

Georgiadis, Georgios; Zhu, Feng

Working Paper

Foreign-currency exposures and the financial channel of exchange rates: Eroding monetary policy autonomy in the Asia and Pacific region?

ADB Working Paper Series, No. 1117

Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

Suggested Citation: Georgiadis, Georgios; Zhu, Feng (2020) : Foreign-currency exposures and the financial channel of exchange rates: Eroding monetary policy autonomy in the Asia and Pacific region?, ADB Working Paper Series, No. 1117, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/238474>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by-nc-nd/3.0/igo/>



ADB Working Paper Series

FOREIGN-CURRENCY EXPOSURES AND THE FINANCIAL CHANNEL OF EXCHANGE RATES: ERODING MONETARY POLICY AUTONOMY IN THE ASIA AND PACIFIC REGION?

Georgios Georgiadis and Feng Zhu

No. 1117
April 2020

Asian Development Bank Institute

Georgios Georgiadis is a senior economist at the European Central Bank. Feng Zhu is senior research director at the Luohan Academy.

The views expressed in this paper are the views of the author and do not necessarily reflect the views or policies of ADBI, ADB, its Board of Directors, or the governments they represent. ADBI does not guarantee the accuracy of the data included in this paper and accepts no responsibility for any consequences of their use. Terminology used may not necessarily be consistent with ADB official terms.

Working papers are subject to formal revision and correction before they are finalized and considered published.

The Working Paper series is a continuation of the formerly named Discussion Paper series; the numbering of the papers continued without interruption or change. ADBI's working papers reflect initial ideas on a topic and are posted online for discussion. Some working papers may develop into other forms of publication.

Suggested citation:

Georgiadis, G. and F. Zhu. 2020. Foreign-Currency Exposures and the Financial Channel of Exchange Rates: Eroding Monetary Policy Autonomy in the Asia and Pacific Region? ADBI Working Paper 1117. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/foreign-currency-exposures-financial-channel-exchange-rates>

Please contact the authors for information about this paper.

Email: georgios.georgiadis@ecb.int, schecho8@yahoo.com

We would like to thank, without implicating them, our discussants Stefan Eichler, Samuel Ligonniere, Olena Ogrokhina, Massimiliano Pisani, Sanjay Singh, and Huanhuan Zheng, as well as Jan-Christoph Ruelke and Eduardo Levy-Yeyati for sharing their data with us, and Menzie Chinn, Luca Dedola, Andrea Ferrero, Johannes Gräß, Sebastian Kripfganz, Gianni Lombardo, Gernot Müller, Dominic Quint, Ilhyock Shim, James Yetman, and Huanhuan Zheng as well as seminar and conference participants at the Asian Development Bank, Bank of Thailand, BIS, ECB, DIW Berlin, National Bank of Serbia, Reserve Bank of India, SEACEN, the 3rd Annual CEBRA International Finance and Macroeconomics Program Meeting, the Central Bank of the Republic of Turkey conference on "Changing Economic Landscape and Policy Implications for Emerging Economies," the CBI/ECB/IMTCD workshop on "International Capital Flows and Exchange Rates," the ADBI/SMU conference on "Macroeconomic Stabilisation in the Digital Age," the LEM/CNRS/University of Lille/GdRe workshop "International Finance: Do Exchange Rates Still Matter?," the 8th IWH/INFER workshop "International Capital Flows and Macroeconomic Stability," and the 23rd International Conference on Macroeconomic Analysis and International Finance for helpful discussions and suggestions. Adam Cap provided outstanding research assistance. This work was partly carried out while Georgios Georgiadis was visiting the BIS under its Central Bank Research Fellowship program. The views expressed in the paper are those of the authors and do not necessarily reflect those of the Luohan Academy or the ECB.

Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

© 2020 Asian Development Bank Institute

Abstract

Foreign-currency exposures on an economy's external balance sheet may jeopardize financial stability when the exchange rate depreciates. In fact, theory suggests that in such an environment it may be optimal for monetary policy in a floating regime to reduce exchange rate variation in order to dampen financial cycles by mimicking foreign monetary policy rather than focusing exclusively on stabilizing macroeconomic fundamentals. We explore whether there is evidence in the data for economies facing such a trade-off between financial stability and macroeconomic stabilization that gives rise to fear of floating. In a panel data set for the time period from 2002 to 2012 and 10 small open economies with floating regimes in the Asia and Pacific region we document evidence that is consistent with fear of floating, i.e., that local mimics base-country monetary policy even after controlling for macroeconomic fundamentals. Importantly, we find that this fear of floating is particularly pronounced in the presence of foreign-currency exposures. Specifically, fear of floating is stronger when the foreign-currency exposures arise through debt rather than nondebt instruments, which is consistent with existing evidence documenting that these instruments are more fickle and sensitive to swings in investor sentiment. Moreover, the evidence for fear of floating is stronger when base-country monetary policy is tightened, suggesting that monetary policy tends to act to address immediate threats to financial stability in the face of depreciation pressures rather than to preemptively mitigate the buildup of foreign-currency exposures when the currency is appreciating.

Keywords: foreign-currency exposures, monetary policy autonomy, spillovers

JEL Classification: F42, E52, C50

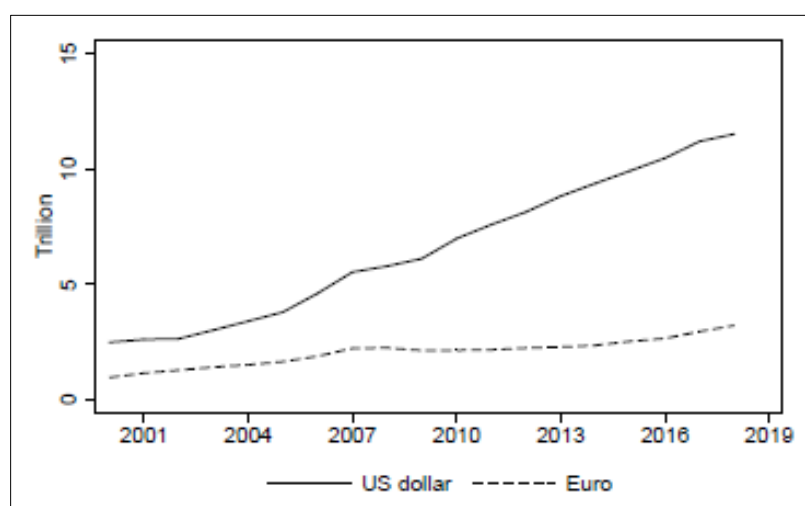
Contents

1.	INTRODUCTION	1
2.	EMPIRICAL FRAMEWORK	4
2.1	Estimated Monetary Policy Reaction Functions	4
2.2	Data and Definition of Variables	5
3.	EMPIRICAL RESULTS.....	8
3.1	Baseline Results for the Role of Foreign-currency Exposures in Fear of Floating.....	8
3.2	Results for Net Long/Short Positions and Different Financial Instruments....	10
3.3	Results for Fear of Floating across Local-currency Appreciations and Depreciations	11
4.	CONCLUSION	12
	REFERENCES	14

1. INTRODUCTION

A cornerstone of international macroeconomics is the notion that exchange rate flexibility confers monetary policy autonomy. The underlying rationale is that because in a flexible exchange rate regime the future exchange rate may change, deviations of a small open economy's (SOE) interest rate from that in the rest of the world do not represent arbitrage opportunities and can hence persist. A large empirical literature has documented that the data have been consistent with this prediction since the 1970s and even over much longer, historical time periods (see, for example, Shambaugh 2004; Obstfeld, Shambaugh, and Taylor 2005; Klein and Shambaugh 2015). However, much has happened relative to the time periods studied in most of this literature. For one thing, financial globalization has taken off. For example, advanced economies (AEs) have accumulated large international investment positions, almost quadrupling the ratio of gross foreign assets and liabilities to GDP. Emerging market economies (EMEs) have accumulated smaller international investment positions, but, in contrast to AEs, exhibit large foreign-currency exposures. Particularly in the aftermath of the global financial crisis when interest rates in AEs reached historic lows, EMEs issued large amounts of foreign-currency-denominated debt (Aldasoro and Ehlers 2018; BIS 2019). Figure 1 plots the evolution of total cross-border credit – including corporate bonds and bank loans – denominated US in dollar and euro to nonfinancial corporations. Clearly, both have risen substantially, even since the global financial crisis. In this study, we explore whether foreign-currency exposures accumulated since financial globalization took off have implied trade-offs between financial stability and macroeconomic stabilization and eventually eroded monetary policy autonomy as reflected in “fear of floating” in SOEs in the Asia and Pacific region.¹

Figure 1: Evolution of US Dollar and Euro Nonresident Credit



Note: The figure displays the evolution of US dollar and euro credit (bank loans and debt securities) of nonresidents and nonbank entities. The data are taken from the BIS Global Liquidity Indicators (BIS 2019).

¹ Georgiadis and Zhu (2019) consider a broader country sample.

It is widely known that foreign-currency exposures come with risks, as was vividly illustrated by a series of EME crises in the 1990s; hence the term “original sin” (Eichengreen and Hausmann 1999). For example, Durdu, Martin, and Zer (2019) document that US monetary policy tightening has continuously raised the probability of banking and currency crises in the rest of the world since 1870, especially when economies exhibited foreign-currency exposures. In particular, when an SOE’s exchange rate depreciates – for example in response to a US monetary policy tightening – then foreign-currency liabilities become more difficult to service and to roll over, which might eventually put at risk financial stability (Bruno and Shin 2015). Against this background, SOE monetary policy may try to reduce exchange rate variation in a floating regime by mimicking base-country monetary policy; and SOE monetary policy may do so both in order to avoid foreign-currency exposures building up in the first place when the local currency has appreciated and later in order to preserve financial stability when the local currency faces depreciation pressures after the accumulation of foreign-currency exposures. As a result, in this case monetary policy would not only be geared towards stabilizing the business cycle, but also towards dampening the financial cycle. As these cycles are in general not synchronized and the transmission lags of monetary policy are different, foreign-currency exposures imply a trade-off. In other words, despite – and in fact precisely because of – a flexible exchange rate, monetary policy autonomy in the sense of being able to focus exclusively on macroeconomic stabilization would be reduced due to a trade-off with financial stability implied by foreign-currency exposures.² Whether it is optimal for SOE monetary policy to reduce exchange rate variation in order to dampen the financial cycle rather than focus exclusively on macroeconomic stabilization depends on the strength of this “financial channel of exchange rates,” and is thus an empirical question (Gourinchas 2018). But at least some policy makers claim that such a financial channel of exchange rates operating on foreign-currency exposures is large in their economies (Basci, Ozel, and Sarikaya 2008; Gudmundsson 2017; Vegh, Morano, and Friedheim 2018).³

Early work discussing that SOE monetary policy may be reluctant to let the exchange rate float freely due to foreign-currency exposures goes back to Calvo and Reinhart (2002). More recently, a growing body of work has explored optimal monetary policy in the presence of foreign-currency exposures in state-of-the-art New Keynesian general equilibrium models. Specifically, Aoki, Benigno, and Kiyotaki (2018) study an SOE with currency mismatches on banks’ balance sheets. In the model, movements in the exchange rate triggered by shocks to foreign interest rates amplify spillovers to the SOE by worsening the balance sheets of banks, creating a trade-off between macroeconomic stabilization and financial stability. Davis and Presno (2017) consider an SOE model with collateral constraints in which variation in capital inflows triggered by shocks to foreign interest rates jeopardize financial stability. In the model, optimal monetary policy in a floating exchange rate regime manages the SOE’s external accounts by mimicking foreign monetary policy. Akinci and Queralto (2019) consider a two-country model in which spillovers from a US monetary policy tightening to EMEs are amplified due to currency mismatches. In contrast to Davis and Presno (2017), however,

² Foreign-currency exposures may also imply a trade-off between output and inflation stabilization. In particular, as an SOE’s exchange rate depreciates the tightening in local financial conditions resulting from foreign-currency liabilities becoming more difficult to service and to roll over may depress output growth, while inflation may still be rising due to increasing local-currency import prices. The latter is particularly pronounced in the case of dominant-currency pricing, i.e., global import prices even for trade not involving the US being invoiced in US dollars (Gopinath et al. 2020; Georgiadis and Schumann 2019).

³ Notice the subtle point also mentioned by Gourinchas (2019) that for policy makers to decide to reduce exchange rate variation it is sufficient that they believe such behavior to be optimal, regardless of whether this is true given the structure of the economy.

in the model of Akinci and Queralto (2019) it is not optimal for EME monetary policy to stabilize the exchange rate by mimicking US monetary policy. And Mimir and Sunel (2019) explore the welfare implications of a variety of monetary policy rules in a rich medium-scale SOE model with currency mismatches on banks' balance sheets. While Mimir and Sunel (2019) find that the optimal policy is not unique and depends on the particular model specification and the shocks hitting the SOE, reducing exchange rate variation by responding to US interest rates is generally welfare improving relative to standard Taylor rules.⁴

While the amount of theoretical work on the subject is large and growing further, empirical evidence on how important foreign-currency exposures are in shaping trade-offs and fear of floating faced by SOE monetary policy in the data is limited. For example, little systematic empirical evidence exists on whether SOEs systematically pursue policies such as those prescribed by Davis and Presno (2017), i.e., on whether SOE monetary policy mimics base-country monetary policy in order to reduce exchange rate variation in the presence of foreign-currency exposures. Of course, it is widely known that foreign exchange interventions are being used in order to reduce excessive exchange rate volatility. But much less evidence exists on the recourse to conventional monetary policy instruments in this context. Indeed, Carstens (2019) forcefully discusses the importance of improving our understanding of monetary policy challenges in SOEs in the context of a highly financially integrated world from a policy maker's perspective.

In this study, we first document evidence that supports the hypothesis that SOE monetary policy exhibits fear of floating in the presence of foreign-currency exposures in a data set for 10 SOEs in the Asia and Pacific region.⁵ In particular, we find that even after controlling for real-time forecasts of macroeconomic fundamentals as well as global variables, SOE monetary policy still responds to changes in base-country policy rates. Moreover, in line with the optimal policy prescriptions in Davis and Presno (2017), we find that the sensitivity of SOEs to base-country monetary policy is stronger the larger the SOE's foreign-currency net short position, that is, the more foreign-currency-denominated foreign liabilities exceed foreign-currency-denominated foreign assets. We also find that the sensitivity of SOEs to base-country monetary policy is particularly large when the foreign-currency exposures stem from portfolio debt instruments or bank loans rather than from more resilient foreign direct investment (FDI) and portfolio equity instruments with state-contingent payoffs and longer investment horizons; this finding is consistent with existing literature that documents that portfolio debt and other investment items are more fickle and more sensitive to swings in investor sentiment than portfolio equity and FDI. Finally, we find that the sensitivity of SOEs to base-country monetary policy is larger when the latter is tightened rather than loosened, suggesting that SOE monetary policy addresses immediate threats to financial stability in the face of depreciation pressures rather than preemptively mitigating the buildup of foreign-currency exposures when the currency is appreciating.

⁴ Earlier work finding that reducing exchange rate variation may be optimal in the presence of foreign-currency exposures includes Cook (2004), Choi and Cook (2004), Elekdag and Tchakarov (2007), Rappoport (2009), and Kolasa and Lombardo (2014). In contrast, Cespedes, Chang, and Velasco (2004); Devereux, Lane, and Xu (2006); Gertler, Gilchrist, and Natalucci (2007) as well as Faia (2010) find that it is optimal to let the exchange rate float freely.

⁵ In Georgiadis and Zhu (2019) we explore a broader country sample and find very similar results.

We obtain these findings by estimating fixed effects dynamic panel data regressions of monetary policy reaction functions for 10 SOEs in the Asia and Pacific region with floating regimes for the time period from January 2002 to December 2012. The reaction function arguments we consider include real-time forecasts of real GDP growth and consumer price inflation, the VIX, commodity prices, and the base-country policy rate. The inclusion of real-time forecasts and global variables accounts for the correlation between SOE and base-country policy rates that is due to common shocks and spillovers through conventional macroeconomic and financial channels. Hence, the coefficient estimate on the base-country policy rate indicates the extent to which an SOE mimics base-country monetary policy *over and above* what we would expect to observe if macroeconomic stabilization was the only policy objective; in other words, we interpret a positive coefficient estimate on the base-country policy rate as empirical evidence of fear of floating. In order to explore the role of the financial channel of exchange rates in shaping this fear of floating, we additionally include interaction terms between the base-country policy rate and various variables reflecting the SOE's foreign-currency exposure in the regression. While doing so we control for alternative reasons why SOE monetary policy may want to reduce exchange rate variation, in particular high exchange rate pass-through to consumer prices and a low stock of foreign exchange reserves.

2. EMPIRICAL FRAMEWORK

2.1 Estimated Monetary Policy Reaction Functions

We estimate the dynamic panel data regression

$$i_{it}^p = d_i + \rho i_{i,t-1}^p + (1 - \rho) \left(\boldsymbol{\theta}' \mathbf{x}_{i,t+M}^e + \boldsymbol{\gamma}' \mathbf{z}_t + \alpha i_{b_i,t}^p \right) + u_{it}, \quad (1)$$

where i_{it}^p is the SOE monetary policy rate, \mathbf{x}_{it}^e includes real-time forecasts of local macroeconomic fundamentals, \mathbf{z}_t is a vector that includes global variables, and $i_{b_i,t}^p$ is the monetary policy rate of SOE i 's base-country b_i . We include the vector of global variables \mathbf{z}_t in order to reduce the risk that the estimate for α is driven by common shocks, although the latter should already be captured by the real-time forecasts of local macroeconomic fundamentals.

In order to test whether fear of floating is shaped at least in part by financial stability considerations related to exchange rate variation and foreign-currency exposures, we further estimate the regression

$$i_{it}^p = d_i + \rho i_{i,t-1}^p + (1 - \rho) \left(\boldsymbol{\theta}' \mathbf{x}_{i,t+M}^e + \boldsymbol{\gamma}' \mathbf{z}_t + \alpha_1 i_{b_i,t}^p + \alpha_2 i_{b_i,t}^p \xi_{it} \right) + \theta \xi_{it} + u_{it}, \quad (2)$$

where ξ_{it} represents a measure of the SOE's foreign-currency exposure.

We omit time fixed effects in the baseline specification because these would be highly correlated with the base-country policy rate, particularly given that we only consider two base countries – the US and the euro area (see below) – and that the correlation between their policy rates during our sample period was very high.⁶ Moreover, notice that even if the coefficient estimate on the level of the base-country policy rate might be contaminated by common shocks, akin to a Bartik instrumental variable, the coefficient

⁶ In Shambaugh (2004), Obstfeld, Shambaugh, and Taylor. (2005), and Klein and Shambaugh (2015), the number of base countries is much larger and the sample period is much longer so that the correlation between base-country policy rates and the time dummies is much smaller.

estimate on the interactions with SOE variables continue to be determined by variation in SOE monetary policy's reluctance to let the exchange rate float freely across different degrees of foreign-currency exposures.

Notice also several remarks on the econometrics underlying the estimation of Equations (1) and (2). First, as we describe below, we consider a small- N /large- T panel data setting. This implies that in contrast to the traditional large- N /small- T panel data setting we expect the Nickell bias in the dynamic fixed effects panel regression – typically addressed by using GMM estimators – to be very small (Judson and Owen 1999). Second, Equations (1) and (2) can be interpreted as an error correction model. Then, if at least some of the variables are nonstationary, the corresponding equilibrium relationship is a cointegrating relationship; and if all variables are stationary, the equilibrium relationship is a long-run-level relationship. Importantly, if such an equilibrium relationship exists, then inference about the coefficient estimates is standard, regardless of whether the variables are nonstationary or stationary (Pesaran and Shin 1999). Third, we could in principle test for the existence of such an equilibrium relationship at the country level, even without knowledge of the orders of integration of the variables involved (Pesaran, Shin, and Smith. 2001). However, we have a very strong prior that such an equilibrium relationship exists, as local monetary policy is almost surely determined either by forecasts of local macroeconomic fundamentals, global variables, or the base-country policy rate. Moreover, while the corresponding tests have been worked out at the country level, they are not available in the panel context. One could then argue that it would be best to resort to panel cointegration analysis, which is, however, known to be rather sensitive to the assumptions on the nature of cross-country heterogeneity under the null and alternative hypotheses, as well as to pretesting for unit roots in panel data, which has its own, nontrivial pitfalls. We thus proceed assuming that there exists an equilibrium relationship between local policy rate, forecasts of local macroeconomic fundamentals, global variables, and base-country policy rates without carrying out formal tests at the (cross-)country level.

2.2 Data and Definition of Variables

2.2.1 Sample Period and Economies Included

We consider a sample of monthly data for 10 SOEs in the (broadly defined) Asia and Pacific region. We only consider country-month observations with floating regimes. Specifically, we consider the de facto exchange rate regime classification of Shambaugh (2004) and Obstfeld, Shambaugh, and Taylor. (2010), and include in our sample only country-month observations that are classified as a “float,” i.e., we drop observations classified as a “peg” or a “soft peg.”⁷ We additionally require that for an economy to enter the sample there are at least 12 country-time observations. The resulting sample of economies includes Australia, Bangladesh, India, Indonesia, Israel, Malaysia, New Zealand, the Republic of Korea, Thailand, and Turkey.

⁷ In particular, a country-year observation is coded as a “peg” by Shambaugh (2004) in a particular year if its bilateral exchange rate vis-à-vis its base country stays within a $\pm 2\%$ band over the course of that year, or if its exchange rate changes only in one month. A country-year observation is coded as a “soft peg” by Obstfeld, Shambaugh, and Taylor(2010) if it is not classified as a “peg” and if the bilateral exchange rate vis-à-vis the base country stays within a $\pm 5\%$ band in a given year, or if there is no month in which the exchange rate changes by more than $\pm 2\%$.

We specify the US as the base country. The time period we consider spans from January 2002 to December 2012. However, we drop the time period from July 2007 to December 2009 in order to preclude that our estimates might be unduly driven by events related to the global financial crisis. We cannot consider the time period after 2012 because the data we use to measure economies' foreign-currency exposure are not available for later years (see below).

2.2.2 Real-time Forecasts and Global Variables

For the real-time forecasts of consumer price inflation and real GDP growth in x_{it}^e we would ideally use actual central bank projections. However, many central banks do not publish their projections. Moreover, among those central banks that do publish their projections, many produce them only a few times per year.⁸ For these reasons, instead of considering actual central bank projections, we use data on real-time forecasts from Consensus Economics (CE). In Georgiadis and Zhu (2019) we document that CE real-time forecasts are highly correlated with publicly available, actual central bank projections.⁹ We include twelve-months-ahead real-time forecasts of real GDP growth and inflation in x_{it}^e .¹⁰ In the vector of global variables z_t we include the first difference of the logarithm of global commodity prices, and the level of the VIX.

2.2.3 Local and Base-country Policy Rates

Our sample reaches into the period in which the Federal Reserve hit the zero lower bound. A widely used measure that reflects the Federal Reserve monetary policy stance during this time period is the shadow rate constructed by Wu and Xia (2016).^{11,12} All data on interest rates are obtained through Haver. For conventional policy rates we generally consider central bank policy rates obtained from the IMF's International Financial Statistics, amended in a few cases by data from country-specific sources.

⁸ This does not mean that policy makers are not updating their views on the outlook before monetary policy decision meetings that take place between the projection exercises. Typically the projections are updated between projection exercises using a variety of macroeconomic tools as well as anecdotal evidence and judgement. For example, the ECB's macroeconomic projections for the euro area are produced just four times a year, namely in March and September when they are produced by ECB staff alone, and in June and December when they are produced jointly by staff of euro area national central banks and the ECB. For the monetary policy decision meetings that take place between the projection exercises, the projections are updated using a variety of macroeconomic tools.

⁹ Notice that using CE forecasts has the advantage that we can consider a large number of economies at the monthly frequency. Monthly data on real activity and inflation are typically available only for a smaller set of economies, and there are generally no real-time data available. Moreover, for real activity one would typically consider industrial production, which is not defined identically across economies, and is more volatile than, and also only reflects a limited share of, overall real activity.

¹⁰ One disadvantage of CE data is that they are fixed-event forecasts; that is, for example, a forecast in month t in year T of real GDP growth over year $T+1$. We adopt the approach of Dovern, Fritzsche, and Slacalek (2012) to transform the CE fixed-event forecasts into fixed-horizon forecasts.

¹¹ Longer-term, such as two-year, rates are another frequently used alternative. However, these are not available for several of the EMEs in our sample and/or for the sample period we consider. Moreover, even for the base countries we consider these have been close to, or essentially at, the zero lower bound, especially for the euro area, for which German Bund yields are typically used.

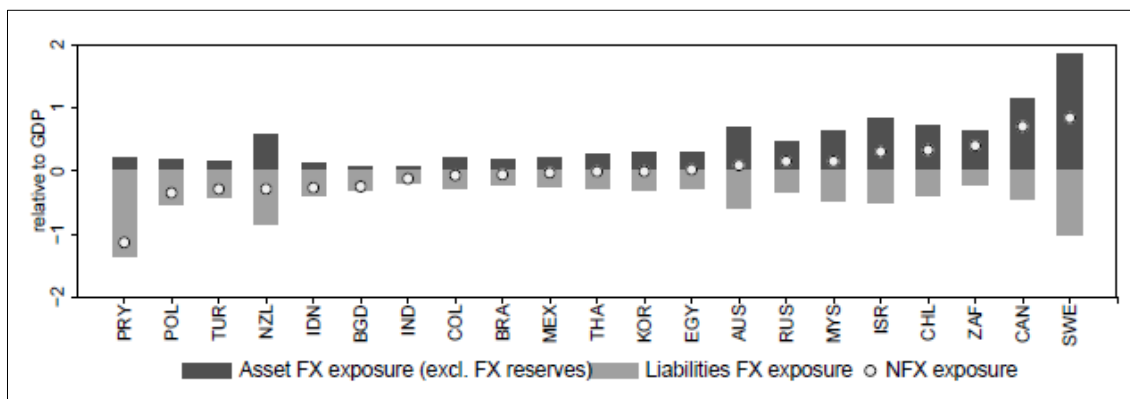
¹² Notice that even when short-term interest rates hit the zero lower bound, monetary policy – and in particular forward guidance – matters for exchange rate determination. This can easily be seen by iterating forward the UIP condition and noticing that one of the fundamental determinants of the spot exchange rate is the path of future expected short-term interest rates, the so-called “expectations component” of the yield curve. Incidentally, shadow rates are constructed exploiting information about the entire yield curve, thereby including the latter expectations component and thus being particularly appealing in a sample period in which the zero lower bound was binding.

2.2.4 Foreign-currency Exposure Measurement and Data

We use the data on foreign-currency exposures of Lane and Shambaugh (2010a) as well as the update provided by Benetrix, Lane, and Shambaugh (2015). Unfortunately, at the time of writing the data of Lane and Shambaugh (2010a) and Benetrix, Lane, and Shambaugh (2015) are available only until 2012. Hence, and as mentioned above, we estimate the sensitivity of local to base-country policy rates based on Equations (1) and (2) only for the time period between January 2002 and December 2012. For the regressions we linearly interpolate the foreign-currency exposure data – which are available at the annual frequency – to monthly frequency. Figure 2 presents the averages of the foreign-currency-denominated foreign assets and liabilities relative to GDP over the time period from 2002 to 2012 – excluding foreign exchange reserves on the asset side – for the Asia and Pacific SOEs in the country sample of this study as well as an additional set of economies considered in Georgiadis and Zhu (2019).

Lane and Shambaugh (2010a) define the *net* foreign-currency exposure as the difference between the foreign-currency-denominated foreign assets and liabilities, both scaled by GDP. The net foreign-currency exposure is negative (positive) for an economy that is net short (long) in foreign currency on its external balance sheet. When an economy is net short in foreign currency, a depreciation of its currency implies an exchange rate valuation loss on its external balance sheet, as the local-currency value of its foreign-currency-denominated foreign assets rises by a smaller amount than that of the foreign-currency-denominated foreign liabilities. More specifically, the net foreign-currency exposure also reflects the change in an economy's net foreign asset position relative to GDP that results from a uniform depreciation of its currency against all foreign currencies by 1% (see Appendix B in Georgiadis and Mehl 2015). Hence, in terms of economic magnitude, Indonesia's net foreign-currency exposure of about –25% of GDP implies that its net foreign asset position relative to GDP would decline by 0.25 percentage points if its currency depreciated by 1%. Thus, for many of the economies in our sample the net foreign-currency exposures are economically nontrivial.

Figure 2: Foreign-currency Exposures from 2002 to 2012



Note: The figure shows the net foreign-currency exposure relative to GDP averaged over the sample period from 2002 to 2012. The data are taken from Lane and Shambaugh (2010a) as well as Benetrix, Lane, and Shambaugh. (2015).

3. EMPIRICAL RESULTS

In this section we present the results for the estimation of Equations (1) and (2). In order to account for alternative motivations for fear of floating, in Equation (2) we include additional variables interacted with the base-country policy rate. In particular, we interact the base-country policy rate with estimates of the SOE's exchange rate pass-through to consumer prices (Hausmann, Panizza, and Stein 2001). Moreover, we interact the base-country policy rate with the SOE's stock of foreign exchange reserves, which indicates the government's ability to support firms that are running out of foreign currency in the case of funding stress;¹³ a large stock of reserves also indicates ample ammunition for exchange rate interventions. For ease of interpretation of the coefficient estimates in the regression tables, we standardize the data on net foreign-currency exposure variables in ξ_{it} .

3.1 Baseline Results for the Role of Foreign-currency Exposures in Fear of Floating

Column (1) in Table 1 reports the result of the regression of Equation (1), i.e., without any interaction terms between the base-country policy rate and the SOE's foreign-currency exposure. The coefficient estimate on the base-country policy rate is positive and statistically significant. The evidence in column (1) suggests that SOE monetary policy responds to exchange rate pressures of the local against the base-country currency *over and above* what we would expect if macroeconomic stabilization was the only policy objective. The evidence is thus consistent with SOEs from Asia and the Pacific having exhibited fear of floating in the early 2000s. We next test for the role of foreign-currency exposures in shaping this fear of floating.

Column (2) reports the results from the regression of Equation (2) in which we add interaction terms between the base-country policy rate and the SOE's foreign-currency asset and liability exposures shown in Figure 2; note that for the regressions we use positive numbers for the foreign-currency foreign liabilities, in contrast to Figure 2. The coefficient estimates for the SOE's foreign-currency foreign asset and liability exposures are negative and positive, respectively, and statistically significant. The positive sign of the coefficient estimate on the interaction with the liability foreign-currency exposure is consistent with the notion that variations in the exchange rate give rise to variations in whether borrowing constraints of SOE firms with foreign-currency foreign liabilities are binding, and hence elicit positive feedback effects that might jeopardize financial stability and that monetary policy may want to prevent by reducing exchange rate variation. In turn, the negative coefficient estimate on the interaction with the foreign-currency foreign asset exposure is consistent with the notion that there are offsetting valuation effects on firms' balance sheets that mitigate the extent to which variations in the exchange rate give rise to variations in whether borrowing constraints are binding. The results are thus consistent with the hypothesis that the fear of floating documented in column (1) is at least partly due to the financial stability implications of foreign-currency exposures.¹⁴

¹³ Estimation of the exchange rate pass-through to consumer prices is described in Georgiadis and Zhu (2019).

¹⁴ Note that the coefficient estimate on the interaction between the base-country policy rate and the SOE's foreign exchange reserves is consistent with the findings in Cheng and Rajan (2019). Specifically, Cheng and Rajan (2019) find that the sensitivity of an SOE to base-country policy rates is reduced when the SOE features larger foreign exchange reserves.

Table 1: Foreign-currency Exposures and the Sensitivity of SOE Policy Rates to Base-country Policy Rates

	(1)	(2)	(3)	(4)	(5)	(6)
Base-country policy rate	0.41** (0.03)	0.53*** (0.00)	0.50*** (0.00)	0.53*** (0.00)	0.53** (0.00)	0.52*** (0.00)
× FX assets rel. to GDP		−0.81*** (0.01)				
× FX liabilities rel. to GDP		0.76*** (0.00)				
× NFX rel. to GDP			−0.72*** (0.01)			
× NFX rel. to GDP × I(NFX ≥ 0)				−0.34* (0.06)		
× NFX rel. to GDP × I(NFX < 0)				−0.50* (0.06)		
× Non-debt NFX rel. GDP					−0.61 (0.11)	−0.54 (0.17)
× Debt NFX rel. to GDP					−0.52*** (0.00)	
× Debt NFX rel. to GDP × I(NFX ≥ 0)						−0.21** (0.02)
× Debt NFX rel. to GDP × I(NFX < 0)						−0.52*** (0.01)
× FX reserves rel. to GDP		−0.59** (0.04)	−0.77*** (0.00)	−0.64*** (0.01)	−0.84* (0.06)	−0.77* (0.07)
× ERPT		−0.11 (0.79)	−0.46 (0.24)	−0.07 (0.87)	−0.36 (0.51)	−0.30 (0.56)
R-squared (within)	0.12	0.20	0.18	0.17	0.19	0.20
Observations	513	513	513	513	513	513
Countries	10	10	10	10	10	10

Note: *p*-values in parentheses, **p* < 0.1, ***p* < 0.05, ****p* < 0.01. Driscoll-Kraay robust standard errors. Coefficient estimates of real-time forecasts and global variables not reported.

Given the coefficient estimates on the foreign-currency asset and liability exposures in column (2), in order to increase efficiency in the following we consider the latter's difference, i.e., economies' *net* foreign-currency exposures. While doing so, it should be understood that a balanced net foreign-currency exposure might mask large gross exposures. As for the analysis of gross relative to net capital flows, large gross flows and foreign-currency exposures might imply nontrivial vulnerabilities even if the net positions are balanced. Moreover, to the extent that negative foreign-currency exposures are concentrated in systemic sectors or firms – such as large banks – exchange rate variation might have a nontrivial effect on the local financial cycle even if the SOE's aggregate net foreign-currency exposure is balanced or even positive.

With these words of caution in mind, column (3) reports the results from a regression in which we enter an interaction term between the base-country policy rate and the SOE's net foreign-currency exposure. The relevant coefficient estimate is negative and highly statistically significant, which is consistent with the results in column (1). The results thus suggest that the sensitivity of the SOE to the base-country policy rate falls with the former's net foreign-currency exposure; put differently, the sensitivity increases with the SOE's net short position and falls with its net long position. Again, this finding is consistent with the hypothesis that exchange rate variation has affected financial cycles in SOEs, and in particular that SOE monetary policy has attempted to reduce exchange rate variation by mimicking base-country monetary policy in order to mitigate

associated financial stability risks (Basci, Ozel, and Sarikaya 2008; Gudmundsson 2017; Vegh, Morano, and Friedheim 2018).

3.2 Results for Net Long/Short Positions and Different Financial Instruments

Columns (4) to (6) document results from regressions that explore more refined hypotheses regarding the role of foreign-currency exposures for shaping fear of floating in SOE monetary policy. First, column (4) reports results from a regression that distinguishes between negative and positive net foreign-currency exposures. The coefficient estimates on the interaction terms between the base-country policy rate and positive and negative net foreign-currency exposures are statistically significant. Notice that the coefficient estimate on the interaction with the negative net foreign-currency exposure is much larger than that on the interaction with the positive net foreign-currency exposure. This finding is consistent with the emphasis on negative foreign-currency exposures – i.e., net short positions – in the context of the financial channel of exchange rates and its financial stability implications of foreign-currency exposures. Specifically, variations in the exchange rate are more likely to induce positive feedback loops – i.e., loosen firms' borrowing constraints in the case of positive shocks to the economy that are followed by local currency appreciation and tighten borrowing constraints in the case of adverse shocks such as base-country monetary policy tightening that are followed by local currency depreciation – when an SOE is net *short* in foreign currency.

Second, the overall net foreign-currency exposure arises as the sum of individual components. Specifically, in terms of instruments, in the definition of Lane and Shambaugh (2010a) the overall net foreign-currency exposure is the sum of debt and nondebt components.¹⁵ Interestingly, differences in the payoff and maturity structures between these two instruments imply testable predictions that allow us to corroborate the evidence that foreign-currency exposures shape fear of floating. In particular, foreign-currency exposures imply greater vulnerabilities if they stem from more fickle portfolio debt instruments and bank loans with nonstate-contingent payoffs than from more stable FDI and portfolio equity instruments with state-contingent payoffs and longer investment horizons. Indeed, Lane and Milesi-Ferretti (2012) and Milesi-Ferretti and Tille (2011) document that bank loans and other investment instruments exhibited the greatest volatility during the retrenchment in global capital flows in the global financial crisis; similarly, Forbes and Warnock (2012) document that debt instruments are particularly likely to exhibit abrupt swings in capital flows. Against this background, we expect that SOE monetary policy is more concerned about dampening the financial cycle when the economy's net foreign-currency exposure stems from debt rather than nondebt instruments. In line with these predictions, the results in columns (5) and (6) suggest that the sensitivity of SOEs to base-country policy rates is indeed stronger for smaller – in particular negative – debt net foreign-currency exposures.

¹⁵ In the data of Lane and Shambaugh (2010a) and Benetrix, Lane, and Shambaugh (2015) nondebt instruments are given by portfolio equity and FDI, and debt instruments by portfolio debt and other investment including bank loans. Lane and Shambaugh (2010a) and Benetrix, Lane, and Shambaugh (2015) assume that portfolio equity and FDI are always denominated in the currency of the issuer. Hence, a nondebt net foreign-currency exposure stems exclusively from holdings of foreign-currency-denominated foreign portfolio equity and FDI and can only assume positive values.

3.3 Results for Fear of Floating across Local-currency Appreciations and Depreciations

It is natural to explore asymmetries not only in the sign of economies' net foreign-currency exposures, but also in the direction of change of the base-country policy rate. Specifically, immediate financial stability risks arise in particular in the case of a depreciation of the local currency and in the presence of negative net foreign-currency exposures. In contrast, even if the optimal policy is symmetric in theory, for political economy reasons it may plausibly be more difficult for SOE monetary policy to limit local-currency appreciation when base-country monetary policy is loosened in order to dampen a buildup of foreign-currency liabilities that could threaten financial stability only later when the tide turns as base-country monetary policy is tightened. Against this background, we expect the sensitivity of an SOE to base-country monetary policy to be greater when the latter is tightened rather than when it is loosened, and when the SOE exhibits negative net foreign-currency exposures. To test these predictions, we first run a regression analogous to that in Equation (1), but we additionally enter separate coefficients for the cases in which the base-country policy rate is raised and when it is lowered.

Table 2: Accounting for Asymmetries in the Sensitivity of SOE Policy Rates to Base-country Policy Rates

	(1)	(2)	(3)	(4)
Base-country policy rate	0.41** (0.03)			
$\times I(\Delta i_{b,t}^P \geq 0)$		0.41** (0.04)	0.50*** (0.00)	0.25 (0.15)
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP}$			-0.75*** (0.01)	
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP} \times I(\text{NFX} \geq 0)$				-0.42 (0.14)
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP} \times I(\text{NFX} > 0)$				-1.19*** (0.00)
$\times I(\Delta i_{b,t}^P \geq 0)$		-2.98 (0.31)	-1.87 (0.40)	-2.72 (0.29)
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP}$			-0.35 (0.69)	
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP} \times I(\text{NFX} \geq 0)$				3.65 (0.17)
$\times I(\Delta i_{b,t}^P \geq 0) \times \text{NFX exposure rel. to GDP} \times I(\text{NFX} < 0)$				-1.85** (0.04)
$\times \text{FX reserves rel. to GDP}$			-0.82*** (0.00)	-0.70*** (0.00)
$\times \text{ERPT}$			-0.48 (0.27)	-0.24 (0.52)
R-squared (within)	0.12	0.14	0.20	0.21
Observations	513	513	513	513
Countries	10	10	10	10

Note: p-values in parentheses, *p < 0.1, **p < 0.05, ***p < 0.01. Driscoll-Kraay robust standard errors. Coefficient estimates of real-time forecasts and global variables not reported.

Accordingly, column (2) in Table 2 reports the results from a regression with separate coefficients for increases and reductions in the base-country policy rate without any interactions with foreign-currency exposure variables. In line with the hypothesis that the trade-off between financial stability and macroeconomic stabilization for SOE monetary policy is perceived to be weaker by policy makers when the local currency appreciates, we find that the sensitivity of SOE policy rates to base-country policy rates documented in the baseline results in Table 1 exclusively stems from cases in which base-country monetary policy is tightened; hence, our findings indicate evidence of a narrower “fear of depreciation” rather than a more general, symmetric fear of floating.

Column (3) in Table 2 reports results from a regression analogous to that in Equation (2) in which we combine the hypothesis relating to asymmetries in the sensitivity of SOE monetary policy to base-country monetary policy across local-currency depreciations and appreciations with that relating to differences in foreign-currency exposures. Specifically, we consider separate interaction terms between the base-country policy rate and SOEs’ net foreign-currency exposures for the cases in which the former is raised and in which it is lowered. In line with the previous findings, the results suggest that the sensitivity of the SOE to the base-country policy rate when the latter is raised is amplified the smaller the net foreign-currency position, i.e., the more net short/the less net long in foreign currency the SOE is on its external balance sheet. In contrast, none of the coefficient estimates relating to the instances in which base-country monetary policy is loosened is statistically significant.

Finally, in column (4) we report results from a regression in which we again introduce separate interaction terms between the base-country policy rate when it is raised/lowered as well as negative/positive net foreign currency exposures, respectively. As in columns (4) and (6) in Table 1, only the coefficient estimate involving the interaction with the negative net foreign-currency exposure is statistically significant. This finding suggests that the sensitivity of an SOE to base-country monetary policy is particularly strong when the latter is tightened and the SOE is net short in foreign currency on its external balance sheet. This is the classic context in which several EME currency crises have erupted in the past, and hence it may not be surprising that this case stands out in our estimates. However, and in contrast to the results for the broader country sample considered in Georgiadis and Zhu (2019), the coefficient estimate on the base-country monetary policy loosening interacted with a negative net foreign-currency exposure also is statistically significant. This suggests that SOEs in Asia and the Pacific may potentially be subject to a somewhat more symmetric fear of floating.

4. CONCLUSION

We estimate dynamic panel data regressions for a panel of 10 SOEs in the Asia and Pacific region with floating exchange rate regimes for the period from 2002 to 2012 in order to assess whether local responds to base-country monetary policy over and above what we would expect to observe if macroeconomic stabilization was the only policy objective. We find that the data are consistent with the hypothesis that SOE monetary policy in floating exchange rate regimes is generally subject to fear of floating, and that this is at least in part due to threats to financial stability implied by foreign-currency exposures. We find that the evidence of fear of floating due to financial stability considerations is particularly pronounced when the foreign-currency exposures arise through debt rather than nondebt instruments and when base-country monetary policy is tightened. In this context, mimicking base-country monetary policy tightening reduces exchange rate depreciation and thereby prevents negative valuation effects on the economy’s external balance sheet from making local borrowers hit borrowing constraints.

From a policy perspective, our findings are particularly relevant at the current juncture, as many EME corporates have accumulated large foreign-currency – typically US dollar – debt liabilities and US monetary policy is expected to be tightened, at least in the medium term.

REFERENCES

- Akinci, O., Queralto, A., 2019. Exchange Rate Dynamics and Monetary Spillovers with Imperfect Financial Markets. Federal Reserve Bank of New York Staff Reports 849.
- Aldasoro, I., Ehlers, T., 2018. Global Liquidity: Changing Instrument and Currency Patterns. BIS Quarterly Review.
- Aoki, K., Benigno, G., Kiyotaki, N., 2018. Monetary and Financial Policies in Emerging Markets. Mimeo, Princeton University.
- Basci, E., Ozel, O., Sarikaya, C., 2008. The Monetary Transmission Mechanism in Turkey: New Developments, in: for International Settlements, B. (Ed.), *Transmission Mechanisms for Monetary Policy in Emerging Market Economies*. Bank for International Settlements. Volume 35 of BIS Papers chapters, pp. 475–499.
- Benetrix, A., Lane, P., Shambaugh, J., 2015. International Currency Exposures, Valuation Effects and the Global Financial Crisis. *Journal of International Economics* 96, 98–209.
- BIS, 2019. Statistical Release: BIS Global Liquidity Indicators at End-March 2019. BIS Global Liquidity Indicators.
- Bruno, V., Shin, H.S., 2015. Cross-Border Banking and Global Liquidity. *Review of Economic Studies* 82, 535–564.
- Calvo, G., Reinhart, C., 2002. Fear of Floating. *Quarterly Journal of Economics* 117, 379–408.
- Carstens, A., 2019. Exchange Rates and Monetary Policy Frameworks in Emerging Market Economies. Lecture by BIS General Manager Agustín Carstens at the London School of Economics.
- Céspedes, L.F., Chang, R., Velasco, A., 2004. Balance Sheets and Exchange Rate Policy. *American Economic Review* 94, 1183–1193.
- Cheng, R., Rajan, R., 2019. Monetary Trilemma, Dilemma or Something in Between? mimeo.
- Choi, W.G., Cook, D., 2004. Liability Dollarization and the Bank Balance Sheet Channel. *Journal of International Economics* 64, 247–275.
- Cook, D., 2004. Monetary Policy in Emerging Markets: Can Liability Dollarization Explain Contractionary Devaluations? *Journal of Monetary Economics* 51, 1155–1181.
- Davis, J., 2017. External Debt and Monetary Policy Autonomy. *Revista ESPE – Ensayos Sobre Política Económica* 35, 53–63.
- Davis, S., Presno, I., 2017. Capital Controls and Monetary Policy Autonomy in a Small Open Economy. *Journal of Monetary Economics* 85, 114–130.
- Devereux, M., Lane, P.R., Xu, J., 2006. Exchange Rates and Monetary Policy in Emerging Market Economies. *Economic Journal* 116, 478–506.
- Dovern, J., Fritzsche, U., Slacalek, J., 2012. Disagreement Among Forecasters in G7 Countries. *Review of Economics and Statistics* 94, 1081–1096.

- Durdu, B., A. Martin, and I. Zer, 2019, The Role of U.S. Monetary Policy in Global Banking Crises, Finance and Economics Discussion Series 2019–039. Board of Governors of the Federal Reserve System.
- Eichengreen, B., Hausmann, R., 1999. Exchange rates and financial fragility. Proceedings – Economic Policy Symposium – Jackson Hole, 329–368.
- Elekdag, S., Tchakarov, I., 2007. Balance Sheets, Exchange Rate Policy, and Welfare. *Journal of Economic Dynamics and Control* 31, 3986–4015.
- Faia, E., 2010. Financial Frictions and the Choice of Exchange Rate Regimes. *Economic Inquiry* 48, 965–982.
- Forbes, K., Warnock, F., 2012. Capital Flow Waves: Surges, Stops, Flight, and Retrenchment. *Journal of International Economics* 88, 235–251.
- Georgiadis, G. and Schumann, B., 2019. Dominant-currency Pricing and the Global Output Spillovers from US Dollar Appreciation, ECB Working Paper 2308.
- Georgiadis, G. Zhu, F., 2019, Monetary Policy Spillovers, Capital Controls and Exchange Rate Flexibility, and the Financial Channel of Exchange Rates, ECB Working Paper, 2267.
- Georgiadis, G., Mehl, A., 2015. Trilemma, not Dilemma: Financial Globalisation and Monetary Policy Effectiveness. Federal Reserve Bank of Dallas Globalization Institute Working Paper 222.
- Gertler, M., Gilchrist, S., Natalucci, F.M., 2007. External Constraints on Monetary Policy and the Financial Accelerator. *Journal of Money, Credit and Banking* 39, 295–330.
- Gopinath, G., Casas, C., Diez, F., Gourinchas, P.O., Plagborg-Moller, M., 2020. Dominant Currency Paradigm. *American Economic Review* 110(3), 677–719.
- Gourinchas, P.O., 2018. Monetary Policy Transmission in Emerging Markets: An Application to Chile, in: Mendoza, E., Past_en, E., Saravia, D. (Eds.), *Monetary Policy and Global Spillovers: Mechanisms, Effects and Policy Measures*. Central Bank of Chile. Volume 25 of Central Banking, Analysis, and Economic Policies Book Series. Chapter 8, pp. 279–324.
- . 2019. The Dollar Hegemon? Evidence and Implications for Policy Makers. Prepared for the 6th Asian Monetary Policy Forum held on 31 May 2019 in Singapore.
- Gudmundsson, M., 2017. Global Financial Integration and Central Bank Policies in Small, Open Economies. *The Singapore Economic Review* 62, 135–146.
- Hausmann, R., Panizza, U., Stein, E., 2001. Why Do Countries Float the Way They Float? *Journal of Development Economics* 66, 387–414.
- Judson, R., Owen, A., 1999. Estimating Dynamic Panel Data Models: A Guide for Macroeconomists. *Economics Letters* 65, 9–15.
- Klein, M., Shambaugh, J., 2015. Rounding the Corners of the Policy Trilemma: Sources of Monetary Policy Autonomy. *American Economic Journal: Macroeconomics* 7, 33–66.
- Kolasa, M., Lombardo, G., 2014. Financial Frictions and Optimal Monetary Policy in an Open Economy. *International Journal of Central Banking* 10, 43–94.
- Lane, P., Milesi-Ferretti, G.M., 2012. External Adjustment and the Global Crisis. *Journal of International Economics* 88, 252–265.

- Lane, P., Shambaugh, J., 2010a. Financial Exchange Rates and International Currency Exposures. *American Economic Review* 100, 518–40.
- . 2010b. The Long or Short of it: Determinants of Foreign Currency Exposure in External Balance Sheets. *Journal of International Economics* 80, 33–44.
- Milesi-Ferretti, G.M., Tille, C., 2011. The Great Retrenchment: International Capital Flows During the Global Financial Crisis. *Economic Policy* 26, 285–342.
- Mimir, Y., Sunel, E., 2019. External Shocks, Banks, and Optimal Monetary Policy: A Recipe for Emerging Market Central Banks. *International Journal of Central Banking* 15, 235–299.
- Obstfeld, M., Shambaugh, J., Taylor, A., 2005. The Trilemma in History: Trade-offs Among Exchange Rates, Monetary Policies, and Capital Mobility. *Review of Economics and Statistics* 87, 423–438.
- . 2010. Financial Stability, the Trilemma, and International Reserves. *American Economic Journal: Macroeconomics* 2, 57–94.
- Pesaran, M., Shin, Y., 1999. An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, in: Strom, S. (Ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*. Cambridge: Cambridge University Press.
- Pesaran, M., Shin, Y., Smith, R., 2001. Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics* 16, 289–326.
- Rappoport, V., 2009. Persistence of Dollarization After Price Stabilization. *Journal of Monetary Economics* 56, 979–989.
- Rülke, J.C., 2012. Are Central Bank Projections Rational? *Applied Economics Letters* 19, 1257.
- Shambaugh, J., 2004. The Effect of Fixed Exchange Rates on Monetary Policy. *Quarterly Journal of Economics* 119, 300–351.
- Vegh, C., Morano, L., Friedheim, D., Rojas, D., 2018. Between a Rock and a Hard Place: The Monetary Policy Dilemma in Latin America and the Caribbean. LAC Semi-annual Report. The World Bank.
- Wu, J., Xia, F., 2016. Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound. *Journal of Money, Credit and Banking* 48, 253–291.