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Exchange rate fluctuations and the financial channel in emerging economies

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Abstract

This paper assesses the financial channel of exchange rate fluctuations for emerging countries and the link to the conventional trade channel. We analyze whether the effective exchange rate affects GDP growth, the domestic credit and the global liquidity measure as the credit in foreign currencies, and how global liquidity affects GDP growth. We make use of local projections in order to look at the shocks' transmission covering 11 emerging market countries for the period 2000Q1–2016Q3. We find that foreign denominated credit plays an important macroeconomic role, operating through various transmission channels. The direction of effects depends on country characteristics and is also related to the policy stance among countries. We find that domestic appreciations increase demand regarding foreign credit, implying positive effects on investment and GDP growth. However, this is valid only in the short-run; in the medium-long run, an increase of credit denominated in foreign currency (for instance, due to appreciation) decreases GDP. The financial channel works mostly in the short run except for Brazil, Malaysia, and Mexico, where the trade channel always dominates. Possibly there is a substitution effect between domestic and foreign credit in the case of shocks in exchange rates.

Keywords: emerging markets, financial channel, exchange rates, global liquidity.
JEL codes: F31, F41, F43, G15.

Joscha Beckmann, orcid.org/0000-0002-6785-2537. Full Professor for Money and Currency, Universität Greifswald, Friedrich-Loeffler-Straße 70 (Raum: 309), 17489 Greifswald. Email: joscha.beckmann@uni-greifswald.de.

Mariarosaria Comunale, orcid.org/0000-0002-7994-5204. Corresponding author, Principal Economist, Applied Macroeconomic Research Division, Economics Department, Bank of Lithuania, Totorių g. 4, LT-01121 Vilnius (Lithuania). Email: mariarosaria.comunale@gmail.com.
Research Fellow, Faculty of Economics and Business Administration, Vilnius University, Vilnius, Lithuania.
Research Associate, Center for Applied Macroeconomic Analysis (CAMA), Australia National University, Canberra, Australia.

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1 Introduction

The effects of exchange rate changes on aggregated demand are controversially discussed among policymakers and academics. The *conventional* trade channel[1] argues that exchange rate appreciations (depreciation) results in contractionary (expansive) effects on domestic economic activity due to a loss (increase) in international competitiveness.[2] However, it is also well established that valuation effects change in the net foreign asset position of an economy. A domestic depreciation can affect the amount of foreign debt denominated in domestic currency and vice versa. Valuation effects have so far been mostly analysed from a current account perspective while less is known about the effect of valuation changes on financial conditions (Bénétrix et al., 2015). The resulting effects contradict the trade channel in the sense that an appreciation eases domestic financial conditions and strengthens the balance sheets of domestic borrowers in foreign currency.

In addition, exchange rate fluctuations and the related choice of an exchange rate regime are of particular importance, especially for emerging economies. Adopting fixed exchange rates and accumulating currency reserves can prevent exchange rate fluctuations but result in a loss of monetary policy independence unless capital controls are introduced.[3] Commodity exporters are particularly strongly affected by fluctuations in global markets. The term 'Dutch Disease' refers to a situation where increasing prices of key exported goods lead to an appreciation of the domestic currency, and the stronger currency harms international competitiveness, negatively affecting other export sectors (Bodart et al., 2012).[4] Since 2008, US dollar credit outside the United States and foreign denominated credit in general has grown substantially, in particular in emerging economies. This development is due to growth in emerging countries and an overall increase in global liquidity, as well as substitution effects due to low interest rates and exchange rate expectations (Bruno and Shin, 2015a,b; McCaughley et al., 2015).

[1] We stress here the word "conventional" because the depreciation is not always found to be expansionary due to a) increasing cost of production, e.g., due to more expensive foreign inputs; and b) higher consumption inflation with more expensive domestic goods due to a) and more expensive imported goods. One would expect that the effect of the trade channel depends on import intensity of export, share of export and import to GDP, but also on the structure of the economy (i.e., firms' size, and all the other factors relevant for exchange rate pass-through as mentioned in Kearns and Patel, 2016).

[2] See for example Comunale (2019).

[3] Emerging market countries accumulate reserves to insure themselves against a variety of risks, but this can be indeed very costly for them (see Borensztein et al., 2009).

[4] The significant increase in US dollar borrowing by oil firms in emerging countries constitutes an additional currency risk which leads to a potential gain of a fixed exchange rate regime. Many oil-exporting countries adopt fixed exchange rates to protect domestic revenues against exchange rate fluctuations. However, the recent drop in oil prices has illustrated the risk of such a strategy since governments that have not hedged oil revenues against the risk of lower oil prices underwent fiscal retrenchment without monetary policy instruments as a shock absorber. Against this background, low oil prices and the need to maintain an exchange rate regime often resemble a negative demand shock (Husain et al. 2015).

Against this background, we contribute to the literature by assessing the macroeconomic effects of credit denominated in foreign currencies for emerging markets. We consider changes in both exchange rates and the amount of foreign denominated credit and assess effects on domestic credit and GDP growth. We make use of the local projections' method by Jordà (2005), given that identification for our set of macroeconomic and financial variables is not clearly established. In a robustness check, we also provide a Bayesian Vector Auto-Regression setup (BVAR). Some proxies to control for possible spillovers and global factors (thus correcting for cross sectional dependence) are included as well. This is a further contribution to the current state of the art, which either applies (mostly homogeneous) single equations or uses homogenous panel VARs with GMM-type estimators without corrections for cross sectional dependence (CSD).[5]

Our work provides new insights on the revitalization of valuation effects due increasing connectedness of international financial markets. We also shed some light on global liquidity effects which have so far been analysed based on interest rates and money supply measures without taking into account the amount of foreign currency debt (Belke et al., 2015).

Our study relates to the work of Kearns and Patel (2016) which finds that the financial channel partly offsets the trade channel for emerging market economies.[6] They argue that this finding is due to valuation effects of foreign currency liabilities which result in a tightening of financial conditions. They apply a homogeneous single ARDL regression in their study. Here we build on their setup by also taking endogeneity and heterogeneity into account and digging deeper into the transmission between exchange rates, GDP growth and credit.

We also extend the analysis of Avdjiev et al. (2017), who find that a stronger US dollar reduces US dollar-denominated cross-border bank flows and real investment in emerging market economies. More recently, Georgiadis and Zhu (2021) analyse the financial channel in a panel setup for emerging and advanced, small, open economies.[7] They show that fear-of-floating is stronger when the foreign-currency exposures arise through debt and in the face of immediate threats to financial stability due to depreciation pressures in the presence of foreign-currency exposures. We extend these studies by analysing the effects on credit denominated in domestic and foreign currency. This allows us to provide a new perspective on the financial channel compared to the trade channel. We assess the overall effect of credit denominated in different currencies

[5] See for instance Avdjiev et al. (2017a, b) for a panel of 34 countries from 2001Q2 to 2016Q4.

[6] From a broader perspective, Bénétrix et al. (2015) show that international currency exposures resulted in substantial currency-generated valuation effects.

[7] They apply a panel data set for 26 advanced and emerging small, open economies with floating regimes for the time period from 2000 to 2017 (monthly frequency). The dependent variable is for country-month observations characterised by flexible exchange rate regimes. The approach is a single equation dynamic panel estimated with OLS and Driskoll-Kraay adjustment for cross-sectional dependence.

instead of focusing solely on valuation effects of foreign currency liabilities. Finally, the local projection exercise and the Bayesian VAR check provide sounder econometric methods with which to build our conclusions.

Our overall results show that a country-by-country analysis is the best way to assess the underlying causalities, compared to a panel approach, given the heterogeneity of the characteristics for the emerging markets in our study. The countries we analyse can all be classified as emerging markets, but they differ with regard to several important characteristics which might affect the significance and the transmission of changes in foreign denominated credit. We find that foreign credit plays an important macroeconomic role, operating through various transmission channels. The direction of effects depends on country characteristics and is also related to the policy stance among countries. Domestic credit often responds negatively to exchange rate appreciations or to increases in GDP. Dynamics of foreign denominated credit behave differently and do not simply behave pro-or anti-cyclical, instead displaying different dynamics with regard to GDP. We also find that domestic depreciations lower demand regarding foreign credit, implying a potential negative effect on investment and GDP.

The paper is structured as follows. Section 2 provides a deeper understanding of measures of foreign currency exposure, followed by the rest of the data description. Section 3 provides the empirical and econometric setups. Section 4 describes the results and Section 5 concludes.

2 Data description

2.1 Measuring foreign currency exposure

Firstly, we aim to clarify our data for foreign currency denominated credit and total domestic credit. Foreign currency exposure is relevant for governments and central banks, as well as the financial and non-financial sector. Three indicators of global liquidity are provided by the BIS: banks' international claims, banks' total claims on the private non-financial sector, and total credit by currency of denomination (BIS, 2016). The underlying data is obtained from BIS international banking and financial statistics.[8]

Our measure of debt and currency risk is based on total credit to non-bank borrowers in foreign currency. This measure is provided for credit in the US dollar, yen and euro. Hence, we are able to analyze, from the perspective of these countries, the credit positions with respect to different currencies. The credit to borrowers outside the currency-issuing jurisdiction we consider includes international debt securities (ids) and locally extended bank loans in foreign currency.

[8] The global liquidity series (credit by currency of denomination) are based on the methodology applied by BIS at the time we downloaded the data (2017).

The debt measure we adopt does not include cross-border bank loans (xbl). This is appealing since cross-border bank loans are not related to credit demand from households and firms, which is important for private consumption and investment demand. Data on domestic bank loans in foreign currency is directly obtained from the BIS locational banking statistics. The data also includes international debt securities issued by non-bank financial institutions, international debt securities issued by non-financial entities, and bank loans to the non-bank sector, including non-bank financial institutions (BIS, 2016).

To disentangle credit denominated in foreign and domestic currency, we also incorporate credit to private non-financial sectors by domestic banks. This includes credits in domestic currency and enables us to compare the paths of domestic and foreign credit, for example with regard to the response to currency fluctuations or changes in GDP. This measure excludes the central bank, the government, and the rest of the world as lenders (BIS, 2015).

2.2 Our dataset

Our dataset covers 11 emerging market countries for the period 2000Q1 to 2016Q3 with quarterly frequency. The countries are from Asia, Latin America and Africa, namely: Brazil, Chile, China, Indonesia, India, Malaysia, Mexico, Russia, South Africa, South Korea and Turkey.[9]

As an exchange rate measure, we consider the broad trade-weighted nominal exchange rates (BNER), i.e., against 60 partner countries, as provided by BIS.[10] Trade weights are based on manufacturing trade flows for exports and imports. They consider the third-country effect via a double weighting scheme (see Klau and Fung, 2006) and the transshipment effect. As an interesting check, we also apply the Debt Weighted Exchange Rate (DWER) from Berger (2016) in Kearns and Patel (2016) and available from BIS, in case of response to domestic credit and GDP growth. The DWER indices use the weights based on foreign currency-denominated total debt and the authors claim that this measure is the closest to the trade-weighted counterpart. [11]

As outlined in the previous section, the BIS global liquidity measure we adopt displays the level of foreign credit in the US dollar, euro and yen. Stock prices are adopted from JP Morgan. We also provide domestic credit series (total credit to non-financial sector) from BIS, adjusted for breaks.[12] Moreover, we have some additional macroeconomic variables, such as GDP growth, in

[9] Data availability varies across countries. For Turkey, the data starts from 2001q1; for Indonesia, data is from 2001q4; and for Russia, data is from 2004q1.

[10] A check with trade-weighted real exchange rates is available on request.

[11] The DWER data are available until 2015Q4. DWER is built as the geometric average of bilateral exchange rates against five major global funding currencies (the US dollar, euro, Japanese yen, pound sterling and Swiss franc), weighted by the shares of these global funding currencies in that country's foreign currency debt. More details are in Kearns and Patel (2016), in Box A by Berger (2016).

[12] The credit to non-financial sector series is from all sectors at market value with domestic currency as units and adjusted for breaks. The BIS data on total credit include domestic denominated but also foreign denominated credit.

the main setup. Proxies for risk and global factor/spillovers are also included such as the VIX, commodity prices and global GDP. All these data are obtained from the IMF. Lastly, we adopt the shadow interest rate from Krippner (2016) to account for the path of unconventional monetary policy after the zero-lower bound. These rates are for the same countries for which we have the foreign-denominated liquidity measures, namely: US, EA, and Japan.[13] The shadow rates and the global factors are taken as exogenous, i.e., the emerging markets under consideration cannot influence them. A few checks are also performed, including a special check for China, given the prominent role of this country in the global environment. As a further check we run our baselines with a crisis dummy, i.e., equal to 1 for 2008Q4, and the Kilian index included in the exogenous set of variables.

3 Empirical framework

The baseline setup includes as main variables: domestic credit to non-financial sector (CR2), stock prices (ST),[14] the broad nominal effective exchange rate (BNER), and GDP growth (GDPGR). We then include, one by one, the total credit to non-bank borrowers by currency of denomination: in euro (GL1), Japanese yen (GL2) or US dollar (GL3). We also add debt-weighted effective exchange rates as a robustness test; however, debt weighted exchange rates (DWER) and the global liquidity measures are correlated since the former is calculated based on the weights implicitly included in the other so that they somehow include the same information: if the relevant domestic currency value changes, the amount of debt in foreign currency changes as well. We include exogenous variables such as the global GDP, VIX (seen also as a proxy for uncertainty in the financial markets), commodity prices (to control for global real and financial cycles as well), and shadow rates from US, euro area and Japan. The Kilian index and a crisis dummy are added in robustness checks.

In order to analyze the channels from exchange rates to GDP and credit via global liquidity, we make use of a local projection exercise à la Jordà (2005). In the baseline we use 1 lag for the endogenous variables and 68% confidence intervals for responses up to 12 quarters (3 years).[15]

[13] These are described and assessed in Comunale and Striaukas (2017).

[14] Results for stock prices are not shown in the main text. This is because, given their higher volatilities and the limited reliability of the financial markets in some EMEs, it is hard to find a proper narrative to the IRFs. These are available upon request. For example, an increase in stock prices is either insignificant or has a negative effect on domestic credit. Stock prices, however, are part of the set of variables to extract the shocks to fully control for the impact of financial markets on the other shocks, nevertheless.

[15] Different sets of results with up to 4 lags and up to 20 quarters horizon are available upon request. The outcomes are very much in line with the baseline.

As pointed out in Gorodnichenko and Lee (2017), this is normally done by using Structural (Bayesian or frequentist) VARs or DSGEs to construct the responses. However, focusing on single shocks and single equation methods to compute them, as in the local projections, helps when the structural shocks cannot be identified well. As reported by Brugnolini (2018), if a Structural VAR cannot be well-specified and/or the sample size is small, the local projections can provide a valid alternative to compute the impulse responses. Moreover, the local projections allow other sources of variation to remain unspecified and impose no restrictions on the shape of the impulse responses. This is very important in our case, given the high number of variables (7) and especially their differing natures (macroeconomic vs. financial measures). As for the latter, as mentioned in Comunale and Mongelli (2019), there is no consensus on the identification of shocks when financial variables and macroeconomic variables are included in a Structural VAR. This also holds in the context of exchange rates, which are jointly determined with macroeconomic fundamentals. The "traditional literature" ranks financial variables as the most endogenous, since for instance asset prices are "fast-moving", while real variables are more "slow-moving" (see Paul (2017), among others). Thus, a financial shock is not likely to have an immediate impact on real variables. This may be different in cases of extreme shocks, such as those that caused the Great Recession, when financial constraint becomes binding immediately. Hence, economic agents adopt a wait-and-see stance rather quickly, the more so when we are dealing with quarterly data. Moreover, it would be a rather strong assumption to let a shock in real GDP having a contemporaneous impact on financial variables, since real GDP is published with a substantial lag (something like 6 weeks or so). If a GDP shock can contemporaneously cause a financial change, this could be seen as assuming perfect foresight. Hence, ideally, one would try to identify two-way instantaneous causality, but this requires non-trivial identification schemes. For the above-mentioned reasons, we do believe that using local projections rather than Bayesian VAR (BVAR) is the best solution in this case. However, we also conduct BVAR estimates as a robustness check.

In order to be able to perform a local projection exercise, we need to extract the relevant shocks. A country-by-country Autoregressive Distributed Lag (ARDL) regression is used to identify "shocks". This idea is based on Gertler and Gilchrist (2018), even if in their case, the regression was used to capture "shocks" to house prices and indicators of aggregate financial conditions. In this framework, "shocks" should be interpreted as surprise movements or "innovations" in analyzed variables.

The first step, the extraction of the shocks, comes from this equation (1):

$$\Delta Y_t = \alpha + \Delta Y_{t-1} + \beta \Delta x_{t-1} + \varepsilon_t \qquad (1)$$

where we include as the dependent variable ΔY_t (as log q-o-q difference or growth rate), each of our main variables k=1...K (CR2, ST, BNER, GDPGR, GL1, GL2, GL3) one by one, and the regressors Δx_t are the other variables. All the data are in (log) differences as q-o-q growth rates. We include only 1 lag in the ARDL setup to preserve degrees of freedom; this is also confirmed for most of the countries and variables by using the Schwarz Bayesian information (SBIC) criterion.

We extract from this setup the shocks $\varepsilon_{i,k,t}$,which are different for each country (i), and one is represented for each variable of interest (k): CR2, ST, BNER, GDPGR, GL1, GL2, GL3 and vary over time (t). The ϵ_t are the exogenous variables, which are added in the second step below in the baseline, although we do have them in the first step in some robustness checks.
The local projection exercise, i.e., the second step, is as follows for each country (i):

$$Y_t = \alpha + \beta\varepsilon_t + \gamma\epsilon_t + \zeta_t \quad (2)$$

We use as dependent variable, once again, each of our main variables k=1...K (CR2, ST, BNER, GDPGR, GL1, GL2, GL3) one by one. Now the regressors are the (positive) one-standard deviation shocks $\varepsilon_{i,k,t}$ and they are added sequentially, representing shocks coming from the other variables.

4 Results

4.1 Stylized facts and descriptive evidence

The countries we analyze can all be classified as emerging markets, but they differ with regard to several important characteristics which might affect the significance and the transmission of changes in and to foreign-denominated debt. An important dimension of these differences corresponds to the policy choices in an open economy. The Mundell's impossible trinity summarizes the tradeoffs that ensue when stable exchange rates, monetary policy independence and open capital accounts are all policy aims of an open economy. The idea is that only two of these three targets can be achieved simultaneously.[16]

We start looking at our set of emerging economies through these lenses, which will help us in reflecting on the outcomes from exchange rates transmission. We make use of Aizenman et al. (2010, 2013), which provides *de facto* measures for these three dimensions. Exchange rate

[16] It is good to recall that the theory of the trilemma has been criticized by Rey (2015), who rather claims that the global financial cycle has transformed this well-known trilemma into a "dilemma". If there is free capital mobility, the global financial cycle constrains national monetary policies regardless of the exchange-rate regime. Our exogenous variables do indeed include some series to control for global financial (and real) cycle such as the VIX, commodity prices and global GDP.

stability (EX) reflects the annual standard deviations of the monthly exchange rate (restricted by a threshold); monetary independence (MON) reflects the reciprocal of the annual correlation between the monthly interest rates of the corresponding country and the base country. EX and MON are *de facto* measures of monetary and exchange rate independence since they reflect statistical relationships and actual behaviors and actions, not official policy arrangements (which are instead *de jure* measures). Financial openness (OPEN) is based on restrictions on cross-border financial transactions, as reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). All these measures are normalized between 0 and 1 with higher numbers reflecting more monetary independence (MON), more exchange rate stability (EX) or more financial openness (OPEN) (Aizenman, 2018). We indeed assess these three measures for the countries under investigation, as shown in Appendix (Figure A1).

The exchange rate regime is important since a fixed exchange rate against an anchor currency provides incentives to issue or denominate credit in the anchor currency, given that the exchange rate risk is obsolete. The role of the regimes and of the fear-of-floating for the financial channel is also investigated in Georgiadis and Zhu (2021). Exchange rate stability has fallen in Malaysia, India, and Russia after 2000 while it is quite low for all the other economies under study, except for China, which has a rather fixed regime (mainly with respect to the US dollar) throughout the sample. [17]

The data we consider on total credit by currency of denomination captures credit to non-bank borrowers from both domestic and foreign sources. Existing capital flow restrictions would suggest that credit denominated in foreign debt is mainly issued by domestic banks. The empirical picture about such restrictions is also quite different. Most of the countries we analyze implemented substantial restrictions over the full sample period, leading to numbers below 0.3 throughout the sample. While Chile, Korea and Russia have slightly relaxed those restrictions over the sample, China, Indonesia, and Mexico have comparatively open capital accounts over the full sample. In China, however, this openness has been declining over time. Monetary policy independence increases slightly for most countries over the sample. However, this measure is also driven by correlation among global interest rates and the (implicit) coordination of monetary policy. This implies that extreme values of these measures are unlikely. Overall, this descriptive evidence opens up the possibility that different findings across countries might for example be traced back to different policy regimes, a possibility we will consider in the Results section.

As a next step, we take a closer look at the debt structure of the corresponding economies. Kearns and Patel (2016) point out that the debt-weighted exchange rate (DWER) is strongly driven

[17] In the “fixed” exchange rate regimes definition, we also include stricter intermediate regimes.

by the bilateral US dollar exchange rate for many economies, particularly in South America. This implies that debt is mostly denominated in US dollars. The debt-weighted exchange falls between the bilateral US dollar exchange rate and the trade-weighted index for other economies, pointing to a more diversified debt structure. We consider the three debt measures for all countries over time and illustrate their path over time in a logarithmic scale in Figure A2 in Appendix. The original numbers are provided in billions of euro (GL1), yen (GL2) and US dollar (GL3).

The graphs show that there are hardly any major changes regarding the relative importance of the three currencies. Foreign-denominated debt decreased around 2008 for most countries but overall, tends to increase over time. This finding points to a pro-cyclical component about GDP and stock prices in foreign debt.

An interesting outcome is that the debt structure partly resembles findings in the literature with regard to the role of the US dollar. Data for global mutual funds show, for example, a broad surge in the US dollar's share and a collapse in the euro's share of corporate and sovereign bond positions after the global financial crisis (Maggiori, 2017) and the general perception is that a shift away from the euro and towards the US dollar has occurred over the last decade (Maggiori et al., 2019). Our data on credit denominated in foreign currencies confirms that the US dollar has become more important over the sample and particularly after 2008 (Eren and Malamud, 2019), while credit denominated in yen and euro has stalled or decreased in some countries. Credit in US dollars has, for example, increased in absolute and relative terms in China, Malaysia, India, and Indonesia. Credit in euro has slightly increased for Mexico, Turkey, Chile, China, and Russia and Turkey after 2008, while remaining constant for other countries. It increased slightly in South Africa and Korea prior to 2008. Euro-denominated credit has increased in its relative importance compared to debt in yen, which decreased for Argentina, Brazil, Chile, Malaysia and South Africa and only increased in Indonesia.

Figure A3 shows the path of the three foreign-denominated debts, all converted to the US dollar, relative to GDP, showing that these increases in debt mostly have not increased the foreign debt level relative to economic activity. These graphs also highlight the dominant role of the US dollar compared to the euro and the yen in absolute terms. They also show that some of the largest debtors in absolute terms, such as China, display rather low levels of debt in relative terms. However, it has to be taken into account that our data does not include foreign debt in terms of currency reserves.

The evidence so far has illustrated that the three debt measures are correlated but often behave differently over time. We therefore include all three measures in our empirical setting.

4.2 Results from local projections

The *conventional* trade channel states that exchange rate appreciations result in a contractionary effect on domestic economic activity due to a loss in competitiveness (exports effects prevail over import effects). By definition (Kearns and Patel, 2016), the financial channel describes how exchange rate movements influence the supply and cost of foreign funding, and hence domestic economic activity. The resulting effects of this "financial channel" contradict the trade channel in the sense that an appreciation eases domestic financial conditions and should have positive impact on credit (total or foreign denominated) and ultimately GDP. Therefore, we look here at two main aspects, in the related sub-sections.

1) The first issue is whether and how the effective exchange rate affects GDP growth, domestic credit to the non-financial sector, and the global liquidity measure, that is, the credit in foreign currencies. Here we disentangle financial from trade channels.
2) The second question is whether the global liquidity measures have a significant impact on GDP growth in the corresponding economies.

We provide the impulse response functions (IRFs) for each of the 11 countries under study: Brazil, Chile, China, Indonesia, India, Malaysia, Mexico, Russia, South Africa, South Korea and Turkey. Given the rich set of results, we focus on some main patterns relating to the two issues described above.

For all countries, we assess the effects for three currencies, euro (GL1), yen (GL2) and US dollar (GL3). Several effects are significant, but the effects are widely dispersed across countries, a fact that is not surprising, given that several country characteristics affect our results.

4.2.1 How effective exchange rates affect GDP growth and credit

As for GDP growth, except for Mexico, Brazil and Malaysia, the effect of an increase in the exchange rate, i.e., appreciation, is positive and significant (Figure 1). The responses become negative only in the long run. Therefore, for most of the EMEs considered, the financial channel seems to be the dominant one in the short to medium-run, as financial flows and variables have indeed a quicker transmission to real variables. The trade channel kicks in later, after 2+ years. In the case of Brazil and Malaysia, however, we find the negative trade impact working from the beginning. This may be related to the fact that both countries experience low levels in the trilemma indices (see Figure A1 in Appendix) during most of the years considered. The more prominent role for trade is especially true for Malaysia, which has low levels of financial openness but very high trade openness (see Figure A4). Mexico is also an outlier, responding very negatively to appreciations. The trade channels seem to be key for that country, which is very open both financially and in

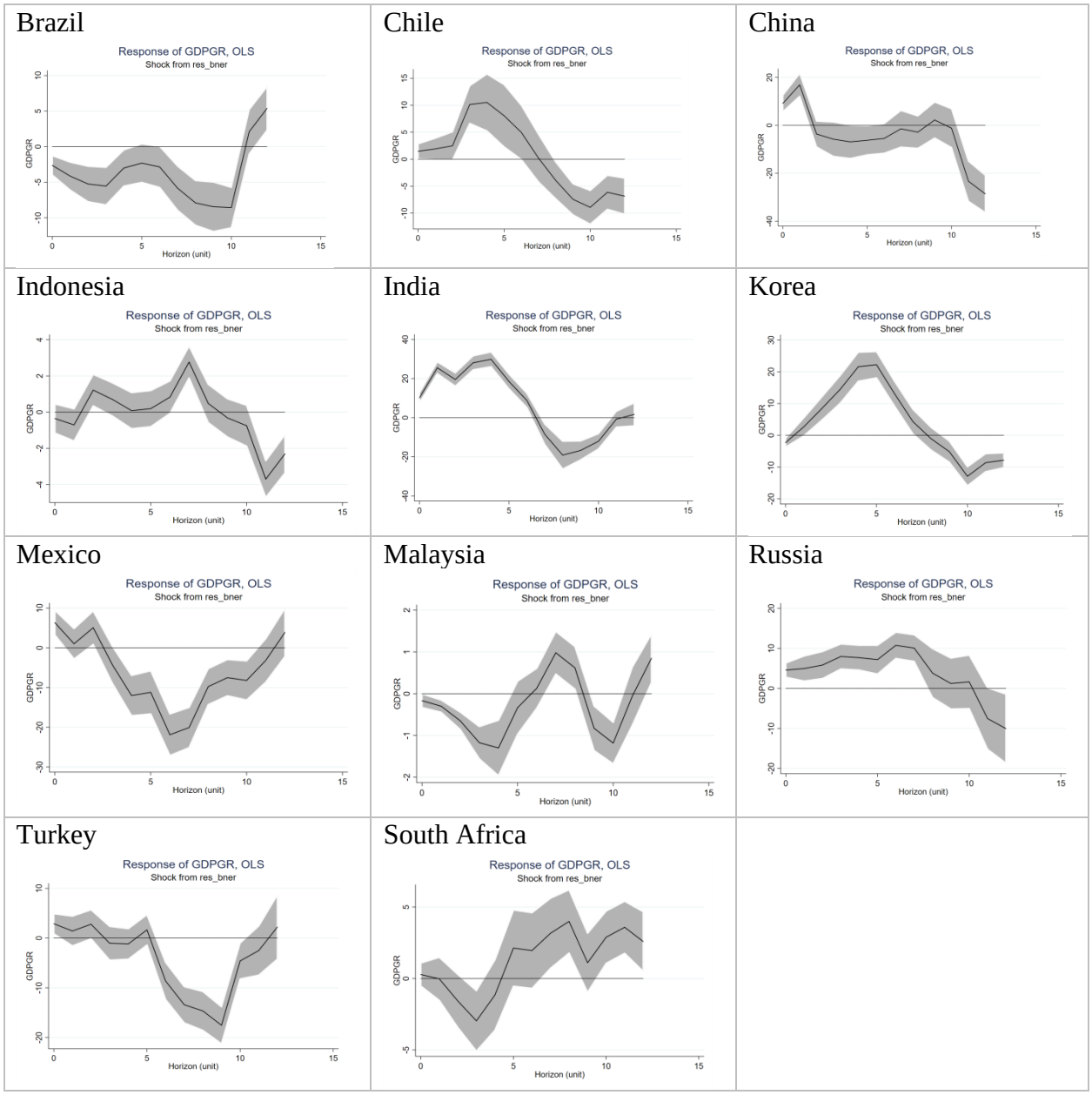
trade and is very much linked to the US via Global Value Chains (GVCs) as well. As for the latter, Mexico recovered the lost ground due to higher integration in the automotive sector and a reallocation of resources to the production of more unskilled-intensive goods, likely generated by an efficient response to competition with China (Chiquiar and Tobal, 2019). Moreover, for more than 20 years, the Mexican peso has been floating freely, based on market forces, and this can amplify the transmission of shocks. The country issues foreign-denominated credit, mostly in US dollars, but the financial channel in Mexico does not seem to be as relevant.

We stress here that we look at the *conventiona*l trade channel because depreciation is not always found to be expansionary due to a) increasing costs of production and b) higher consumption inflation, due to more expensive imported goods. The effect of the trade channel depends on the import intensity of export, and share of export and import to GDP, i.e., trade openness, but also on the structure of the economy. As was shown empirically in Lane and Stracca (2018), the contractionary effect of depreciation dominates for the euro area, at least for the exchange rate and monetary policy shocks. As for theoretical work, in de Walque et al. (2017), euro-dollar depreciation was found to initially suppress euro area output.

If this is the case in one of the countries under study, the sign of the effect alone cannot be used to distinguish between the trade and the financial channel. This is the case for EMEs as well, except for Mexico, Brazil and Malaysia.

If the depreciation (appreciation) would suppress (increase) the total demand for credit, the drop (rise) will then be distributed between domestic and foreign credit; this will amplify the "financial channel". For this reason, we also look at the responses of *total* credit to the non-financial sector (credit denominated in both domestic and foreign currency) to shocks in exchange rate. If the total credit demand falls, but the credit in currency A grows, this could better isolate the financial channel.

Figure 1 How exchange rate affects GDP growth



Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth, CR2 denotes total domestic credit and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks.

We also look at a quantitative assessment of the effects of channels, which complements the analysis of the directions of the effects. In our local projections, it is not straightforward to quantify the percentage of GDP growth due to these movements, i.e., the contribution of shocks to its variation. This is not like in a BVAR, where we can have historical decompositions based on a specific identification. As explained before, we use local projections exactly because there is no clear identification for the BVARs in this case. Also, we cannot do something like a historical decomposition in local projections because in step 2 we only have one shock and the exogenous variables. A possible solution is to have the simple coefficients for the shocks of exchange rates on GDP and then look at how much these shocks impact GDP. However, this will represent the joint trade and

financial channels in this pseudo-decomposition (or rather, pseudo factor analysis) at different horizons. We perform this exercise for horizons 1, 4, 8 and 12, based on the last data point, also reporting the magnitude of the elasticities to an exchange rate shock (Table A1 and A2 in Appendix).[18]

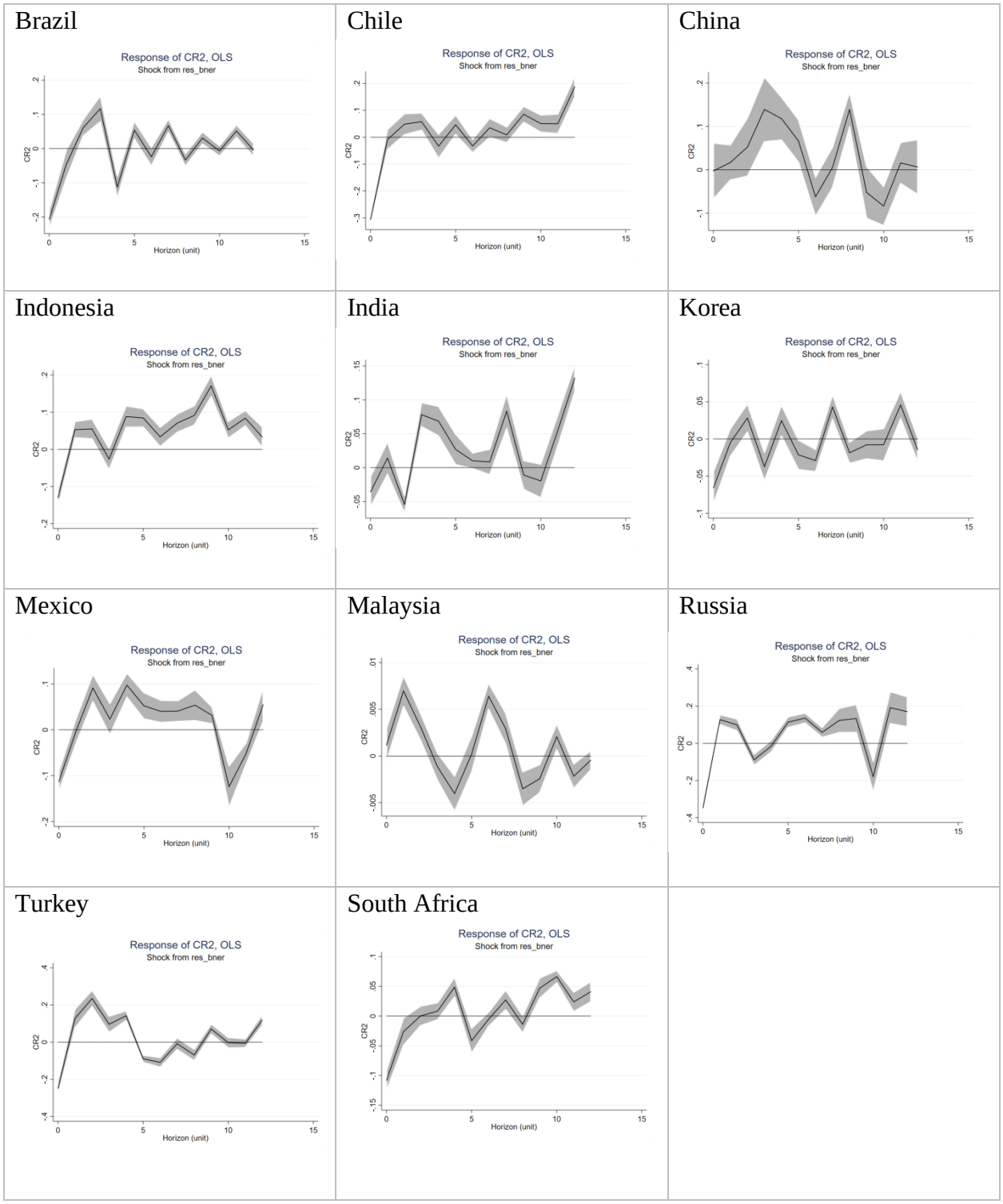
A shock in exchange rate can cause GDP growth to vary, especially in Mexico and Brazil. Financial and trade channels (simply identified by the sign) play different roles at different horizons. Looking at only 1 quarter after an exchange rate shock, which should represent the fact that financial variables transmit to real variables more rapidly than changes in trade conditions, the variation is especially substantial in Brazil (1.32pp).

We now analyze the impact of exchange rate shocks on total domestic credit to the non-financial sector (Figure 2). For all countries except Malaysia and China, we find that an increase in the effective exchange rate, that is, a nominal appreciation, reduces domestic credit at impact, an effect which could stem from a reduction of credit demand due to a drop in exports after a domestic appreciation. This suggests that a domestic depreciation increases credit, a finding which is not in line with the financial channel. The role of domestic denominated debt seems to be bigger compared to the credit only denominated in foreign currency.

The effect of exchange rate changes on foreign credit is often positive, implying that a domestic appreciation increases the foreign credit, showing that the denomination of credit influences this effect (Figure 3). For example, in China, a positive shock in BNER has a positive effect in the short-run for credit in yen or the US dollar, with the latter being the main currency of denomination for Chinese debt, and in the long-run for euro-denominated credit. For Russia, credit in foreign currencies is also very positive in the short run (especially denominated in US dollars) but turns negative at later horizons. This pattern is in line with the contractive effect of the financial channel and the underlying valuation effects since a domestic depreciation will decrease foreign-denominated credit.

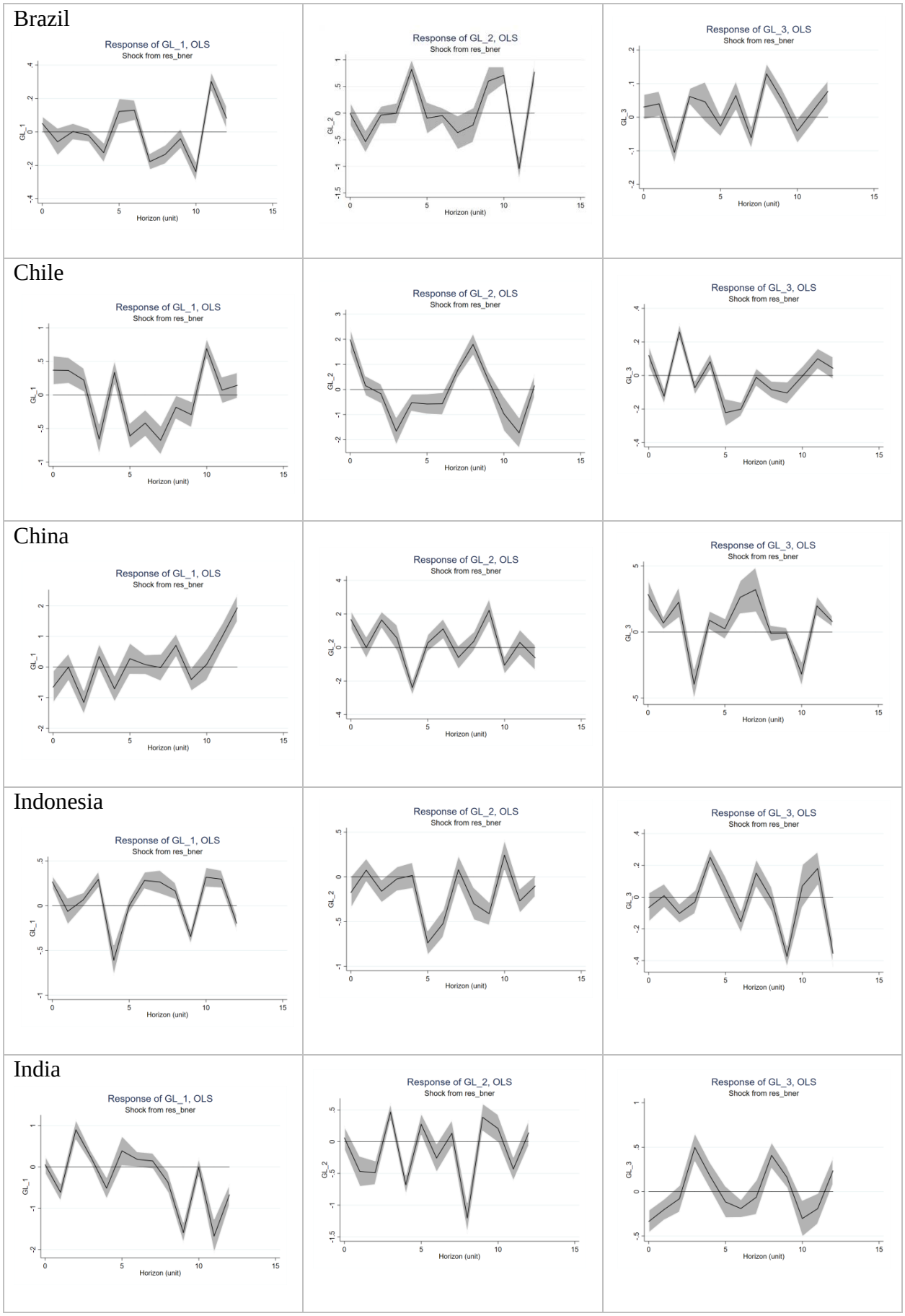
[18] The full set of contributions over time and for every horizon is available upon request.

Figure 2 How exchange rate affects domestic credit

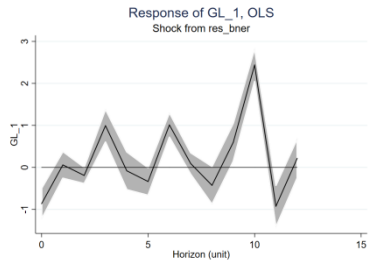


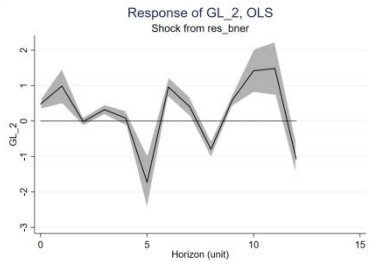
Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth, CR2 denotes total domestic credit and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks.

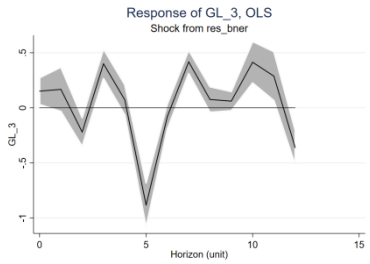
Figure 3 How exchange rate affects credit denominated in euro/yen/US dollar



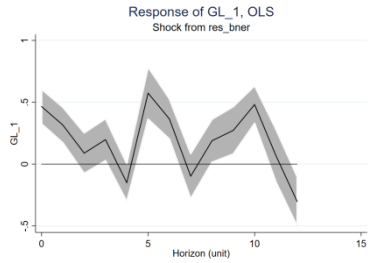
Korea

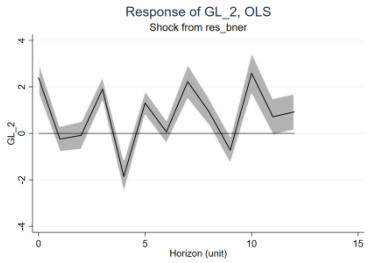


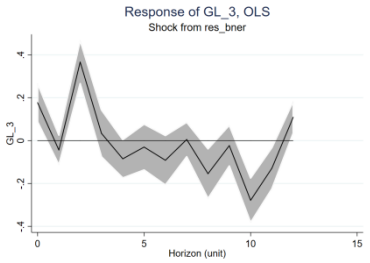




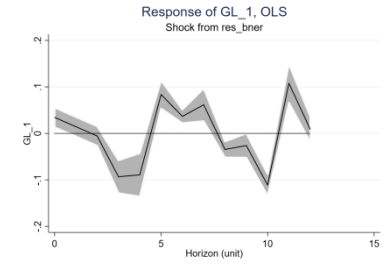
Mexico

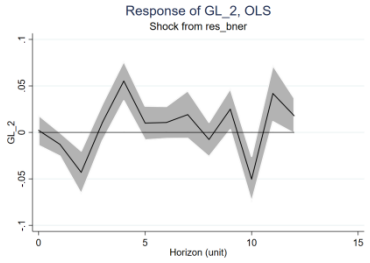


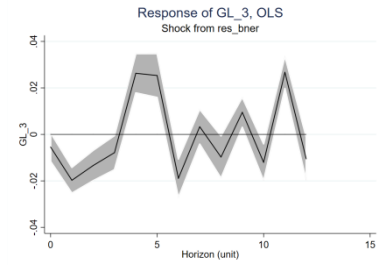




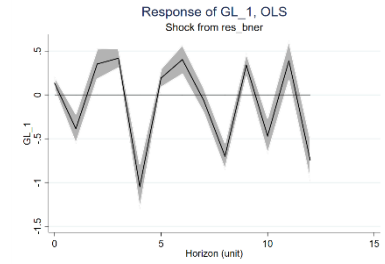
Malaysia

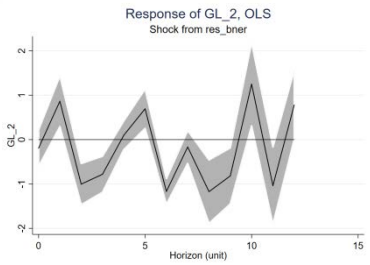


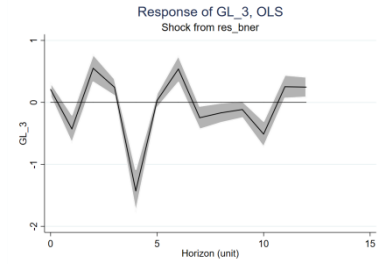




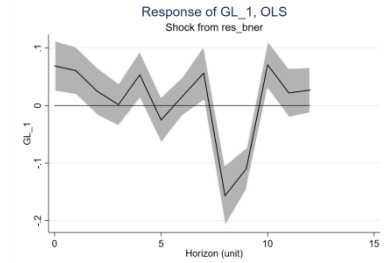
Russia

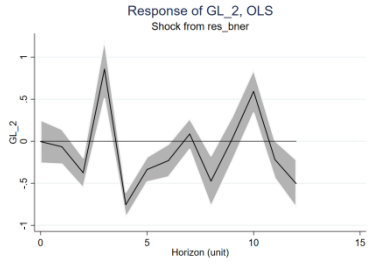


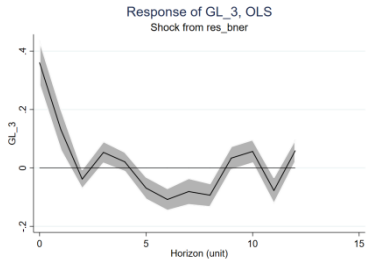


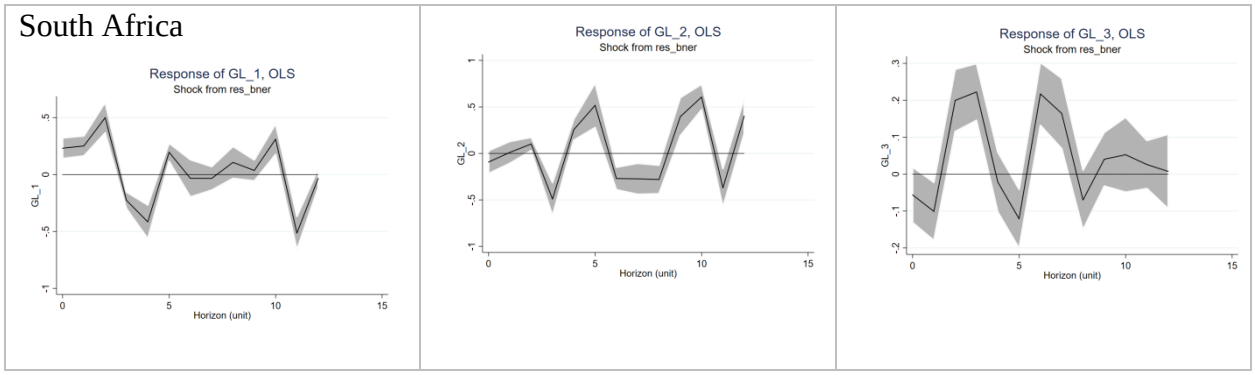


Turkey









Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth, CR2 denotes total domestic credit and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks.

This could reflect either the fact that currency fluctuations will affect the quality of credit to domestic firms and households, or that demand for foreign-denominated credit falls since the corresponding value in domestic currency increases. The latter effect depends, of course, on the expected exchange rate over the maturity of the loan.

Another interesting question is whether we see (mostly) a substitution between credit responses in different currencies (this would be solely the financial channel), as the three measures react in different directions, or a change in total demand for credit (this is the trade channel, whether it is contractionary or expansionary, plus the financial channel) with all foreign-denominated credit moving synchronously. It is very hard to find any substitution effect across currencies; however, we can see some different paths in the cases of Turkey and South Africa for the US dollar-denominated credit.

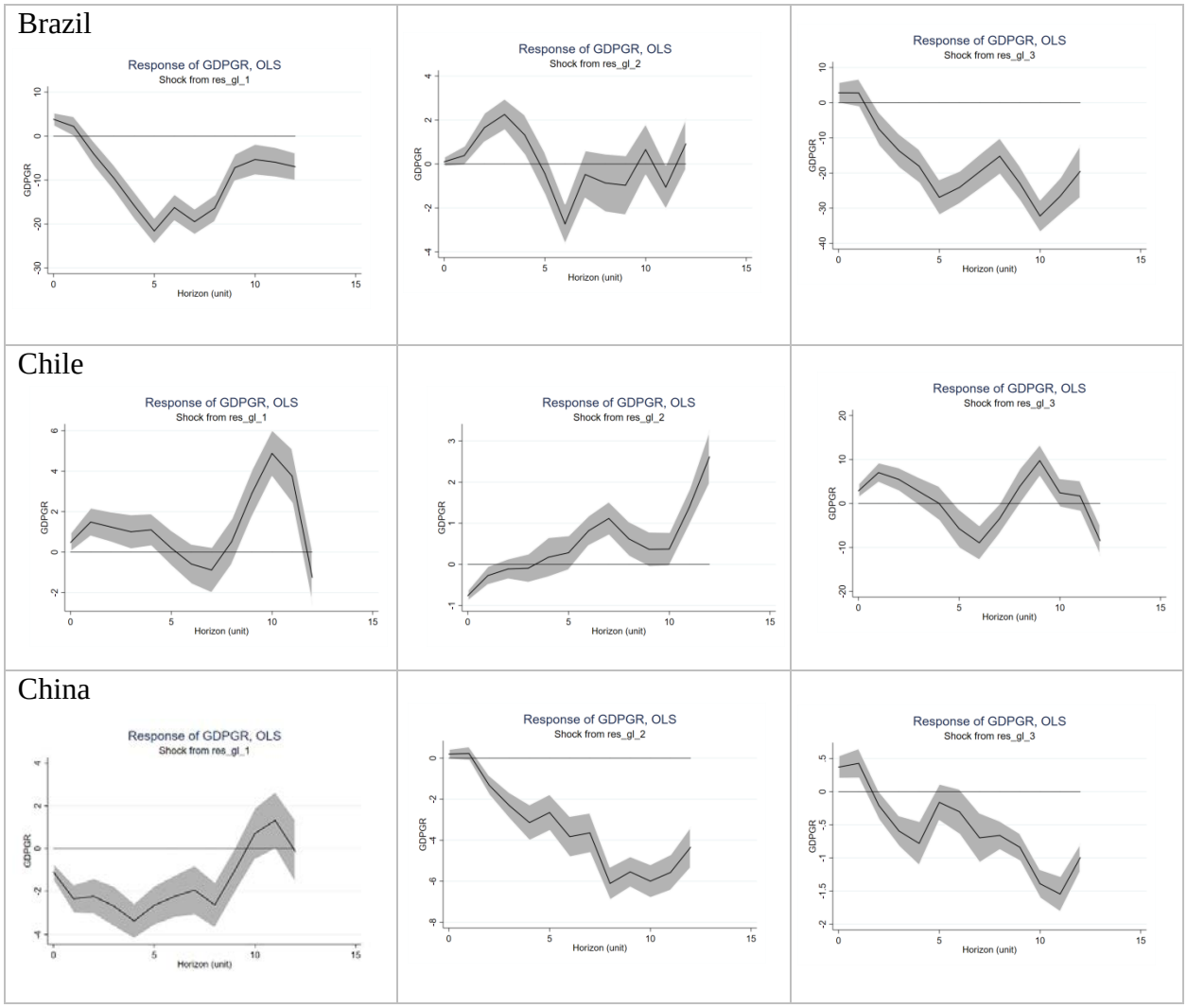
4.2.2 How global liquidity impacts GDP growth

Now we look at the second question: whether global liquidity measures have a significant impact on GDP growth (Figure 4). Findings are rather uniform across countries: an increase in foreign-denominated debt increases domestic GDP in the EMEs but mostly at impact or in the short-run. The exception is Chile, which experiences a positive effect in both the short and long run. Chile is a success story in terms of flexible exchange rate regimes in EMEs. The credibility of its floating regime has significantly lowered the currency mismatch of assets and liabilities (Claro and Soto, 2013) and, as we see here, this helped the financial channel to fully express its positive effects on GDP growth. Chile is also one of the few countries in which the amount of credit issued in US dollars (as a ratio to GDP, Figure A3) decreased over time. The other one is Russia. However, for Chile, it started to increase slightly since 2014.

In the other countries, the positive effect of foreign-denominated debt is only seen in the very short run (China) or after more than one year (Russia, Malaysia). Therefore, in the medium-long run, an increase of credit denominated in foreign currency (for instance due to a currency

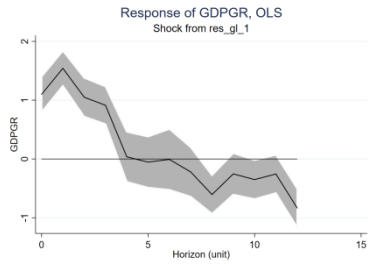
appreciation) decreases GDP and the financial channel works in line with trade channel. Interesting cases are represented by Korea and Turkey, which experience a persistent negative effect on GDP growth following a shock in foreign currency denominated credit, regardless of the currency. Given the exchange rate regimes of both Turkey and Korea, which are floating *de jure* (see Figure A2 in Appendix), large swings in exchange rate are not beneficial to GDP via the financial channel. Generally, the responses go in the same direction regardless of the currency. The only exceptions are South Africa and China. For the former, the total credit in foreign currencies is also driven by the credit denominated in yen and credit in other currencies goes in the opposite direction.[19] As for China, the euro-denominated credit is the one which gives a more persistent positive reaction of GDP growth. The credit denominated in US dollar or yen instead has a negative effect on GDP in the medium run. These two global liquidity series drive the responses of the total foreign-denominated credit.

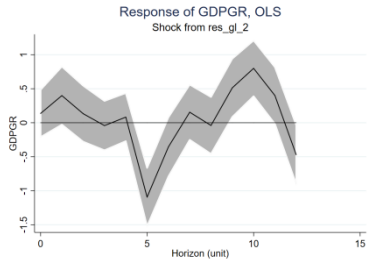
Figure 4 How credit denominated in euro/yen/US dollar impacted GDP growth

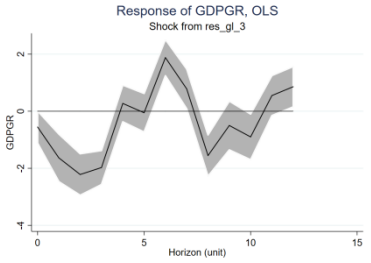


[19] This set of responses is available upon request.

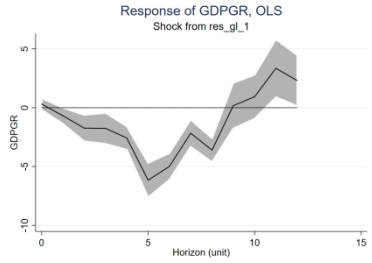
Indonesia

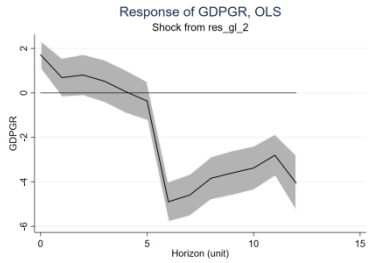


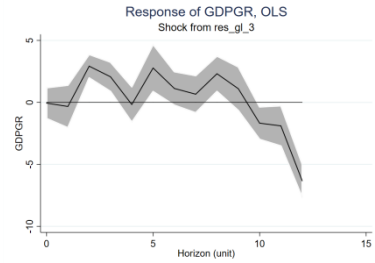




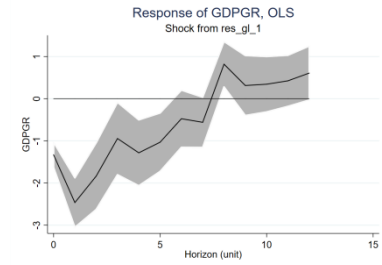
India

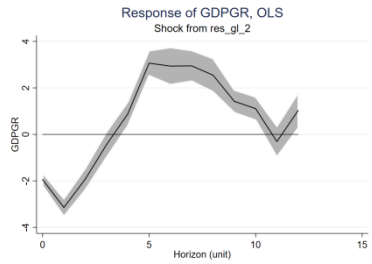


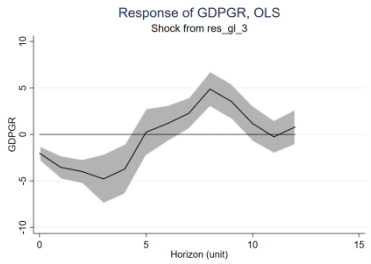




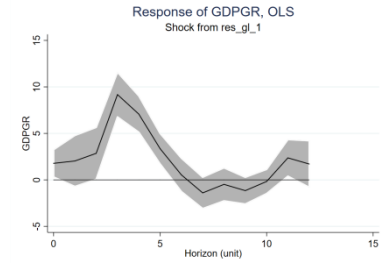
Korea

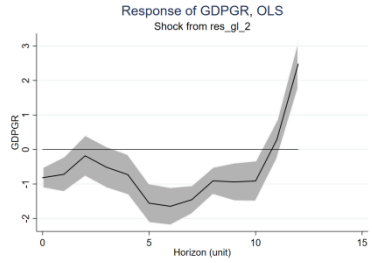


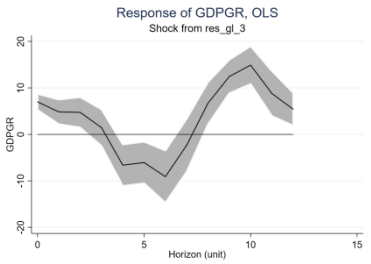




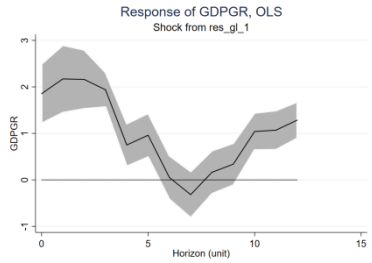
Mexico

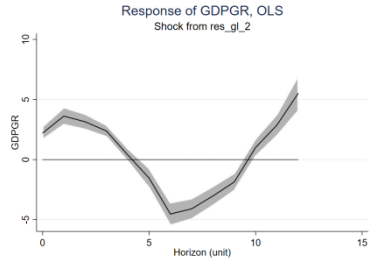


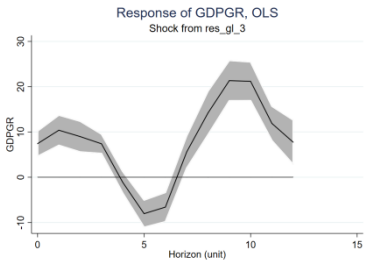


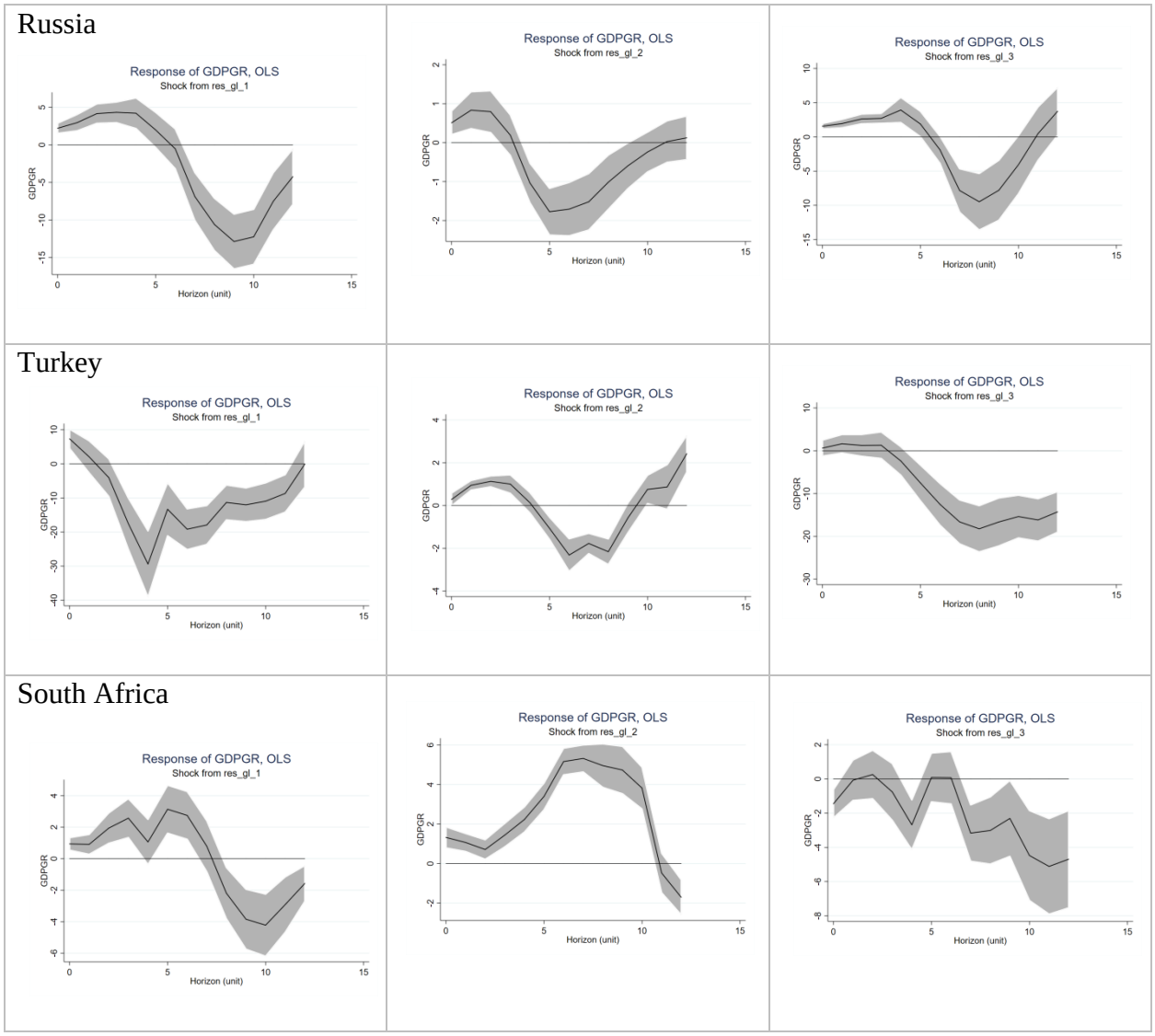


Malaysia









Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth, CR2 denotes total domestic credit and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks.

4.3 Robustness checks

In order to look at robustness of our outcomes, we perform some other robustness checks.[20] More specifically, we look at: 1) bilateral rates vis-à-vis the US dollar instead of effective rates, 2) investments instead of GDP in all the steps, 3) a panel setup for the first step, 4) inclusion of a dummy for the Global Financial Crisis, 5) using the Kilian index instead of commodity prices in the local projections, 6) using for China the global GDP as dependent variable and, 7) we replace the regular nominal exchange rate (BNER) with the debt weighted exchange rate (DWER). At the very end, we also look at the impulse responses by making use of a BVAR setup.

Firstly, as a check on the exchange rates, we use the bilateral rates vis-à-vis the US dollar, as there is evidence that most of world trade is done in a dominant currency (US dollar), as pointed

[20] The full set of results is available upon request.

out in Gopinath et al (2020). In this case, the only relevant exchange rate for the trade channel is the US dollar-domestic currency exchange rate. As an illustration, in China, most of the international trade is done in US dollars, while US share of China's exports is less than 20% (and less than 10 % of its imports). Hence, weighting the US dollar by 20% (as in the construction of the BNER) could produce misleading results for the trade channel. This does not apply to all of the countries under study, however. Turkey, for instance, trades extensively with the euro area and this trade is denominated in euros. Even when Turkey exports to the US, the goods are sometimes priced in euros. Nevertheless, 60% of Turkey's imports are still invoiced in US dollars (Gopinath, 2015). The US dollar is also the currency in which most of the credit is issued in the country and generally worldwide (as shown in Figure A3 in Appendix). However, it is not always the case in our EMEs, where the euro also plays a relevant role, in Turkey for example. Eren and Malamud (2019) call this evidence the "dominant currency debt". This issue is taken into consideration when the DWER check is performed. If we take China as an example, the impact of the US dollar bilateral rate on GDP growth is much more persistently positive, turning zero only at a very long horizon (see Figure A5 in Appendix). The financial channel is even more prominent for that country when the US dollar is used instead of the BNER effective rate. Moreover, basically by construction, the bilateral exchange rate vis-à-vis the US dollar affects credit denominated in US dollars in a more persistently positive way. For Turkey, the responses of GDP growth to a shock in BNER (or DWER) differ from the shocks in the US dollar rate. When BNER (or DWER) is used, as it accounts more accurately for euro/US dollar dominance in both trade and financial denominations, we see a small positive effect in GDP growth at impact when the Turkish lira appreciates, an effect which turns negative in the medium run. If the bilateral rate vis-à-vis the US dollar is used instead, this fails to account for the specific characteristics of the country, and the response of the GDP is found to be negative for more than a year before turning very positive later on.

The second check uses investments (GFCF)[21] instead of GDP in the regressions (in both the first and the second steps). This is done because if we do not use investment as a regressor, movements in investment will be partially present in innovations at the first stage, and consequently affect the responses. We are referring to the movements in investment that should capture the variations in *domestic* demand for credit through the trade channel (because we cannot be sure about the sign of the effect). By definition (Kearns and Patel, 2016), the financial channel describes how exchange rate movements influence the supply and cost of *foreign* funding, and hence domestic economic activity. While movements in GDP are certainly correlated with movements in investment, GDP also reflects variation in other components – consumption and net export, which

[21] The data are from OECD, quarterly growth rates. China and Malaysia are not included because of data availability.

do not necessarily move in the same direction as investment. However, we do find that the correlation between shocks in credit series, as in the baseline (with GDP growth), and in this check (with investments growth), are very robustly high across all the countries (the lowest is 0.94 for India in the case of total credit). Therefore, we look at how investment growth is affected by a shock in exchange rates (Figure A6).[22] The impacts of exchange rates on investments are mainly positive in the medium run, except for Mexico. At impact the responses are overall in negative territory. We find some positive responses in the case of GDP growth (Figure 1). An appreciation of the BNER drives domestic investments up in the medium run, which is not in line with the *domestic* demand for credit through the trade channel. This can be partially because these countries also are affected by capital flows coming from abroad, for example in the form of Foreign Direct Investments (FDIs), and this can affect the supply of credit (Figure A7) in a longer horizon. In addition, the financial channel of exchange rates acts as a potential offset to the trade channel, in that an exchange rate appreciation boosts domestic economic activity (Kerns and Patel, 2016) but boosts investments even more through easier financial conditions in the medium run. In the short run, in contrast, the trade channel plays a role for investments and an appreciation is detrimental. In Mexico, the trade channel works as expected for much longer, since Mexico is quite trade-open and GVC-linked, and the amount of net FDIs inflows over GDP is relatively small compared to the other countries studied.

In the third robustness check, we also investigate the problem in a panel setup. We still believe that, especially in an analysis of financial channels, the country perspective is able to deliver more informative outcomes given the high level of heterogeneity in the trilemma variables and in trade openness. A country-by-country approach in a similar context has been used in Staehr and Vermeulen (2016), for example, to analyze the macroeconomic and financial relationships by individual VARs for 11 EA countries. A key message from these results is that the transmission mechanism for shocks is different in different countries. The consequence of varying transmission mechanisms is that results cannot be generalized to the EMEs panel. The full local projections in panels are also normally applied in a pooled sense (or with FE). This will also compromise the heterogeneous analysis we want to build. A panel BVAR (with partial pooling, as recommended in Canova and Ferroni, 2020) could be an option, but as pointed out here, we prefer a local projections approach due to the difficulties in properly identifying the shocks. Given these points, we indeed conduct panel estimates, but only for the first step, as a test for robustness; looking at how the shocks would vary compared to shocks extracted from the country-specific regressions. This provides the benefit of increasing the number of observations. We use the common correlated

[22] The impulse responses are in general less smooth than for GDP growth, because the investment growth series from OECD is spikier.

mean group estimator (CCEMG, as in Pesaran and Tosetti, 2011) in the panel, which considers at least some level of heterogeneity, as it takes the simple mean across country-specific coefficients, and accounts for both spillovers and global factors. Looking at the correlations between the shocks computed by using the panel and the ones in the baseline, they fall between 0.6 and 0.9.[23] The main responses do not vary in signs; only some very small changes are seen in the magnitudes (see Figure A8 for GDP growth responses to exchange rate shocks, for instance).[24]

Still about the shocks' extraction, we also include a global financial crisis dummy in the first step, as fourth check. The new shocks are almost perfectly correlated to the baseline; with a correlation from 1.00 to 0.86 (all the correlations below 0.95 concern the stock prices). Thus, the shocks seem to be quite robust to the addition of a dummy for the GFC. Again, the IRFs do not vary in signs; only some very small changes are seen in the magnitudes.[25]

The fifth check includes the Kilian index, replacing commodity prices in the local projections. The Kilian index is taken from the updated and corrected version of the index of global real economic activity in industrial commodity markets, as proposed in Kilian (2009).[26] The results are robust in both signs and magnitude. The inclusion of global GDP in the list of exogenous variables in the local projections (second step) does not alter the main messages from the baseline. The results are still robust in both signs and magnitude. If we do not have any exogenous controls in the local projections, the responses vary in magnitude, albeit not dramatically. The main conclusions still hold. We include all the exogenous variables and the crisis dummy in the regression for the extraction of shocks (step 1). The shocks are correlated with the ones from the baseline, yielding correlations from 0.80 to 0.98. There are some differences in the IRFs, mainly in magnitude rather than in sign.

Then, in the case of China, we add in the shocks' extraction, i.e., in the first step, the global GDP as dependent variable. Since China is a large player on the global scale, it could indeed impact the overall global GDP. The latter is now not exogenous anymore and therefore we have a global GDP shock in the case of China as well. The correlation of the common shocks with the baseline is 0.99. Hence, the shocks are also very robust in this case. The reaction of Chinese GDP to a positive global GDP shock is small but positive and significant in the short run but becomes

[23] The results are available upon request.

[24] The full sets of IRFs with shocks extracted from the panel are available upon request.

[25] The full sets of IRFs are available upon request.

[26] Kilian (2009) claims that not all oil price shocks are alike, and the nature of the correction is further discussed in Kilian (2019). For more discussions of the advantages of this index compared with measures of global real GDP or global industrial production, in particular, see Kilian and Zhou (2019).

larger after 2 years. In China, the effects on credit denominated in foreign currencies is quite volatile and negative for a longer time in the medium run in the case of US dollar-denominated credit.[27]

Lastly, to look at the transmission, following Kearns and Patel (2016), we replace the regular nominal exchange rate (BNER) with the debt weighted exchange rate (DWER) in the shocks extractions and responses. In their paper, the authors use a homogeneous single equation dynamic panel approach (ARDL) and include both rates, i.e., BNER and DWER, together in their setup. Here instead we do count for endogeneity across variables, keeping full heterogeneity in the responses. The impulse responses to a DWER shock are very similar to the ones to BNER, with small differences only in the magnitudes. The responses of our variables of interest to a DWER shock are slightly bigger than for BNER shocks (see Figure A9 for exchange rate DWER shocks to GDP growth). Here we do not have both exchange rates together in the shocks extraction, even if their correlation is around 0.3. If shocks in BNER and DWER are extracted from an ARDL with both rates in the setup, the correlation with baseline shocks is between 0.5 and 0.7, depending on the variable. The main responses for BNER and DWER are again quite robust. [28]

4.3.1 Comparison with BVAR results

As an additional check, we also make use of a country-by-country BVAR with the same main variables as in the local projections. We let the data speak for themselves, i.e., we do not impose any identification scheme. Minnesota priors are applied and 68% confidence intervals (as for the local projections).[29]

Overall, the responses from the BVARs and from the local projections are robust in terms of signs but the former IRFs are much smoother. With BVARs, however, it is trickier to find significance in the responses.

Given that, some uniform outcomes can still be found with BVARs. For the responses of GDP growth to shocks in BNER, if they are significant (India, Korea), they are in line with the local projections. All these significant responses represent cases in which the signs are positive, i.e., it can be a sign of the financial channel being stronger than the trade channel.

A shock in credit issued in US dollars (GL3) drives an increase in GDP growth in most of our countries of interest (Brazil, China, Chile, Mexico, Malaysia, Russia, and Turkey). This is

[27] The full sets of responses with this check for China are available upon request.

[28] The full set of responses of GDP growth (and other variables) is available upon request.

[29] We use either 1 lag (as in the local projections) or 4 lags (as a main check). The results are robust and available upon request.

quite in line with the main conclusions from the local projections. However, the currency of denomination may vary over countries, as does the response for domestic credit. An increase in foreign-denominated credit can also result in downswings, as in the local projections.

An increase in the effective exchange rates (BNER) generally has a positive impact on foreign-denominated credit, with the notable exceptions of India and Korea (for euro-denominated credit only). These findings broadly reflect the results from local projections. The domestic credit normally responds negatively to an increase in the BNER. The results for BNER shocks are less straightforward when applying the local projections technique: the IRFs are very noisy, and the sign of the responses depends on the horizon after the shock occurs.

5 Conclusions

This paper studies the financial channel of exchange rate fluctuations for emerging countries. We consider the amount of credit issued in different currencies, as well as exchange rate measures, to analyze the impact of exchange rate fluctuations on GDP growth and domestic credits. We look at the shock transmission covering 11 emerging-market countries for the period 2000Q1–2016Q3, making use of local projections in order to identify the underlying effects. We extend previous studies by assessing the overall effect of credit denominated in different currencies instead of focusing solely on valuation effects of foreign currency liabilities.

Our overall results show that a country-by-country analysis is the best way to assess the underlying causalities, as compared to a panel approach. The countries we analyze can all be classified as emerging markets, but they differ about several important characteristics which might affect the significance and the transmission of changes in foreign denominated credit.

We find that domestic appreciations increase demand for foreign credit, implying positive effects on investment and GDP growth. However, this is valid only in the short run; in the medium-long run, an increase of credit denominated in foreign currency (for instance due to appreciation) decreases GDP. The financial channel works in the short run for most countries except for in Brazil, Malaysia, and Mexico, where the trade channel instead always dominates.

A major finding is that domestic credit often responds negatively to exchange rate appreciations or to increases in GDP. Possibly there is a substitution effect between domestic and foreign credit in case of shocks in the effective exchange rate. This substitution effect is somehow in line with what has been found in the literature between domestic and foreign currency loans in case of monetary policy shocks. Restrictive monetary policy leads to a decrease in domestic currency lending but simultaneously accelerates foreign-currency-denominated loans in Central Eastern Europe, for example (Brzoza-Brzezina et al., 2010).

The dynamics of foreign-denominated credit with regard to GDP are different, not showing simple pro-or anti cyclical behavior. An increase in foreign-denominated credit mostly increases domestic GDP but only at impact. The findings for an increase in US dollar-denominated debt, for example, point to a positive effect on GDP, except for in Indonesia and Korea, where a negative pattern is observed. In other countries, the positive effect is seen in the very short run (China) or after more than one year (Russia). Therefore, in the medium-long run, an increase of credit denominated in foreign currency (for instance due to an appreciation) decreases GDP and the financial channel works in line with the trade channel. In line with the findings that yen-denominated debt stalled or decreased, we find little evidence for positive effects from the yen. We also find that foreign debt plays an important macroeconomic role, operating through various transmission channels. The direction of effects depends on country characteristics but mostly points to a positive effect on GDP in case of an increase in foreign-denominated credit.

Our results have important implications for the financial channel, which seems to be largely driven by foreign-denominated credit, given that domestic credit is not tightened after a domestic depreciation. We find that exchange rate depreciations have different effects on the real and financial sector via the credit channel, making comparison with the trade channel a challenging task. Our conclusions can be relevant when policy makers intend to set or assess the impact of exchange rate shocks on the macroeconomic and financial variables or even their exchange rate regime. Disentangling and identifying trade and financial channels can be more complicated than expected and considering the specific characteristics of each emerging market is recommended.

Our measure does not include central bank and government debt. An important extension for further research would be a comparison with other dimensions of foreign debt, as well as capital flows and the holding of currency reserves. Combining these three dimensions could shed further light on exchange rate effects beyond the conventional trade channel. It could also help to disentangle the relative importance of the US dollar, the yen and the euro as international currencies. Another extension for future research could focus on foreign-denominated debt to the financial sector, given that the data we are using focuses on the non-financial sector.

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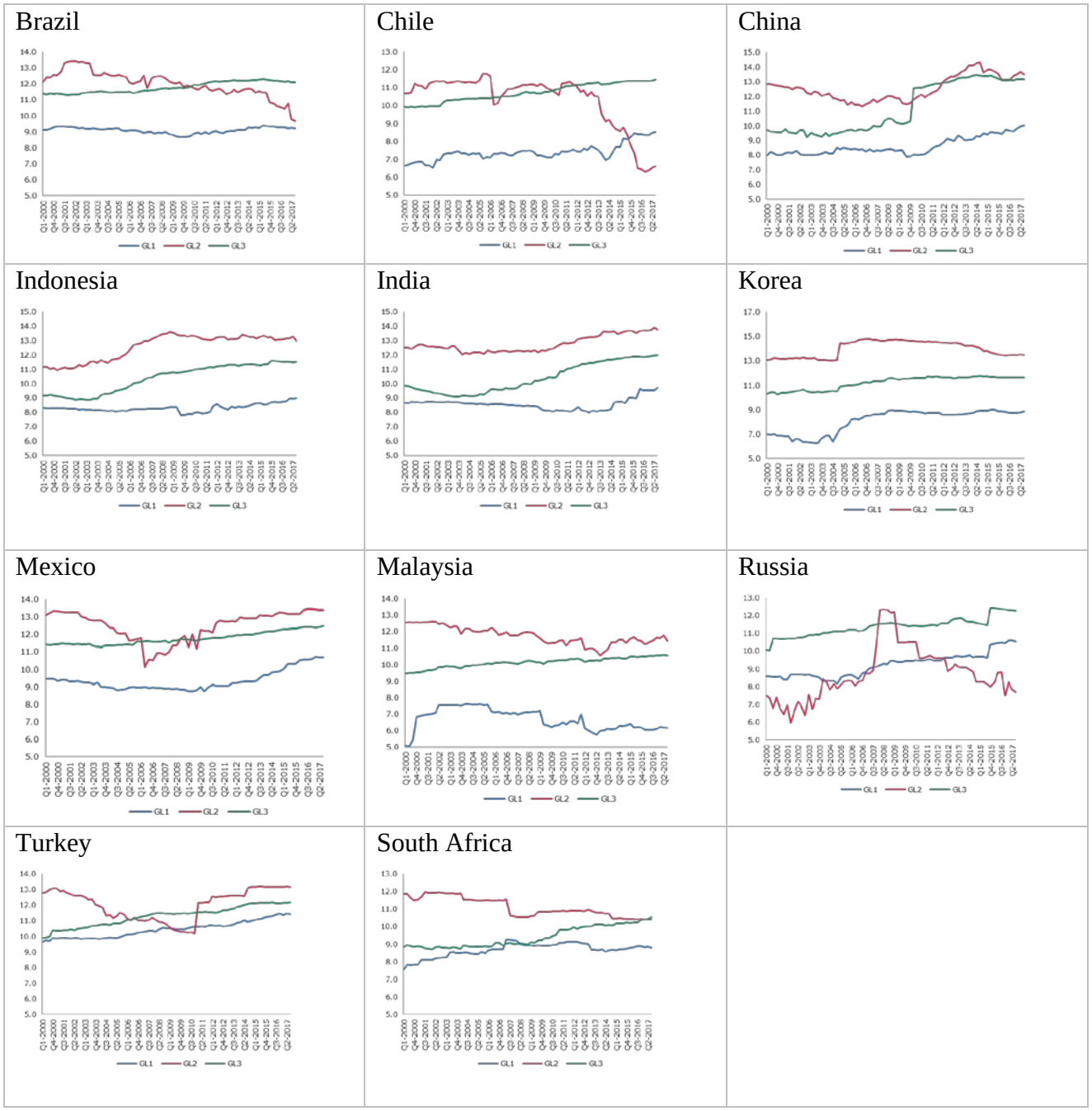
Appendix – Tables and figures

Figure A1 Impossible Trinity Index

Note: The graphs display the impossible trinity measures described in Section 4.1 for each country. Exchange rate stability (EX) reflects the annual standard deviations of the monthly exchange rate (restricted by a threshold); monetary independence (MON) reflects the reciprocal of the annual correlation between the monthly interest rates of the corresponding country and the base country. Financial openness (OPEN) is based on restrictions on cross-border financial transactions as reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Source: authors' elaborations on Aizenman, Chinn and Ito (2010, 2013).

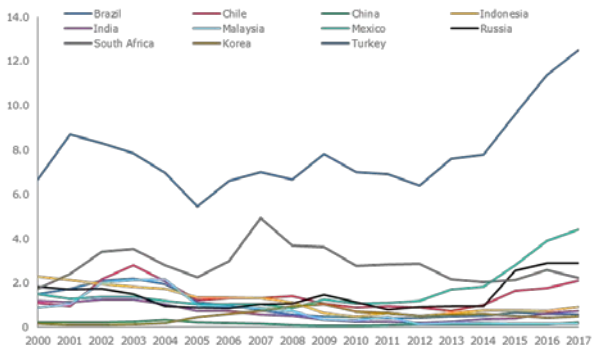
Figure A2 Foreign-denominated debt measures for all countries



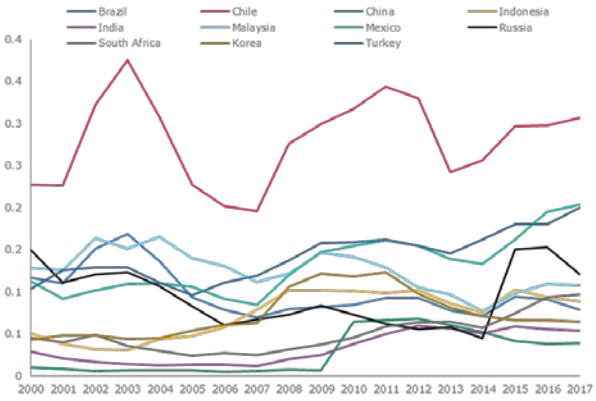
Note: The graphs display credit denominated on foreign currency on a logarithmic scale (ln) for euro (GL1), yen (GL2) and US dollar (GL3). Data are in the currency of issue. Source: BIS.

Figure A3 Foreign-denominated debt measures for all countries over GDP

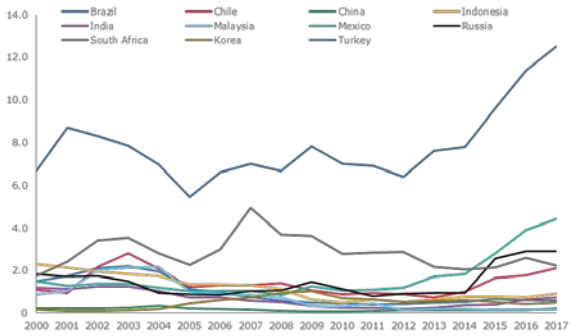
GL1: Euro



GL2: Yen



GL3: US dollar



Sources: authors' calculations on BIS and World Bank (FRED) data. Data are in nominal terms and in US dollars.

Figure A4 Trade Openness

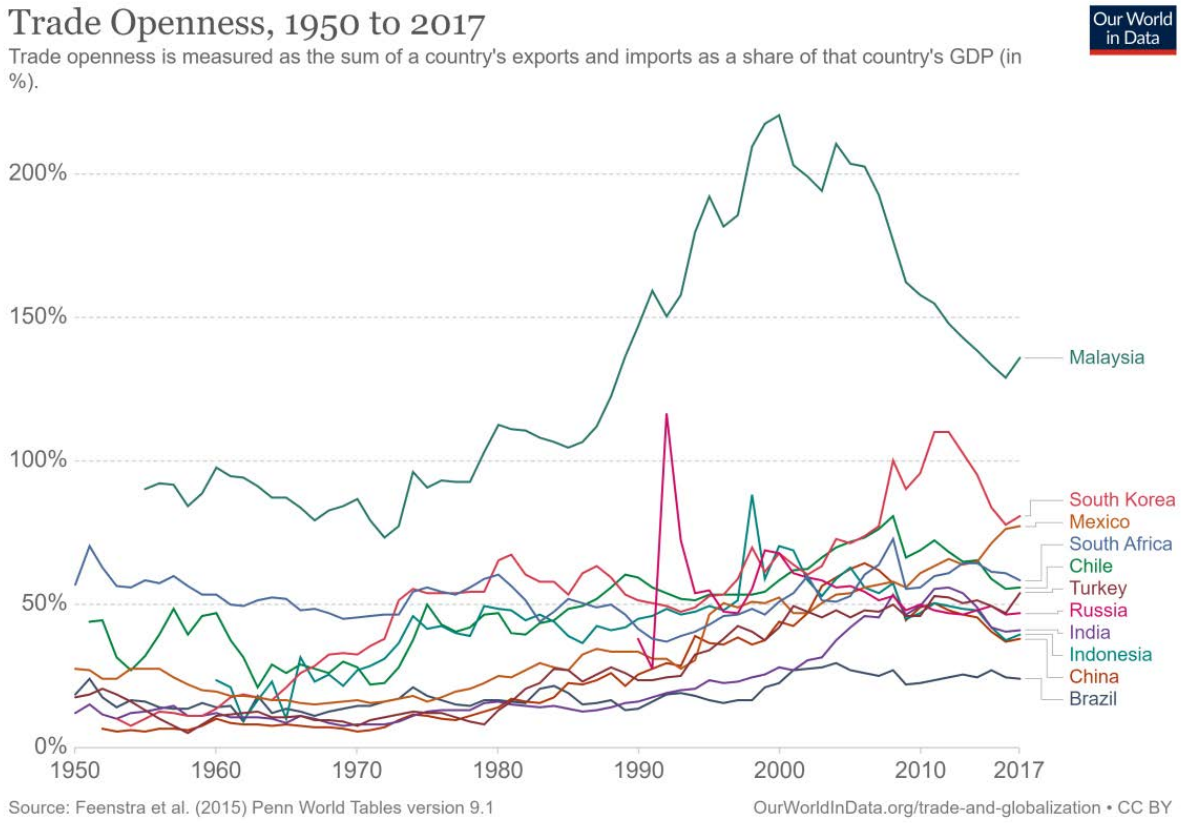


Table A1 Coefficients of local projections for shocks in BNER to GDP growth

country	Coefficients h=1	Coefficients h=4	Coefficients h=8	Coefficients h=12
BRA	-4.14	-3.00	-7.91	5.38
CHI	1.91	10.52	-3.94	-6.85
CHN	16.89	-6.90	-2.85	-28.61
IDN	-0.71	0.08	0.48	-7.83
IND	25.49	29.81	-19.13	1.70
KOR	2.64	21.58	-1.07	-7.83
MEX	1.01	-12.02	-9.77	3.87
MYS	-0.30	-1.30	0.62	0.85
RUS	4.97	7.68	3.82	-10.04
TUR	1.42	-1.19	-14.66	2.22
ZAF	-0.02	-1.16	4.00	2.59

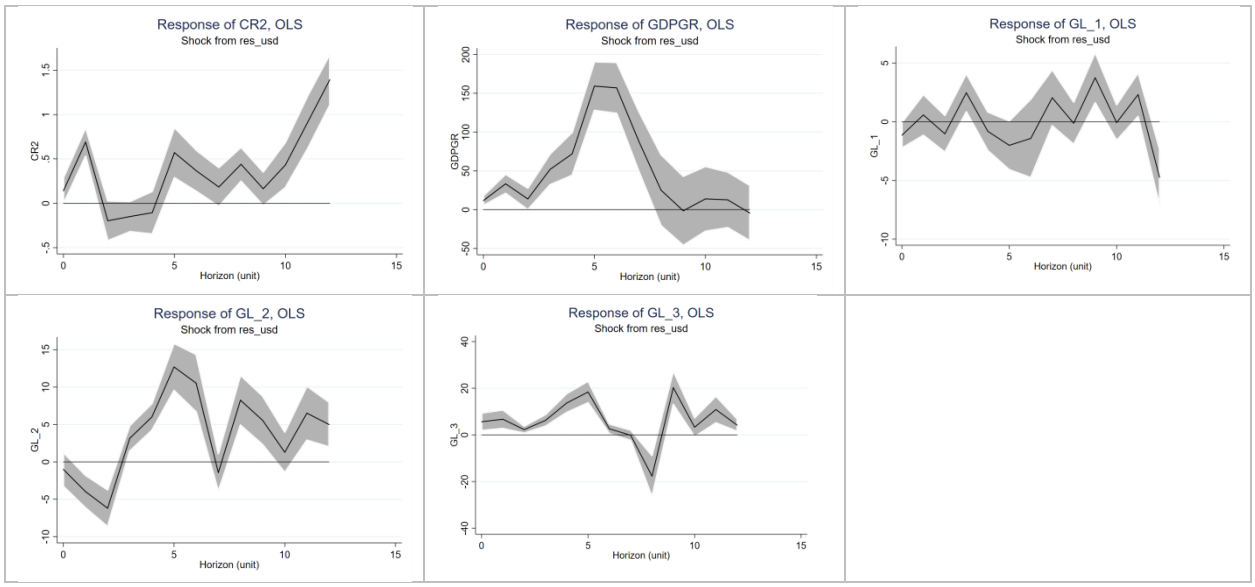
Table A2 Variation in GDP growth due to BNER shocks (pseudo factor analysis)

country	% variation in gdpgr	h=1	h=4	h=8	h=12
BRA	**-0.32**	1.32	0.95	2.51	-1.71
CHI	**-0.35**	-0.66	-3.67	1.37	2.39
CHN	**-0.01**	-0.25	0.10	0.04	0.42
IDN	**0.03**	-0.02	0.00	0.01	-0.21
IND	**-0.08**	-2.13	-2.49	1.60	-0.14
KOR	**0.17**	0.46	3.74	-0.18	-1.35
MEX	**-0.34**	-0.35	4.10	3.33	-1.32
MYS	**-0.05**	0.01	0.06	-0.03	-0.04
RUS	**-0.72**	-3.56	-5.50	-2.74	7.19
TUR	**-0.05**	-0.07	0.06	0.75	-0.11
ZAF	**-2.07**	0.04	2.39	-8.28	-5.36

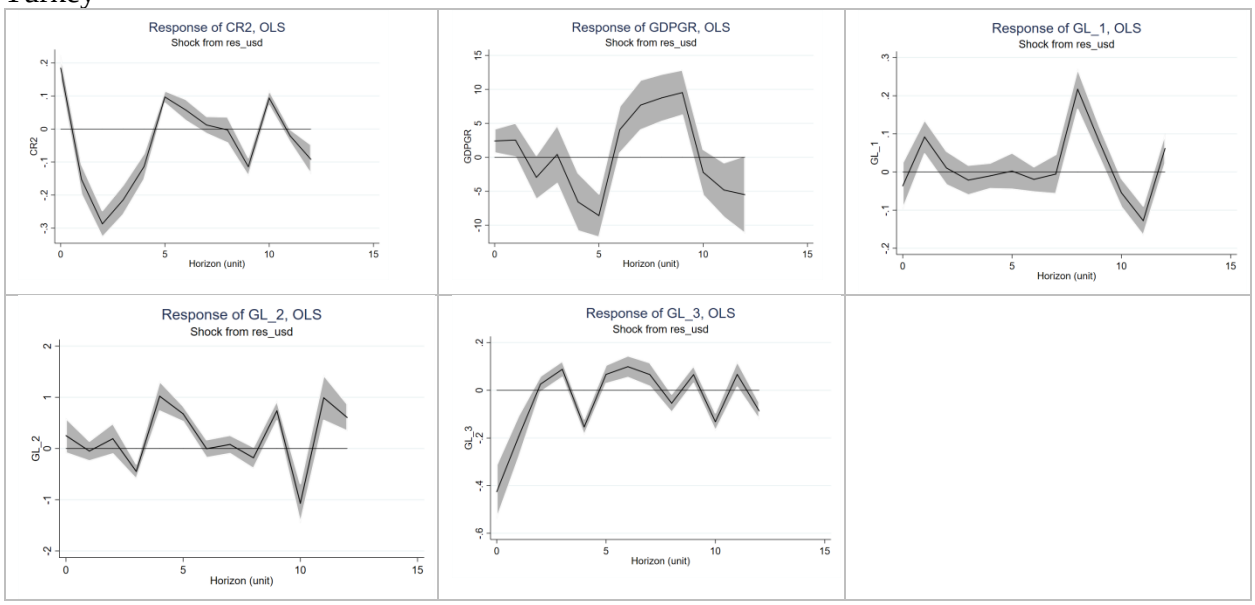
Note: An increase may represent the financial channel; a decrease tries to capture the conventional trade channel. We use here the % variation in GDP growth between 2016Q2 and 2016Q3. Full time series are available upon request.

Figure A5 Selected responses with the US dollar bilateral rate – China and Turkey

China

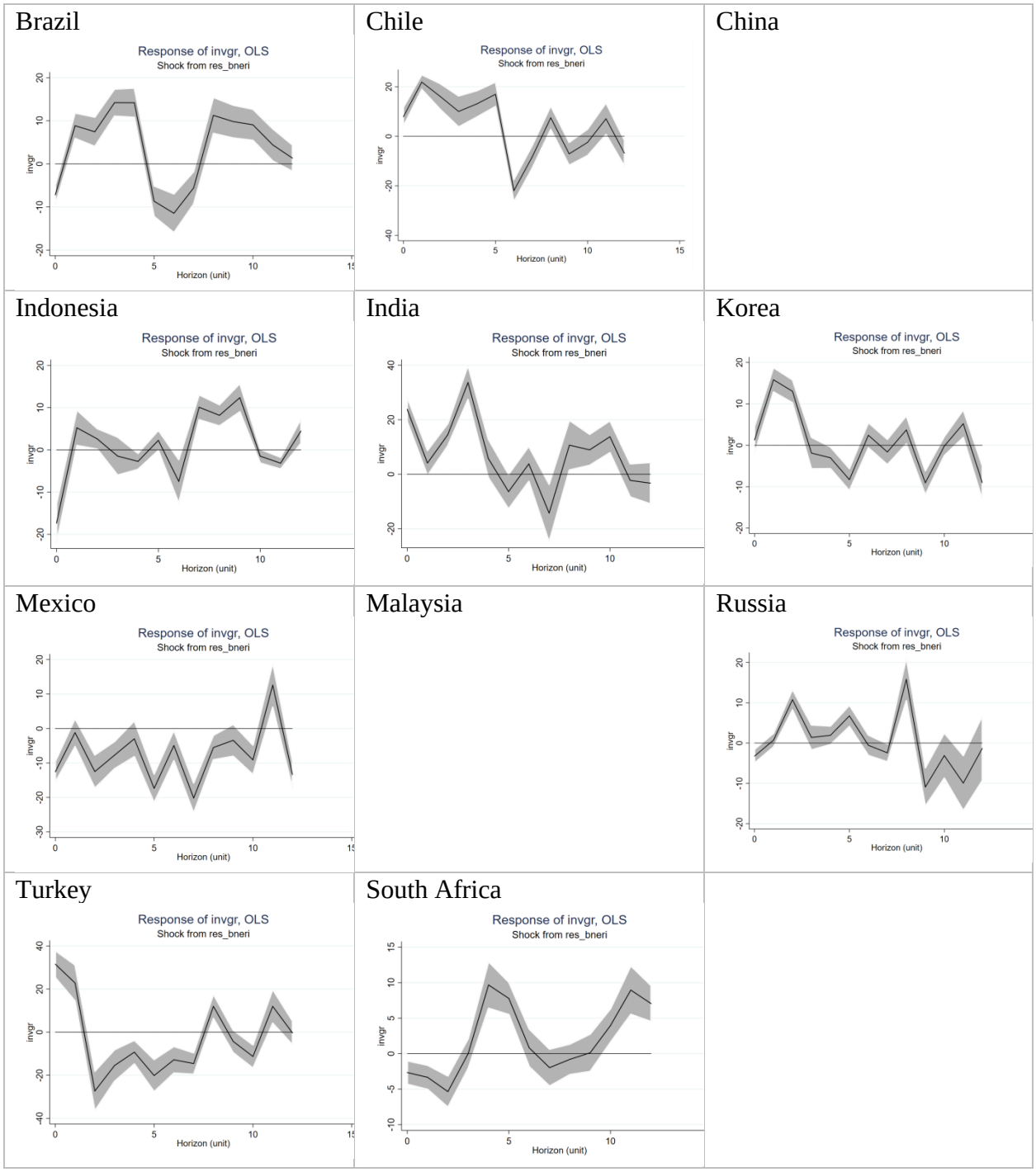


Turkey



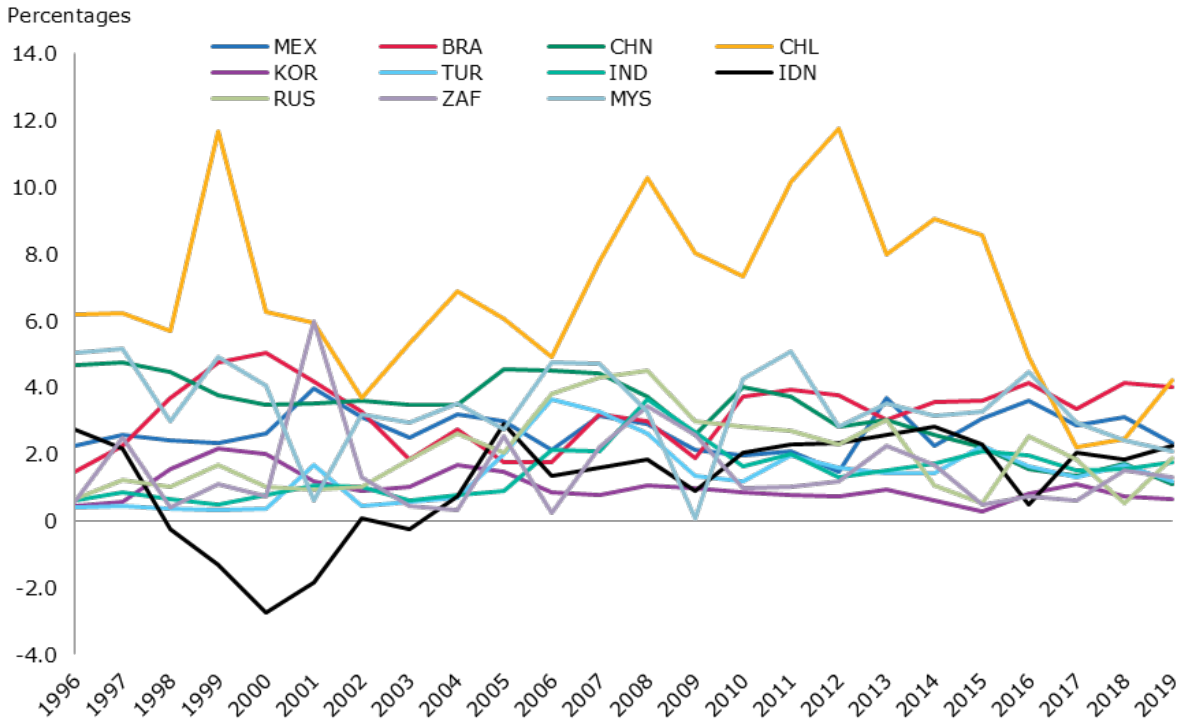
Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth, CR2 denotes total domestic credit and USD is the bilateral exchange rate vis-à-vis the US dollar. *res_* are the shocks.

Figure A6 How exchange rate affects investment growth



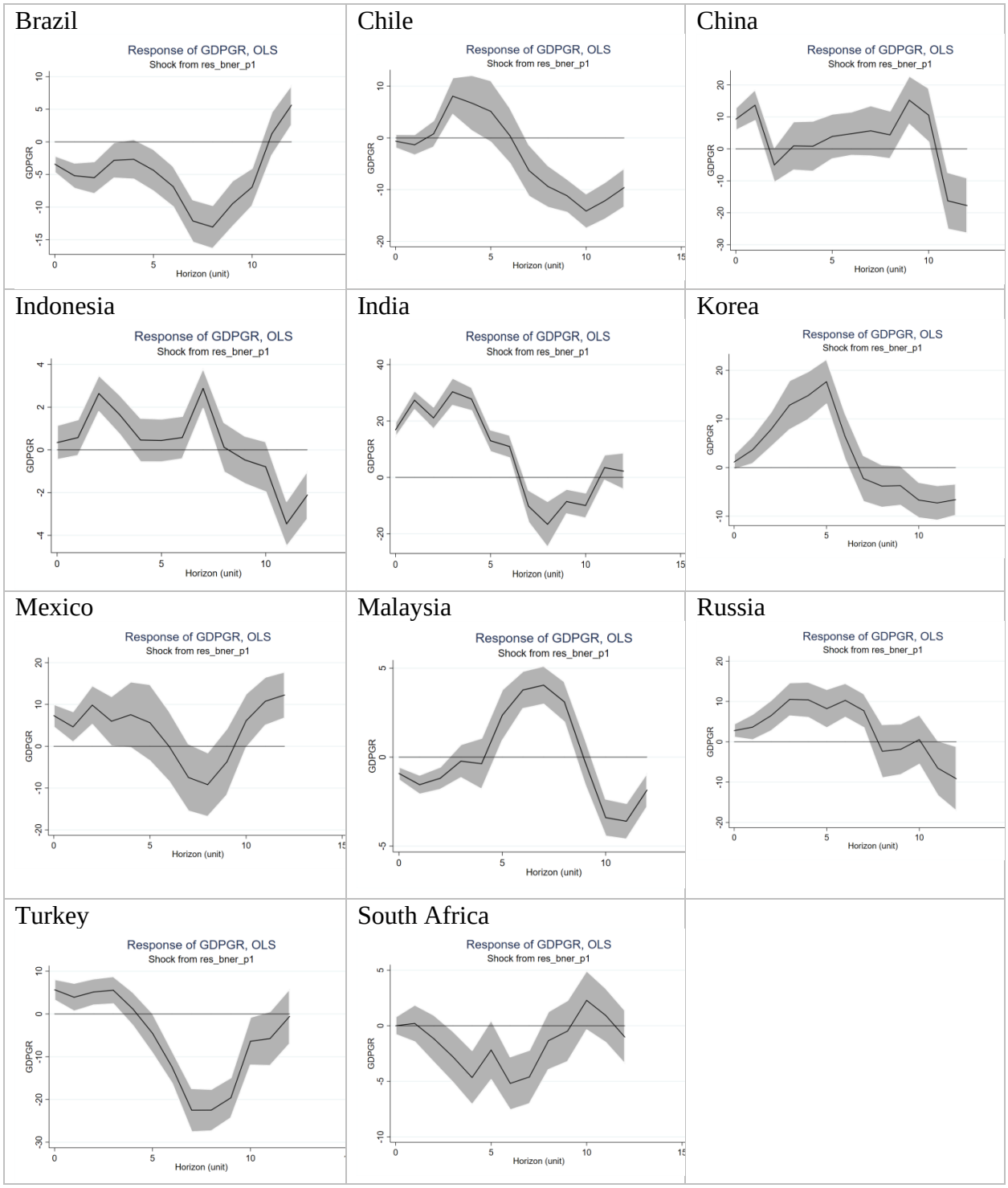
Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and US dollar (GL_TOT is the total), INVGR is the growth in investments and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks. China and Malaysia are not included because of lack of available data.

Figure A7 Foreign direct investment, net inflows (% of GDP)



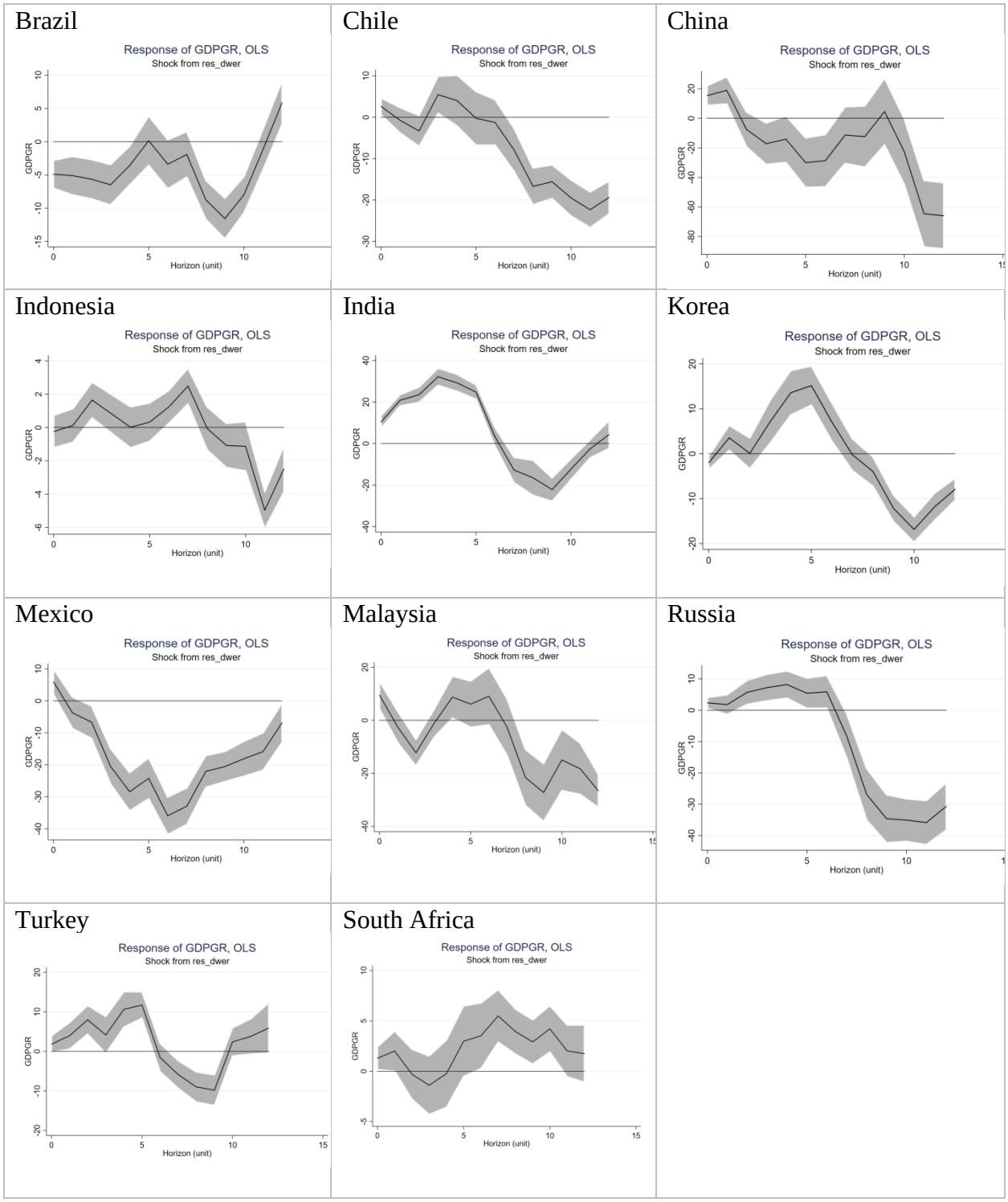
Sources: World Bank World Development Indicators

Figure A8 How exchange rate affects GDP growth – shocks extracted from panel



Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth and BNER denotes the broad nominal effective exchange rate. *res_* are the shocks.

Figure A9 How exchange rate affects GDP growth – using DWER



Note: The graphs display the impulse-responses based on local projections. GL 1–3 denotes foreign credit in euro, yen and the US dollar, GDPGR denotes real GDP growth and DWER denotes the Debt Weighted Exchange Rate (DWER) from Berger (2016). *res_* are the shocks.

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