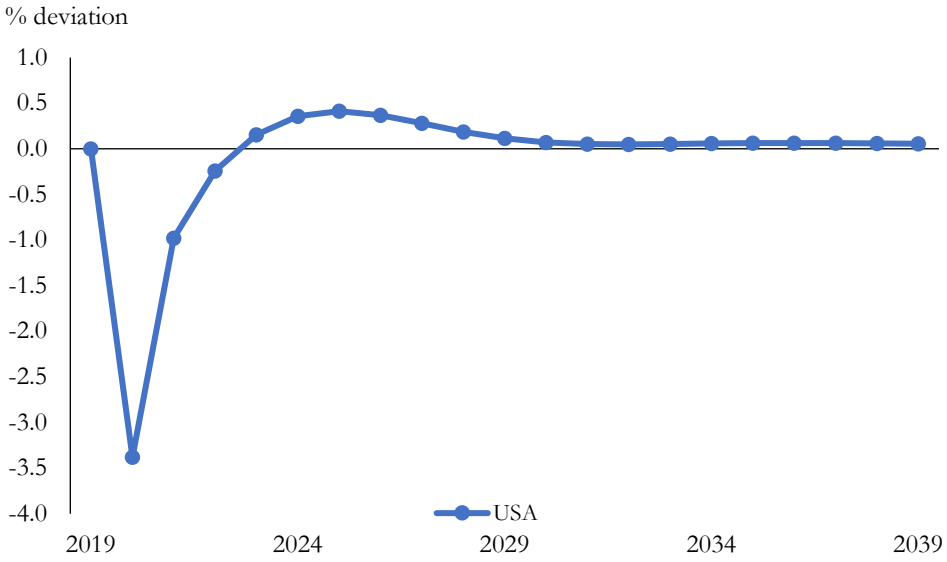


Figure 7 **U.S. depreciating alone: U.S. investment**

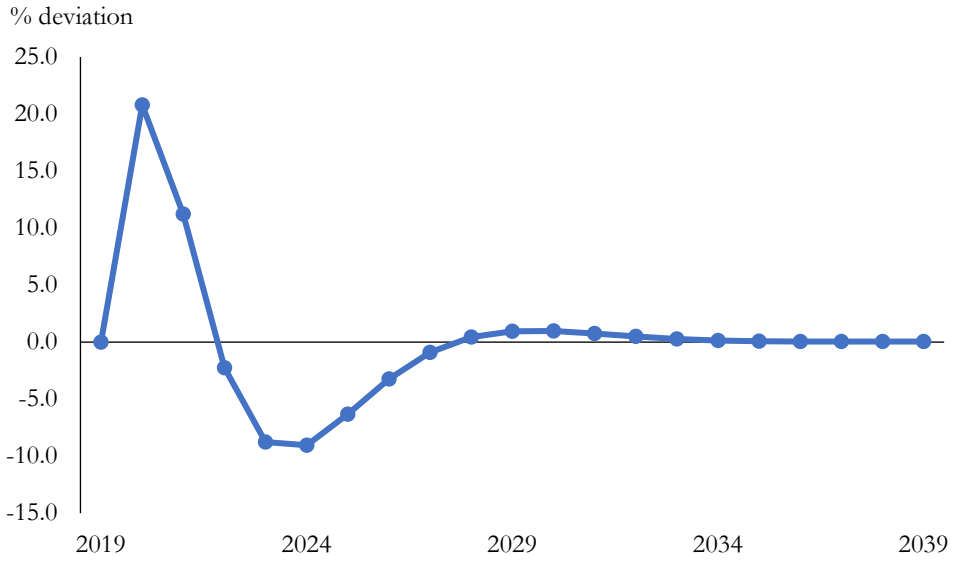


Figure 8 **U.S. depreciating alone: U.S. consumption**

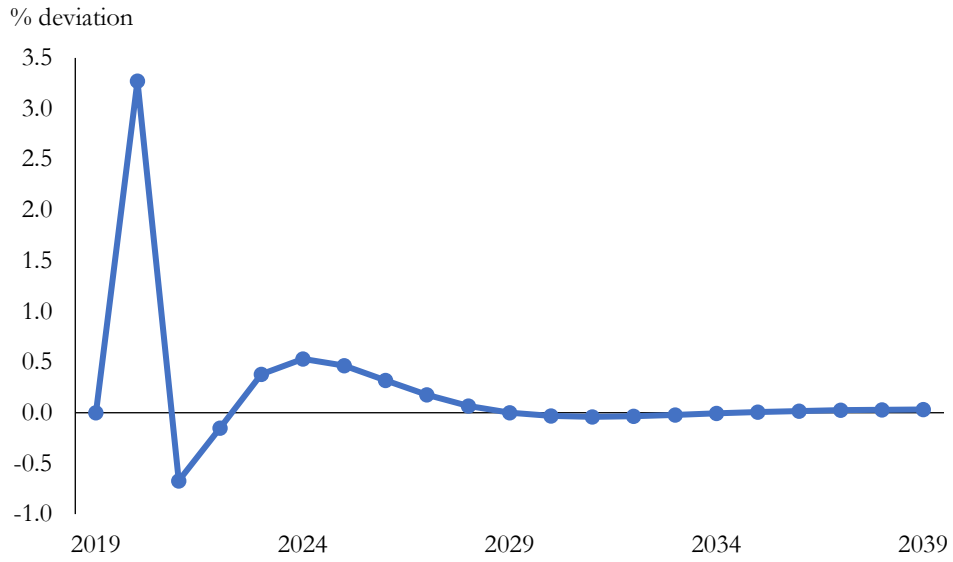


Figure 9 **U.S. depreciating alone: U.S. GDP**

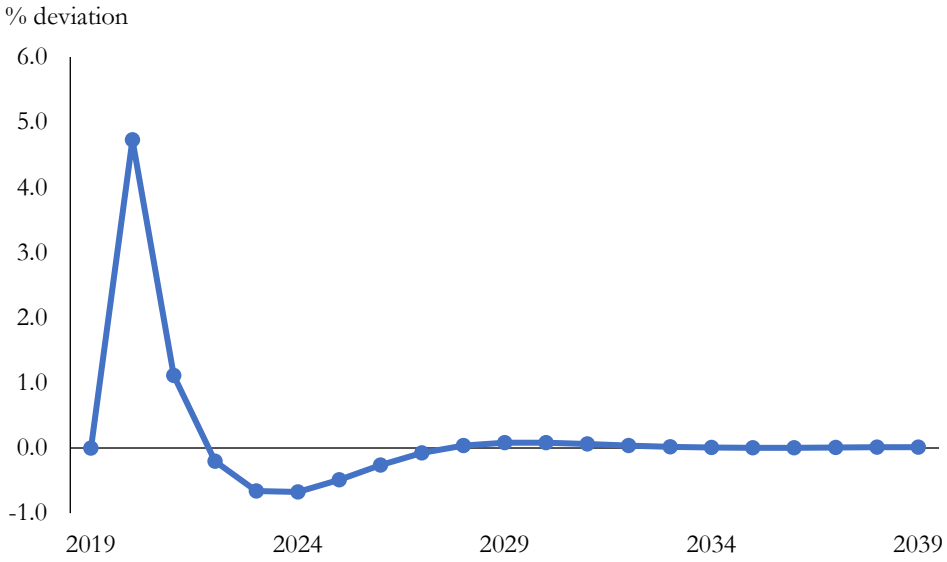


Figure 10 **U.S. depreciating alone: U.S. trade balance**

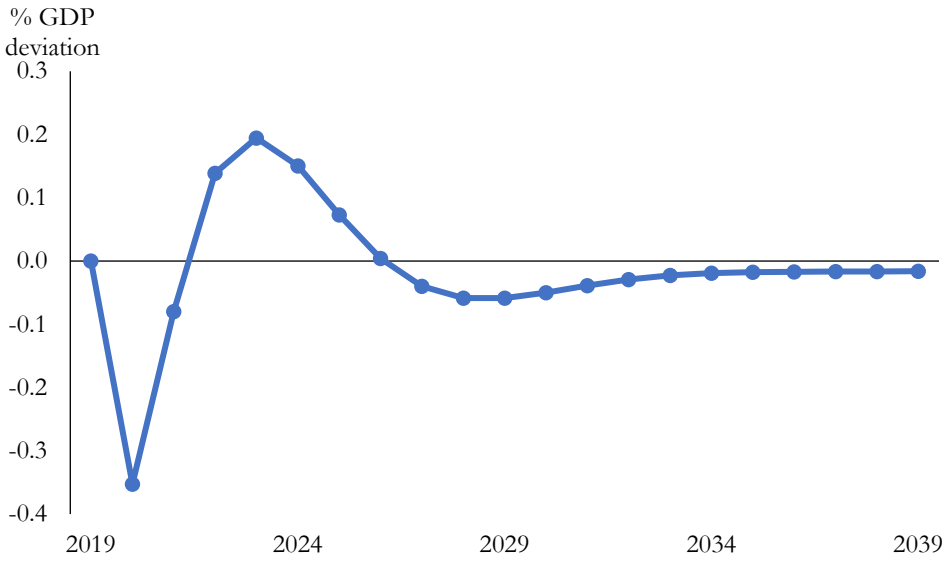


Figure 11 **U.S. depreciating alone: Exchange rates of other G20 economies**

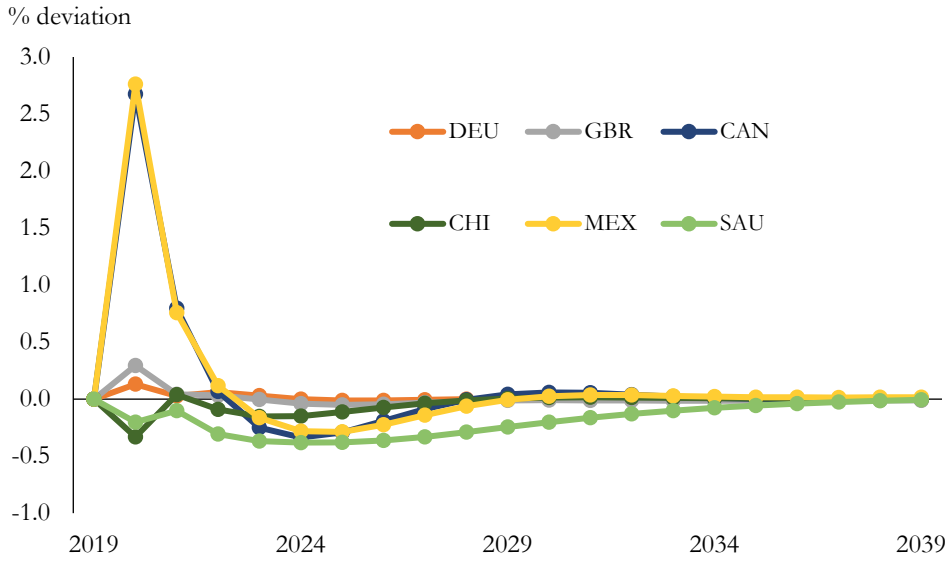


Figure 12 **U.S. depreciating alone: Trade balances of other G20 economies**

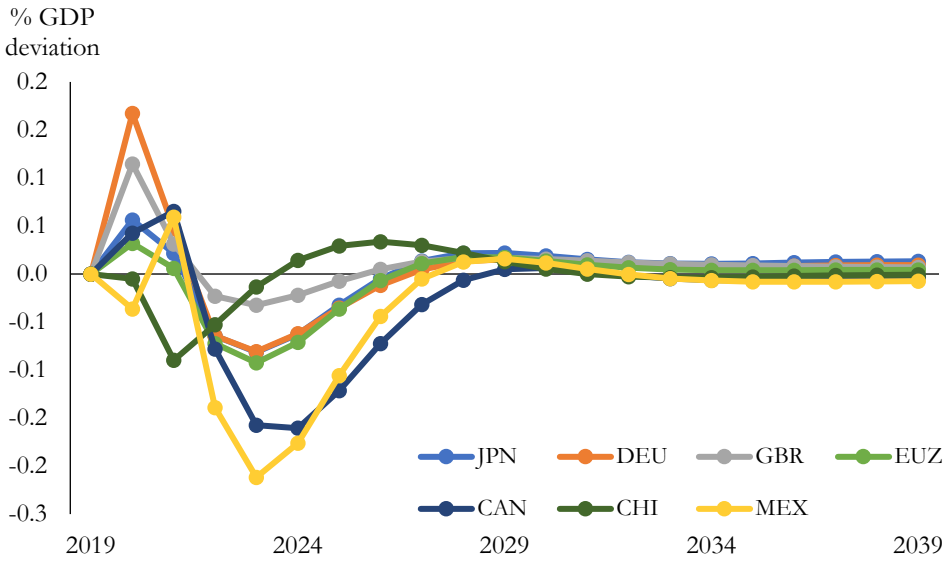


Figure 13 **U.S. depreciating alone: Investment in other G20 economies**

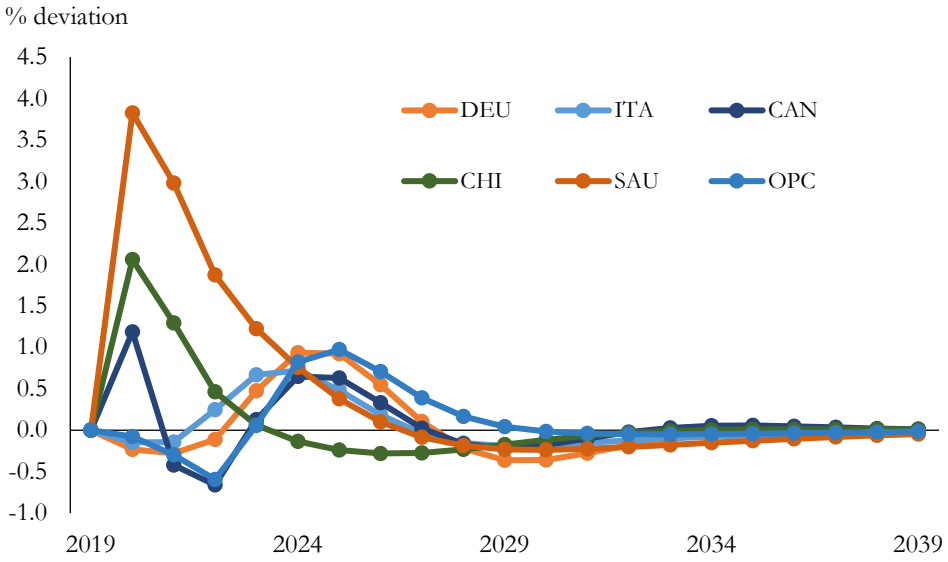


Figure 14 **U.S. depreciating alone: GDP of other G20 economies**

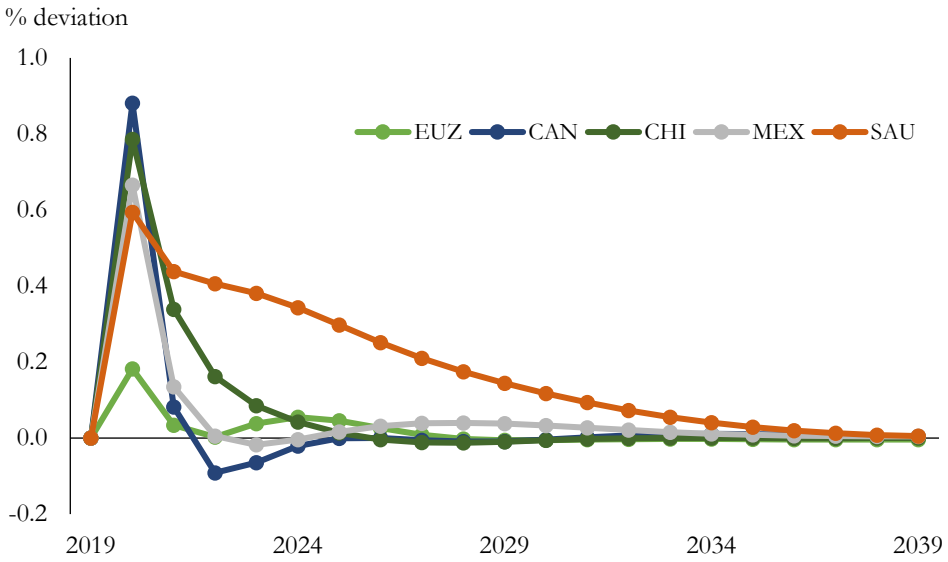


Figure 15 **U.S. depreciating alone: U.S. sectoral effects**

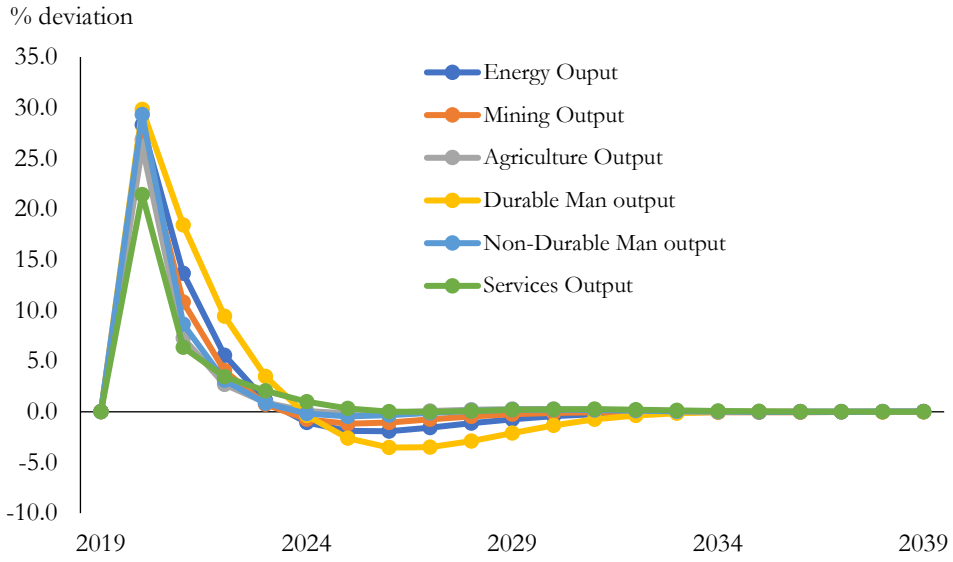


Figure 16 **U.S. depreciating alone: Australia sectoral effects**

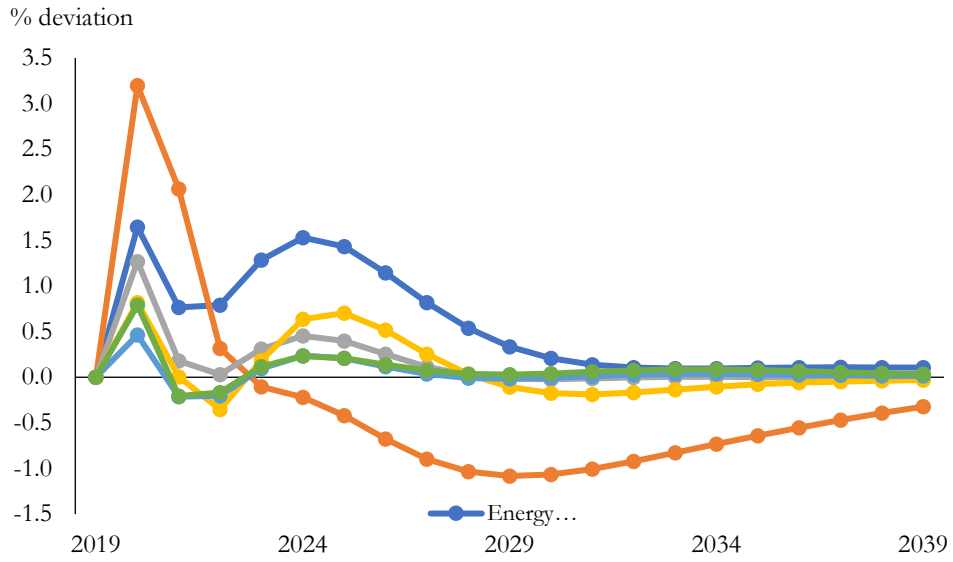


Figure 17 When other countries depreciate with the US: U.S. REER acting unilaterally compared to acting together

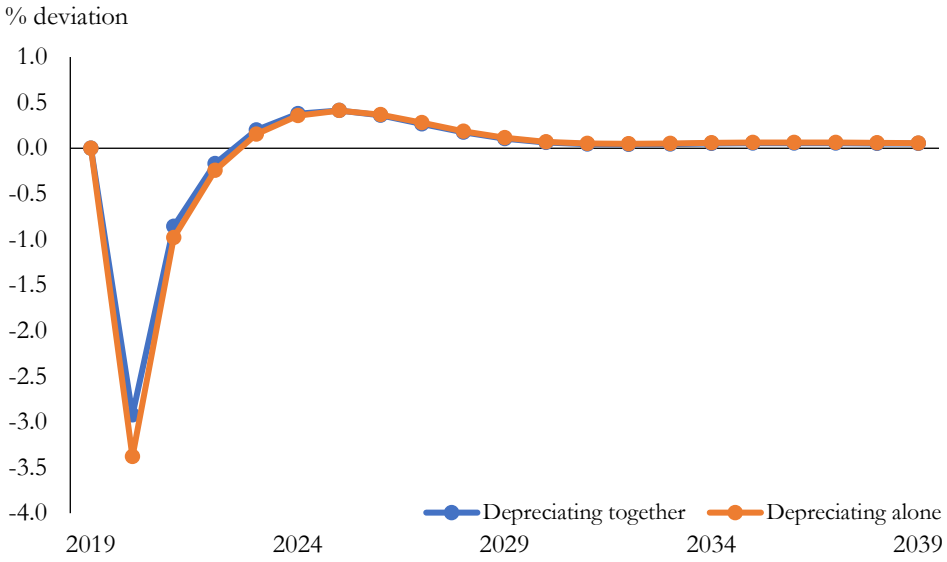


Figure 18 When other countries depreciate with the US: REER of other G20 economies

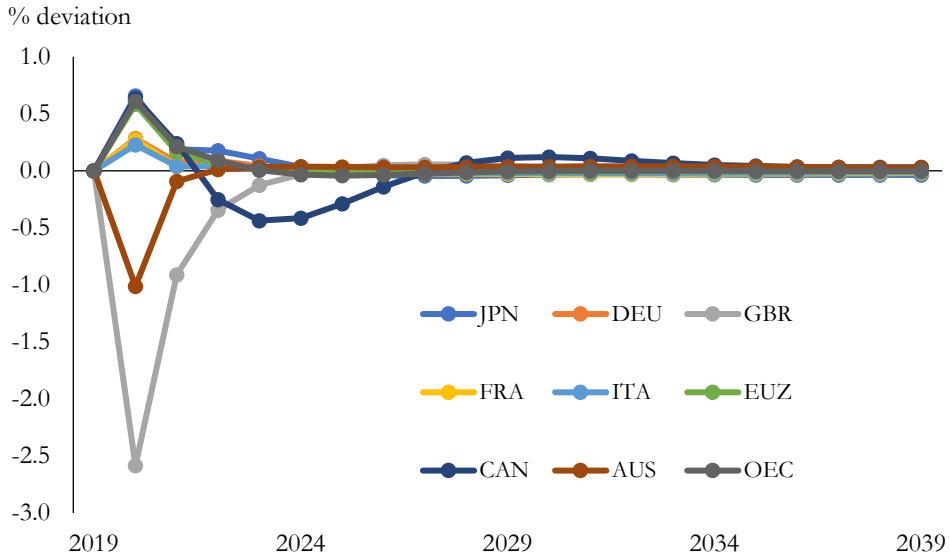


Figure 19 When other countries depreciate with the US: Investment in other G20 economies

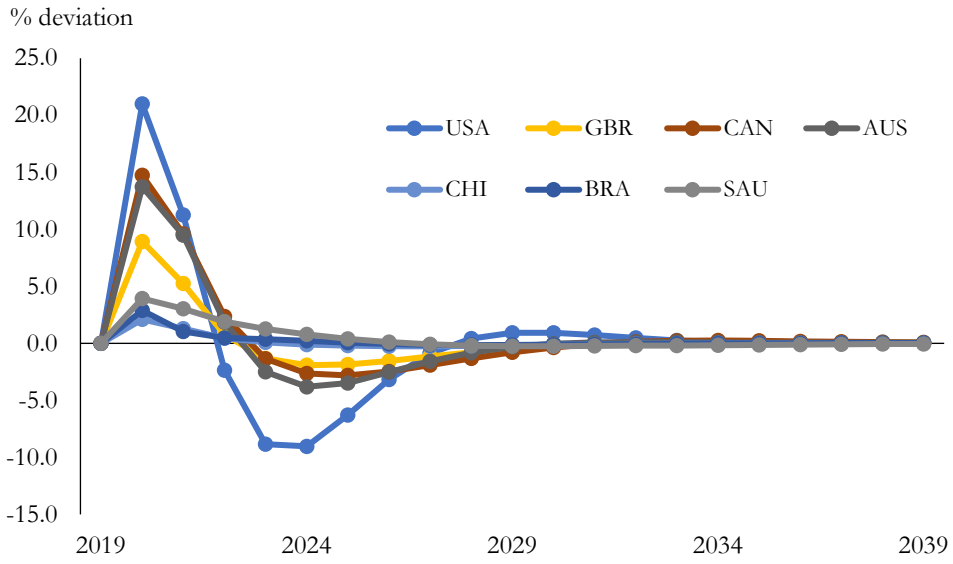


Figure 20 When other countries depreciate with the US: Trade balances of other G20 economies

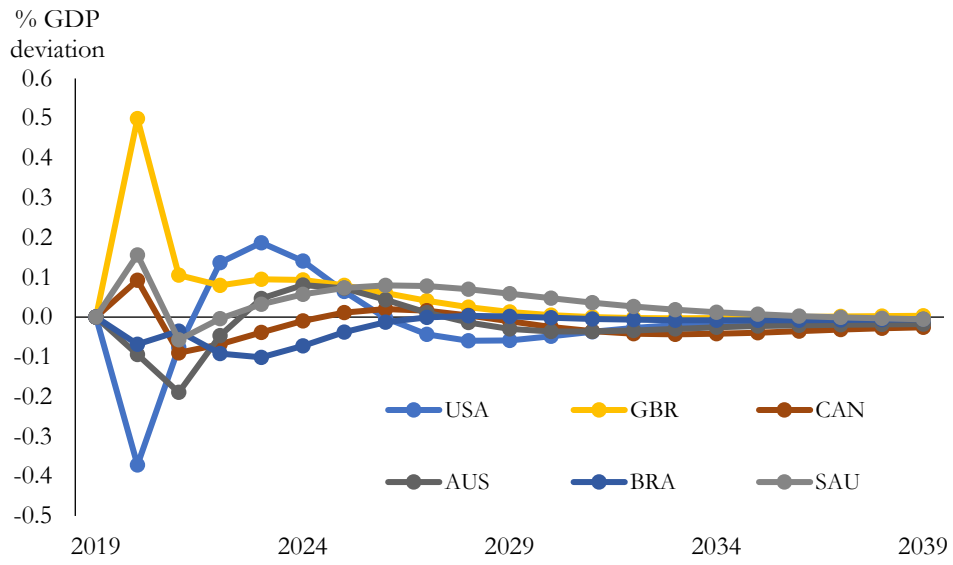


Figure 21 When other countries depreciate with the US: GDP of other G20 economies