Currency-Induced External Balance Sheet Effects at the Onset of the COVID-19 Crisis*†

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Abstract

At the onset of the COVID-19 economic crisis, as in other crisis episodes, the flight to safety was accompanied by a rapid appreciation of "safe haven" currencies. We quantify the aggregate external balance sheet effects of this episode using new data on the currency composition of cross-border portfolio debt and other investment (which mostly represents banking positions) for 48 countries. We find that, while currency mismatch was present on many countries' external balance sheets at the onset of the current crisis, the magnitude of this mismatch was modest and the resulting external balance sheet losses at the aggregate level are small. To account for the potential mismatch that may have resulted from *domestic* investments by financial intermediaries borrowing abroad, we compute an upper bound for possible losses and find that they might be quite sizable for a number of countries. These results highlight the importance of accounting for domestic assets when assessing currency-induced balance sheet effects.

Keywords: currency mismatch, balance sheet effects, COVID-19, coronavirus, flight to safety

JEL classification: F32, F34, G15

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1 Introduction

Flight to safety in times of economic turmoil is now well documented and understood in the literature (see, for example, Hartmann, Straetmans, and Vries, 2004; and Beber, Brandt and Kavajecz, 2009).[1] Akin to other crisis experiences, during the COVID-19 crisis, flight to safety was accompanied by a rapid appreciation of safe haven currencies, especially the U.S. dollar. As a counterpart, values of many emerging economies' currencies have declined considerably (Figure 1), in line with the description in Corsetti, Lloyd and Marin (2020).

History teaches us that sharp unexpected changes in exchange rates are likely to produce significant balance sheet losses for countries with a disproportionate share of foreign currency liabilities relative to foreign currency assets.[2] But is this time different? Until recently, it was hard to address this question directly for aggregate external balance sheets at a global scale due to the lack of information on the currency breakdown of external asset and liability positions.[3] A recent data set released by the IMF makes this exercise possible.

In this paper, we assess the size of the aggregate external balance sheet effects resulting from the sharp appreciation of major currencies during the early phase of the COVID-19 crisis, from January 1 to March 31 2020. To do so, we build on the novel data set published by the IMF (Bénétrix, Gautam, Juvenal, and Schmitz, 2019), which provides the currency composition of countries' stock of external assets and liabilities. Our sample includes 48 economies, both advanced and emerging. We focus on the debt portion of external assets and liabilities which comprises portfolio debt and other investment. We exclude portfolio equity and FDI from our calculations for two reasons. First, equity liabilities are denominated in the currency of the host country (domestic currency) while equity assets are mostly denominated in foreign currencies. As a result, any depreciation of the domestic currency will lead to currency-induced improvements in equity positions on countries' external balance sheets. Second, as Gourinchas, Rey, and Govillot (2010) show, in times of global economic stress there is a net transfer from the U.S. to the rest of the world on external equity

[1] This is documented also in Baele, Bekaert, Inghelbrecht, and Wei (2019).

[2] Balance sheet effects of currency depreciation drew attention following the Asian financial crisis in 1997-98 (see, for example, Corsetti, Pesenti, and Roubini, 1999).

[3] The first effort to obtain the currency breakdown of the international investment position was by Lane and Shambaugh (2010). However, the most updated dataset is only available up to 2012.

positions. Thus, including equity in our calculations would mitigate losses associated with currency-induced balance sheet effects resulting from the flight to safe currencies.[4]

For each country, we compute balance sheet costs of changes in the exchange rate as elasticities of total *net* debt liabilities, as a share of total debt assets, with respect to the change in the value of the U.S. dollar relative to the domestic currency and to other global currencies.[5] We make these calculations separately for two asset classes: portfolio debt and other debt investment.[6] The sum of these elasticities weighted by the observed change in corresponding exchange rates gives us the total change in net liabilities as a result of all exchange rate changes for each asset class. We also calculate total balance sheet costs (or gains) in U.S. dollars resulting from these currency-induced valuation effects.

Overall, we observe that currency-induced balance sheet losses during the early stage of the COVID-19 economic crisis were modest in magnitude, despite the fact that some emerging markets currencies depreciated substantially. This indicates that currency mismatches accumulated on most countries aggregate external balance sheets were quite modest at the end of 2019. We acknowledge, however, that in this paper we only focus on currency-induced valuation effects and do not account for capital flows or any valuation effects resulting from asset price changes.[7]

One important caveat of our analysis is that aggregate positions may mask substantial currency mismatches on balance sheets of individual institutions or for more granular asset classes.[8] While we do not have access to institution-level data, we conduct our analysis separately for portfolio debt assets and liabilities and for other debt investment assets and liabilities, which consist mostly of banking positions. Even this disaggregation reveals that for some countries there is an offset of currency mismatches across these two asset classes, suggesting that further disaggregation may reveal larger losses.

[4]In fact, we observe large currency-induced valuation gains for the U.S. in the early 2020 on portfolio debt positions, in contrast with what we would expect to find for equity.

[5]We count as global currencies the "big four" currencies according to Aizenman, Cheung, and Qian (2020). These are: the U.S. dollar, the British pound, the euro, and the Japanese yen.

[6]Other investment is mostly composed of debt positions and we will refer to it as "other debt investment" and "other investment" interchangeably.

[7]Hofmann, Shim, and Shin (2020) emphasize that emerging markets with higher shares of foreign ownership in local currency markets experienced larger increases in local bond spreads and higher capital outflows.

[8]By focusing on aggregate external balance sheets we also miss any effects of domestic dollarization as described in Luca and Petrova (2008) and Fidrmuc, Hake, and Stix (2013) for the case of transition economies.

An even more important omission arises from the fact that the financial intermediation sector is likely to accumulate currency mismatches on its balance sheet by borrowing abroad but investing domestically in local currency. While we do not have data on the currency breakdown of domestic investment or the source of funding of domestic investment, we make two assumption to compute an upper bound of currency-induced balance sheet losses from such financial intermediation. First, we assume that the total value of external net liabilities is intermediated and lent or invested domestically in the form of domestic assets. Second, we assume that these domestic assets are denominated in home currencies. We then compute currency-induced losses on the U.S. dollar value of these hypothetical domestic assets and combine them with the total currency-induced valuation effects on external positions. Our findings indicate that the upper bound on the losses is substantial for some countries, in excess of 20 billion U.S. dollars. While this estimate is an upper bound, it points to the need of accounting for domestic investments when evaluating the balance sheet effects of currency depreciation.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 presents the methodology. The results are shown in Section 4 and Section 5 concludes. The Appendix provides additional details on the data.

2 Data

Our data set combines information on the stock of portfolio debt and other investment (assets and liabilities) for a sample of 48 countries, the currency composition of those items, and exchange rates.[9]

Since we are limiting our analysis to exchange-rate driven valuation effects and do not consider changes in asset prices or capital flows, we focus on the stocks of portfolio debt and other investment assets and liabilities at the end of 2019. Stocks data are sourced from the External Wealth of Nations data set by Lane and Milesi-Ferretti (2007).[10,11]

[9] See Table A.1 in the Appendix for details on the country coverage.

[10] We use gross asset and liability positions for each of the two asset classes considered. Technically, these positions are "gross net" positions, net of repayments.

[11] For some countries, 2019 data are not yet available and we therefore use stocks as of the end of 2018. For the

The currency composition of gross assets and liabilities builds on a novel data set on currency exposures published by the IMF.[12] The main source of currency composition data is a survey sent to country authorities by the IMF Research Department in collaboration with the Statistics Department. The survey requested data on the main components of the international investment position (IIP) broken down into five main currencies (i.e. U.S. dollar, euro, Japanese yen, British pound and renminbi), domestic currency (when different from the previous five), and "other currencies" which include all the other foreign currencies not included in the previous categories. Country authorities responded to the survey on a voluntary basis and around 55 percent of countries reported some data. Currency composition data are only available through 2017, but Bénétrix et al. (2019) show that the breakdown has been very persistent in the last 10 years. Thus, we apply 2017 currency weights to 2019 stocks.

Table A.1 details the sources of currency composition data for each country in 2017. Actual data on the currency breakdown of portfolio debt assets was obtained from the IMF survey and complemented with the data reported in the Coordinated Portfolio Investment Survey (CPIS).[13] For the eleven countries for which actual data are not available, estimates from the IMF dataset are used.[14]

The currency composition of portfolio debt liabilities is also reported in the IMF survey. In the absence of actual data we fill the gaps using "synthetic data" obtained from two sources. For a subset of countries, the currency breakdown is from the Bank of International Settlements (BIS) International Debt Statistics. Since the BIS does not report the currency composition of domestically issued debt securities and there is no information on non-resident holdings of such securities, the share of domestic currency debt could be underestimated for emerging economies. To control for this, the share of debt denominated in domestic currency is taken from Arslanalp and Tsuda (2014) and the foreign currency shares are computed based on BIS international issuance data.

vintage of the data set we are using these are Chile, Egypt, Guatemala, Malaysia, Peru, and Philippines.

[12]See Bénétrix et al. (2019). Public data are available at: https://www.imf.org/en/Publications/WP/Issues/2019/12/27/Cross-Border-Currency-Exposures-48876.

[13]Table 2 of CPIS includes the currency of denomination of portfolio debt assets for a subset of countries.

[14]The estimation methods are described in Bénétrix et al. (2019).

The main component of other investment assets and liabilities is bank-related. Therefore, the actual survey data was complemented with the currency of denomination of banks' cross-border positions reported to the BIS Locational Banking Statistics.

For the purpose of this exercise, for each country, we focus on four global currencies: the U.S. dollar (USD), the British pound (GBP), the euro (EUR), and the Japanese yen (JPY), in addition to domestic currency. These currencies combined account for 92% of the total stock of external portfolio debt assets and liabilities and for 92% of other external investment assets and liabilities.

Nominal exchange rates at yearly frequency are from the External Wealth of Nations and the daily exchange rates for 2020 are from Datastream.

3 Measuring Balance Sheet Effects of Exchange Rate Changes

In order to evaluate the size of the balance sheet effect of exchange rate changes, we compute the percentage change in net liabilities of a given asset class, as a share of total assets of that class, that would result for a one percentage change in a given exchange rate. That is, we calculate the elasticity of net liabilities with respect to exchange rate changes. This elasticity gives us a balance sheet cost, as a share of total assets, that results from exchange rate movements and differences in currency composition of gross assets and liabilities for each asset class.

To illustrate our approach, we focus on one country and one asset class. Suppose a country has both assets and liabilities of this asset class denominated in three currencies, x, y, and z. Let us denote these as A_x, A_y, A_z and L_x, L_y, L_z. Assume that z is the domestic currency and x is the U.S. dollar. Because data are usually reported in U.S. dollars, we will measure everything relative to total assets expressed in U.S. dollars. Superscripts denote in which currency each portion of the balance sheet is measured. For example, A_z^x denotes the amount of assets that are denominated in domestic currency z but evaluated in U.S. dollars, or currency x. $A_z^x = E_{xz}A_z$, where E_{xz} is the exchange rate expressed as amount of currency x needed to buy one unit of currency z. Increase in E_{xz} indicates depreciation of currency x relative to currency z.

First, we express all assets A and all liabilities L in terms of x.

$$A^x_{all} = A_x + E_{xy}A_y + E_{xz}A_z,$$

$$L^x_{all} = L_x + E_{xy}L_y + E_{xz}L_z.$$

What is the exposure to movements in E_{xz}? From an accounting point of view, what matters is the change in net liabilities that results from a change in the exchange rate and the currency composition of gross assets and liabilities. If there is no currency mismatch on balance sheets, net liabilities will remain unchanged when relative prices of currencies change. We scale net liabilities by total assets of that asset class, assuming that any shortfall needs to be covered by a sale of an asset in the same class.

Thus, the exposure of total net liabilities of a given asset class, expressed in x as a share of the total amount of this asset is

$$\frac{\partial}{\partial E_{xz}} \frac{L^x_{all} - A^x_{all}}{A^x_{all}} = \frac{L_z}{A^x_{all}} - \frac{A_z L^x_{all}}{{A^x_{all}}^2} = \frac{L^x_z}{E_{xz}A^x_{all}} - \frac{A^x_z L^x_{all}}{E_{xz}{A^x_{all}}^2}. \tag{1}$$

Equation (1) gives us the effect of a *unit* change in the exchange rate and will depend on the scale of exchange rates and therefore not comparable across countries. Instead, we want to know the effect of a *percentage change* in the exchange rate.

Denote total net liabilities of a given asset class as a share of total assets of that class as $nl = (L^x_{all} - A^x_{all})/A^x_{all}$.

From (1), we established that

$$\mathrm{d}nl|_{E_{xz}} = \left[\frac{L^x_z}{E_{xz}A^x_{all}} - \frac{A^x_z L^x_{all}}{E_{xz}{A^x_{all}}^2}\right] \mathrm{d}E_{xz}.$$

Dividing both sides by $|nl|$, the absolute value of net liabilities, we get a unit-free elasticity of net liabilities in all currencies with respect to a change in E_{xz}:[15]

$$\frac{\mathrm{d}nl|_{E_{xz}}}{|nl|} = \frac{A^x_{all}L^x_z - L^x_{all}A^x_z}{A^x_{all}|L^x_{all} - A^x_{all}|} \times \frac{\mathrm{d}E_{xz}}{E_{xz}}. \tag{2}$$

Similarly,

$$\frac{\partial}{\partial E_{xy}} \frac{L^x_{all} - A^x_{all}}{A^x_{all}} = \frac{L_y}{A^x_{all}} - \frac{A_y L^x_{all}}{{A^x_{all}}^2} = \frac{L^x_y}{E_{xy}A^x_{all}} - \frac{A^x_y L^x_{all}}{E_{xy}{A^x_{all}}^2},$$

and the elasticity with respect to a change in E_{xy} is

$$\frac{\mathrm{d}nl|_{E_{xy}}}{|nl|} = \frac{A^x_{all}L^x_y - L^x_{all}A^x_y}{A^x_{all}|L^x_{all} - A^x_{all}|} \times \frac{\mathrm{d}E_{xy}}{E_{xy}}.$$

By combining the two elasticities together, we get the total change in net liabilities resulting from changes in all exchange rates:

$$\frac{\mathrm{d}nl}{|nl|} = \frac{A^x_{all}L^x_z - L^x_{all}A^x_z}{A^x_{all}|L^x_{all} - A^x_{all}|} \times \frac{\mathrm{d}E_{xz}}{E_{xz}} + \frac{A^x_{all}L^x_y - L^x_{all}A^x_y}{A^x_{all}|L^x_{all} - A^x_{all}|} \times \frac{\mathrm{d}E_{xy}}{E_{xy}}.$$

This measure generalizes to the total currency-induced valuation effect on net liabilities for K currencies as:

$$V \equiv \frac{\mathrm{d}nl}{|nl|} = \sum_{k=1,k\neq x}^{K} \left(\frac{A^x_{all}L^x_k - L^x_{all}A^x_k}{A^x_{all}|L^x_{all} - A^x_{all}|} \times \frac{\mathrm{d}E_{xk}}{E_{xk}} \right), \tag{3}$$

Intuitively, continuing with our example where x represents the U.S. dollar, a dollar appreciation (negative $\mathrm{d}E_{xk}$) will lead to increase in net liabilities ($V > 0$) if the share of non-dollar assets is higher than the share of non-dollar liabilities (negative numerator). In other words, liability dollarization leads to balance sheet losses from a 1% appreciation of the U.S. dollar with respect to all other currencies equal to a V percent increase in net liabilities.

[15] We use the absolute value to preserve the direction of the effect regardless of whether the country is a net lender or net borrower for a given asset class in a given currency.

3.1 Comparison with Other Measures

How does our measure of elasticity compare with other measures proposed in the literature? Lane and Shambaugh (2010) compute the valuation effect as a percentage change in the external-portfolio weighted exchange rate index they construct, multiplied by the sum of total external portfolio assets and liabilities (scaled by GDP). The measure that most closely resembles our valuation effect is a percentage change in what they call "financial exchange rate." It differs from ours in three main ways: first, they do not construct a measure by asset class, but rather a weighted average of all components of external assets and liabilities, including debt as well as equity; second, they compute the ratios of assets and liabilities in each currency to the sum of all assets and liabilities and then take the difference, rather than computing the ratio of net liabilities to total assets as we do; third, they use domestic currency as a numeraire, while we use the U.S. dollar. If expressed in continuous terms using our notation and restricted to a specific asset class, with currencies denoted as k, the Lane-Shambaugh measure is

$$V^{LS} = -\sum_{k=1,k\neq z}^{K} \left(\left(\frac{A_k^z - L_k^z}{A_{all}^z + L_{all}^z} \right) \times \frac{\mathrm{d}E_{zk}}{E_{zk}} \right), \tag{4}$$

where z denotes domestic currency. Note that V^{LS} here reflects *losses* resulting from domestic currencies *depreciating* with respect to global currencies.

Most other papers on currency mismatch either simply compute the share of all assets and all liabilities in foreign currency in total assets, liabilities, or sum of both, as described in Eichengreen, Haussman, and Panizza (2007). Papers that lack necessary data, use statistical inference to measure mismatch. For example, Alfaro, Asis, Chari, and Panizza (2017) infer currency mismatches from the response of firms' financial characteristics to exchange rate changes. Importantly, our measure reflects the impact of currency mismatch in *gross positions* on net liabilities as a share of total assets. Thus, our measure can be interpreted as a balance sheet cost of changes in exchange rates due to currency mismatch.

4 Currency-Induced Valuation Effects in Early 2020

We use our measure to compute changes in net liabilities that are due to the appreciation of major currencies between January 1 and March 31, 2020. For each country in our sample, we calculate the measure in equation (3) for $K = 4$ separately for portfolio debt and other investment net liabilities. Specifically, for country i the valuation effect is

$$V_i = D^i_{USD} * \varepsilon_{USD,i} + D^{EUR}_{USD} * \varepsilon_{USD,EUR} + D^{GBP}_{USD} * \varepsilon_{USD,GBP} + D^{JPY}_{USD} * \varepsilon_{USD,JPY}, \tag{5}$$

where D^i_{USD} is the percent depreciation of the U.S. dollar with respect to currency of country i (negative in most cases), and $\varepsilon_{USD,i} = (A^x_{all} L^x_z - L^x_{all} A^x_z)/(A^x_{all}|L^x_{all} - A^x_{all}|)$ is the first term of the elasticity from equation (2). Let V^p_i and V^b_i denote, respectively, currency-induced valuation effects for portfolio debt net liabilities and other investment net liabilities.

Figure 2 shows our calculations for V^p_i on the left panel and V^b_i on the right panel. We decompose total effects into those due to a movement of the home currency against the U.S. dollar, i.e. $D^i_{USD} * \varepsilon_{USD,i}$, represented with dark bars, and those due to global currencies moving against each other, represented with light bars. In both cases, the countries are sorted from largest increase in net liabilities (i.e. valuation losses), to largest valuation gains for the asset class in consideration.

In terms of portfolio debt liabilities, valuation gains on portfolio debt positions were more likely than valuation losses, with largest percentage gains recorded in South Korea (KOR), Russia (RUS), Colombia (COL), and Thailand (THA), all due to a domestic currency depreciation. This implies a relative prevalence of U.S. dollar portfolio debt assets relative to U.S. dollar portfolio debt liabilities in these countries.

We observe higher balance sheet losses on other investment positions. The largest percentage losses are due to other currency movements in Singapore (SGP) and Ireland (IRL). The largest percentage of valuation gains on other investment positions are observed due to a domestic currency depreciation in the Netherlands (NLD) (compensated, to some extent by other exchange rate movements), Russia (RUS), South Africa (ZAF), and Uruguay (URY).

The above calculations are reported as percentages of net liabilities over assets for each asset class. Thus, they are not easily combined across asset classes. They can also give a misleading ranking of countries or sense of magnitude if for some countries actual values of net liabilities in either asset class are small. To rectify this, we compute valuation changes in each asset class measured in million U.S. dollars by multiplying the percentage change in net liabilities over assets, by the absolute dollar value of net liabilities:

$$V_i^{\$} = V_i \, |L_{all,i}^x - A_{all,i}^x|. \tag{6}$$

Figure 3 shows the distribution of currency-induced valuation effects measured in U.S. dollars for both asset classes stacked together (without decomposing by the source of change as in Figure 2). The countries are ranked from highest U.S. dollar losses in total net liabilities to highest U.S. dollar gains.

Figure 3 allows us to observe the importance of actual net positions in overall effects. Largest currency-induced valuation losses are experienced by Japan (JPN), with the amount exceeding 20 billion U.S. dollars, mostly due to its portfolio debt positions. This is because JPY liabilities largely exceed JPY assets in Japan's external portfolio debt balances, combined with an appreciation of the Japanese yen with respect to all currencies (see Figure 1). The largest balance sheet losses in countries other than Japan, which are less than 5 billion U.S. dollars, are experienced by Switzerland (CHE), and, to a lesser extent, Singapore, China (CHN), Australia (AUS), and France (FRA).

For some countries, we observe a compensating mismatch of portfolio debt with other investment positions. This is the case in Sweden, Brazil (BRA), India (IND), and Ireland. The largest currency-induced valuation gains, in excess of 20 billion U.S. dollars in portfolio debt positions are observed for the U.K. (GBR), the U.S. (USA), and Canada (CAN). For the U.S., large valuation gains on portfolio debt net liabilities are mostly due to extensive net liabilities denominated in euros, which depreciated against the U.S. dollar. Turning the attention to other investment, we observe that the U.S. experienced moderate currency-induced valuation losses. By contrast, currency-induced valuation gains in Russia are mostly due to other investment.

Focusing on countries that experienced the largest domestic currency depreciations during the time period in consideration, South Africa and Brazil, we find external balance sheet gains in South

Africa in both asset classes, and bank balance sheet losses that are more than offset by portfolio debt balance sheet gains for Brazil. More generally, currency-induced balance sheet losses across both asset classes are modest in magnitude for most countries in our sample, not exceeding 1 billion U.S. dollars, except for top 7 countries in Figure 3.

4.1 Examples

Our results are somewhat surprising in the context of historical experiences in which currency depreciations lead to balance sheet losses, especially in emerging markets. To try to understand these results further, we explore two examples.[16]

South Africa. South Africa experienced balance sheet gains rather than losses, as a result of its 22.6% currency depreciation. In terms of portfolio debt, South Africa was a net borrower at the end of 2019, with portfolio debt liabilities of nearly 92 billion USD and portfolio debt assets of about 11 billion USD. Around 32% of portfolio debt liabilities were denominated in domestic currency and 49% were in USD, while portfolio debt assets were all in foreign currencies, including 46% in USD. Thus, the domestic currency depreciation lowered the liabilities but did not affect the assets, resulting in a nearly 5 billion USD improvement in South Africa's portfolio debt liabilities. Similarly, South Africa was a net borrower in terms of other investment positions with about 65 billion USD in liabilities and 39 billion USD in assets. Of other investment position liabilities, 48% were denominated in domestic currency and 39% in USD, while for assets, 23% were in domestic currency and 57% in USD. As a result, the domestic currency depreciation lowered liabilities by more than assets, with a net improvement of about 2.7 billion USD.

Japan. One country that shows significant balance sheet losses is Japan. The Japanese yen appreciated with respect to the U.S. dollar by 1.1%. Japan was a net lender in terms of portfolio debt at the end of 2019 — with net portfolio assets of about 1 trillion USD. The currency composition of portfolio debt assets and liabilities is quite unmatched. Liabilities are primarily denominated in

[16] The currency breakdown numbers quoted in these examples are either publicly available from the BIS or sourced from non-confidential data from the IMF.

JPY (85%) and in USD (13%). Assets, on the other hand, are 51% in USD, 19% in euro, and only 14% in JPY. Therefore, the Japanese yen appreciation led to large increase in net portfolio debt liabilities for Japan, of over 20 billion USD. In terms of other investment positions, Japan was a net borrower, with net liabilities of about 0.5 trillion USD. Looking at other investment positions denominated in JPY only, we see net liabilities equivalent to 42 billion USD. Given that the yen appreciated with respect to other major currencies, this resulted in increase in total net liabilities of just under 1 billion USD.

4.2 Role of Domestic Assets

In our analysis we focus exclusively on cross-border assets and liabilities. Therefore, it is not surprising that we find, for most countries, very small foreign asset positions in domestic currency, especially for portfolio debt. This is because very few countries issue debt instruments in foreign currencies that are not one of the main global currencies. As a result, we are not able to fully capture potential balance sheet losses for institutions that borrow abroad in variety of currencies and lend or invest domestically in domestic currency — the most likely source of currency mismatch on financial institutions' balance sheets. While we do not have institution-level data to analyze these effects directly, we can provide an upper bound to potential currency-induced valuation effects experienced by the financial intermediation sector.

To do so, we simply assume that the total value of net foreign liabilities, regardless of the asset class, is lent or invested domestically in local currency. We can then compute losses in these hypothetical domestic asset positions due to a depreciation of the home currency and compare them to the currency-induced changes in external net liabilities that we reported in Figure 3. The combination of these two effects will give us a measure of the overall impact on the financial intermediation sector that channels global funds to the domestic economy.[17] This result provides us with an upper bound on losses because: (i) some of the domestic investment could be in foreign currencies, (ii) long-term investment in the real economy may not be subject to nominal currency-

[17] To the extent that foreign liabilities include government debt, we think of a government as part of the financial intermediation sector. The structure of the data does not allow us to separate government assets and liabilities from private ones.

induced losses, or (iii) currency risk may be hedged. We conduct this exercise only for net borrowers in terms of total external debt, combining portfolio and other investment net liabilities.

Specifically, total external net liabilities expressed in USD are given by $L^x_{all} - A^x_{all}$. We assume that this amount is lent domestically in domestic currency. As before, D^i_{USD} is the percent depreciation of the U.S. dollar with respect to currency i (negative in most cases). Therefore, currency-induced valuation losses on domestic investments financed by foreign borrowing are given by

$$HV^{\$}_i = D^i_{USD}(L^x_{i,all} - A^x_{i,all}) \quad (7)$$

The combined effect of currency-induced valuation gains or losses on external net liabilities (now presented as negative of $V^{\$}_i$, so positive numbers indicate gains) and currency-induced losses on hypothetical domestic assets expressed in USD are presented in Figure 4, in millions USD.

We can see that small currency-induced valuation losses on the external position for Australia are likely to be amplified if net external liabilities are invested domestically in domestic currency, for a total of about 80 billion USD. Consistent with historical experience, we find that Brazil's financial intermediation sector has likely experienced substantial currency-induced valuation losses due to the domestic currency depreciation, with an upper bound of about 60 billion USD. For Turkey (TUR), the upper bound is 22 billion USD. Even though countries like India (IND), Mexico, Canada, and the U.K. experienced a substantial decline in their net *external* liabilities due to valuation gains, their financial intermediation sectors' valuation losses on *domestic* assets may have more than offset these gains.

While these back-of-the-envelope calculations are an upper bound on possible currency-induced valuation losses, they highlight the importance of considering domestic assets. As illustrated quite clearly by the Asian financial crisis of 1997-99, financial intermediaries that do not expect a depreciation might not hedge currency mismatches on their balance sheets that result from borrowing in global markets and investing domestically.[18]

[18] See, for example, Burnside, Eichenbaum, and Rebelo (2001).

5 Conclusion

In this paper we evaluate the magnitude the effects on aggregate external balance sheets for 48 countries resulting from the appreciation of global currencies in the early stage of the COVID-19 economic crisis.

We find that, while not insignificant, the magnitudes of the currency-induced valuation effects on external aggregate balance sheets for most countries are quite modest. Perhaps overcoming original sin by both governments and private sector borrowers in recent decades helped reduce currency mismatches on external balance sheets for many countries (Aizenman, Jinjarak, Park, and Zheng, 2020; Hale, Jones, and Spiegel, 2020). We leave the investigation of the dynamics of currency mismatch over last two decades to future research.

Although our results are encouraging, it is important to keep in mind that our analysis is limited in a number of ways. First, we do not measure valuation changes resulting from relative movements in asset prices. Second, while we find small aggregate external balance sheet effects, individual institutions that may have had large currency mismatches on their balance sheets at the beginning of 2020 are likely to have experienced substantial losses, given the large and unexpected depreciation of some currencies. Finally, we are not looking at actual capital flow retrenchment from emerging economies at the beginning of 2020, but only at the effect of exchange rate changes on the stocks of assets and liabilities that were in place prior to the onset of the crisis.

Most importantly, our main analysis does not include the currency composition of domestic assets. While we do not have data to formally include them in our analysis, we use back-of-the envelope calculations to evaluate an upper bound on potential currency-induced valuation losses for institutions that borrow abroad and invest domestically. We find that the upper bound on potential losses due to currency depreciation is quite large for some countries. The discrepancy between the calculations based purely on the external position and the potential losses that arise if domestic assets are included points to the importance of gathering data on currency composition of domestic assets.

References

Aizenman, J., Y.-W. Cheung, and X. Qian (2020a): "The Currency Composition of International Reserves, Demand for International Reserves, and Global Safe Assets," *Journal of International Money and Finance*, 102, 102120.

Aizenman, J., Y. Jinjarak, D. Park, and H. Zheng (2020b): "Good-Bye Original Sin, Hello Risk On-Off, Financial Fragility, and Crises?" NBER Working Papers 27030, National Bureau of Economic Research, Inc.

Alfaro, L., G. Asis, A. Chari, and U. Panizza (2017): "Lessons Unlearned? Corporate Debt in Emerging Markets," Discussion paper 12038, Centre for Economic Policy Research.

Arslanalp, S. and T. Tsuda (2014): "Tracking Global Demand for Emerging Market Sovereign Debt," IMF Working Papers 14/39, International Monetary Fund.

Baele, L., G. Bekaert, K. Inghelbrecht, and M. Wei (2019): "Flights to Safety," *The Review of Financial Studies*, 33, 689–746.

Beber, A., M. W. Brandt, and K. A. Kavajecz (2009): "Flight-to-Quality or Flight-to-Liquidity? Evidence from the Euro-Area Bond Market," *Review of Financial Studies*, 22, 925–957.

Bénétrix, A., D. Gautam, L. Juvenal, and M. Schmitz (2019): "Cross-Border Currency Exposures: New Evidence Based on an Enhanced and Updated Dataset," IMF Working Papers 19/299, International Monetary Fund.

Burnside, C., M. Eichenbaum, and S. Rebelo (2001): "Hedging And Financial Fragility In Fixed Exchange Rate Regimes," *European Economic Review*, 45, 1151–1193.

Corsetti, G., S. Lloyd, and E. Marin (2020): "Emerging Market Currency Risk Around Global Disasters: Evidence from the Global Financial Crisis and the COVID-19 Crisis?" a voxEU.org eBook, CEPR Press.

Corsetti, G., P. Pesenti, and N. Roubini (1999): "What Caused the Asian Currency and Financial Crisis?" *Japan and the World Economy*, 11, 305–373.

Eichengreen, B., R. Hausmann, and U. Panizza (2007): "Currency Mismatches, Debt Intolerance, and the Original Sin: Why They Are Not the Same and Why It Matters," in *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, ed. by S. Edwards, Chicago: University of Chicago Press, chap. 3, 121–169.

Fidrmuc, J., M. Hake, and H. Stix (2013): "Households Foreign Currency Borrowing in Central and Eastern Europe," *Journal of Banking & Finance*, 37, 1880 – 1897.

Gourinchas, P.-O., H. Rey, and N. Govillot (2010): "Exorbitant Privilege and Exorbitant Duty," IMES Discussion Paper Series 10-E-20, Bank of Japan.

Hale, G. B., P. C. Jones, and M. M. Spiegel (2020): "Home Currency Issuance in International Bond Markets," *Journal of International Economics*, 122, 103256.

Hartmann, P., S. Straetmans, and C. G. de Vries (2004): "Asset Market Linkages in Crisis Periods," *The Review of Economics and Statistics*, 86, 313–326.

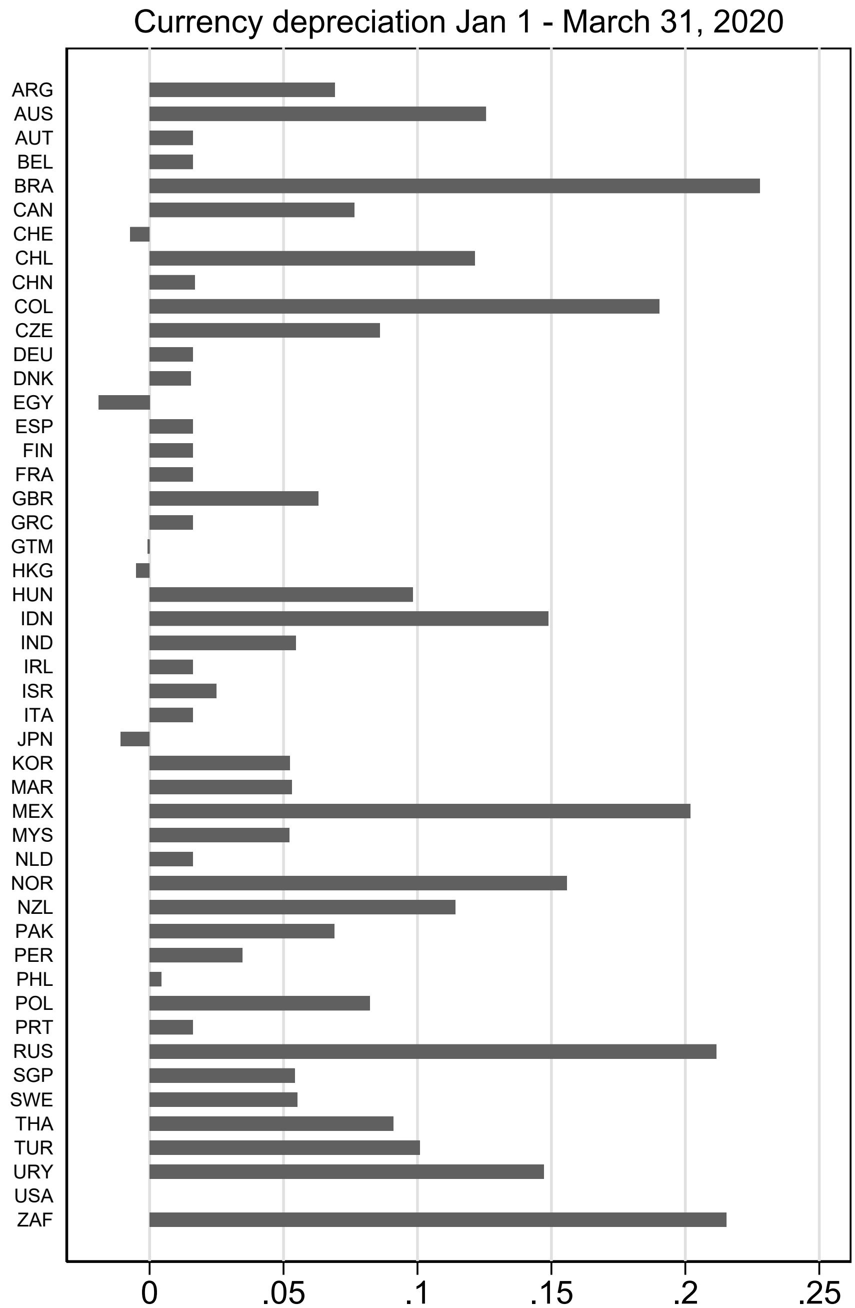
Hofmann, B., I. Shim, and H. S. Shin (2020): "Original Sin Redux and Policy Responses in Emerging Market Economies During the COVID-19 Pandemic," a voxEU.org eBook, CEPR Press.

Lane, P. R. and G. M. Milesi-Ferretti (2007): "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004," *Journal of International Economics*, 73, 223–250.

Lane, P. R. and J. C. Shambaugh (2010): "Financial Exchange Rates and International Currency Exposures," *American Economic Review*, 100, 518–540.

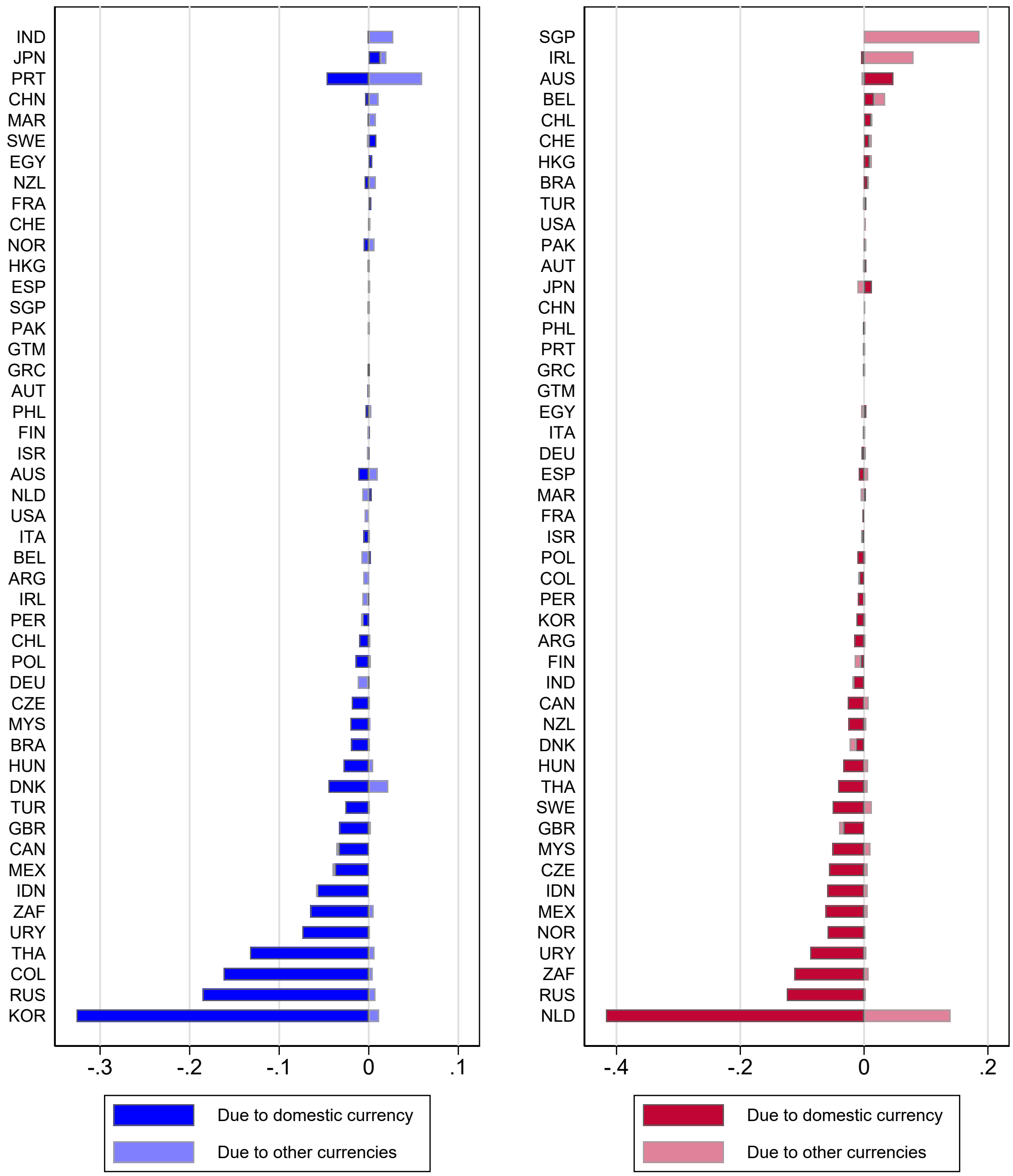
Luca, A. and I. Petrova (2008): "What Drives Credit Dollarization in Transition Economies?" *Journal of Banking & Finance*, 32, 858 – 869.

Figure 1: Exchange Rate Dynamics



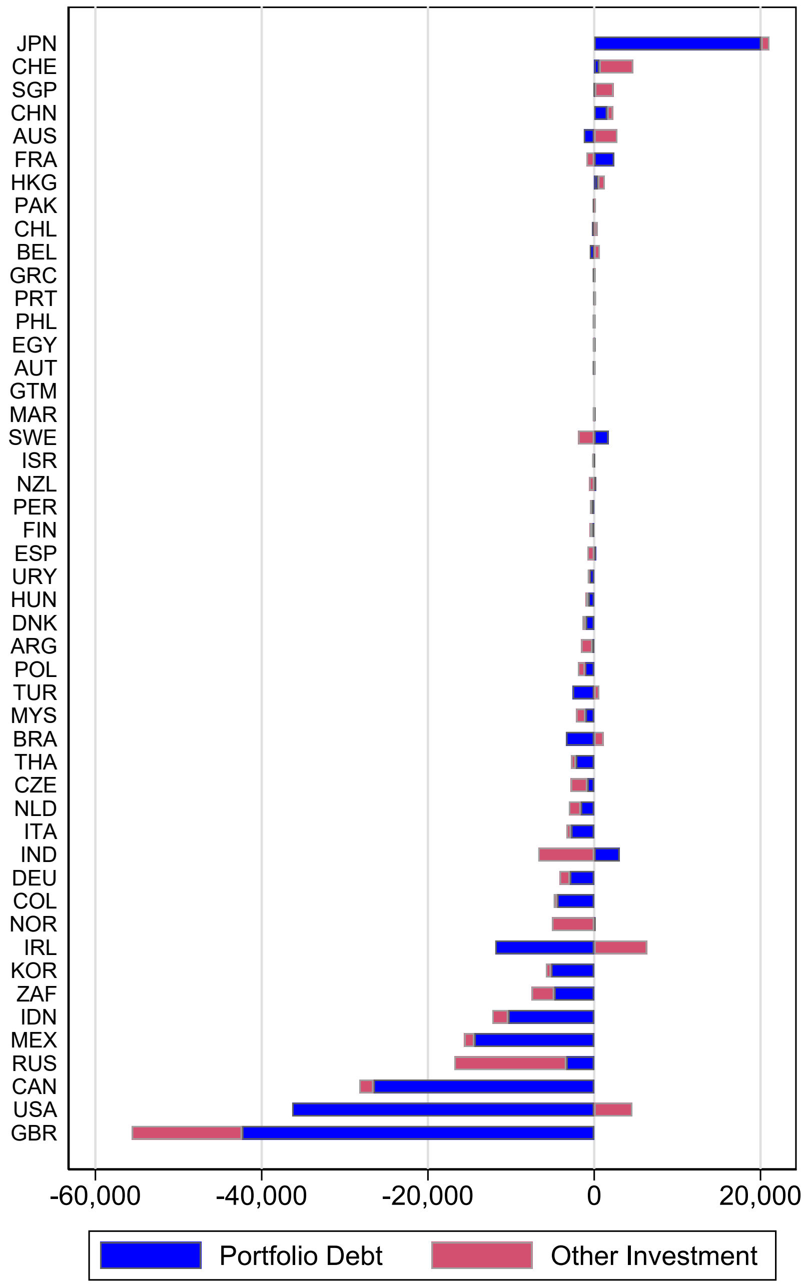
Notes: The bars represent percentage depreciation (0.25 = 25%) of the currency of each listed country against the U.S. dollar from close of January 1, 2020 through close of March 31, 2020 and are sourced from Datastream. The number is zero for the U.S. dollar and the USA is listed for completeness. Data labels use International Organization for Standardization (ISO) country codes and are listed alphabetically.

Figure 2: Change in Net Liabilities: percent



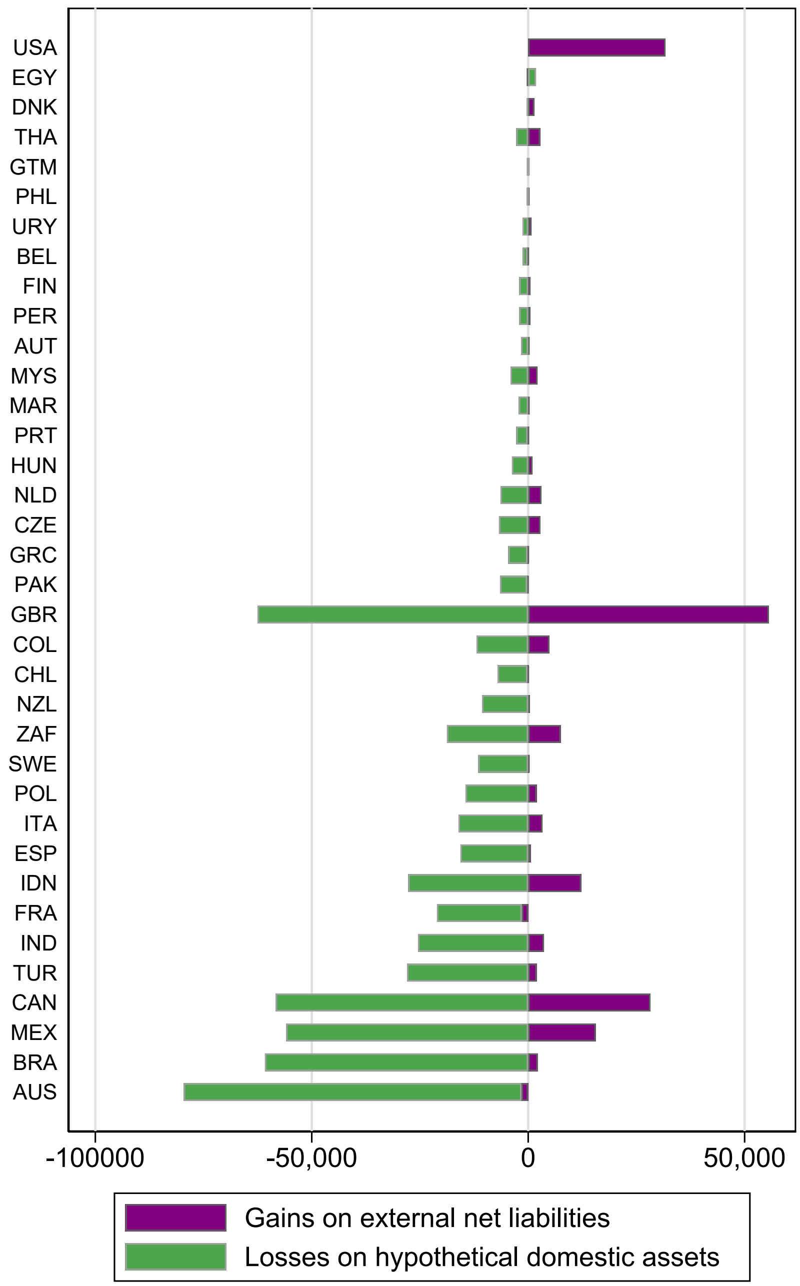
Notes: The bars represent percent changes in net liabilities due to currency-induced valuation effects (0.1 = 10%). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on the ratio of total net external liabilities to total external assets so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for portfolio debt are in the left panel and for other investment in the right panel. The bars are stacked, with dark bars showing the change due to a movement of the home currency *vis-à-vis* the U.S. dollar ($D^i_{USD} * \varepsilon_{USD,i}$) and light bars showing the change due to relative movements in global currency values. For countries with home currency being a global currency, light bars show the change due to the relative movements in other global currency values.

Figure 3: Change in Net Liabilities: millions U.S. dollars



Notes: The bars represent changes in millions of U.S. dollars in total net liabilities due to currency-induced valuation effects. See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on total net external liabilities. The impact is measured in millions U.S. dollars. The bars are stacked, with blue bars showing the impact on portfolio debt net liabilities and light red bars showing the impact on other investment. The numbers are obtained by multiplying the percentage impact shown in Figure 2 by the U.S. dollar value of net liabilities for each asset class.

Figure 4: External Net Liability Gains and Hypothetical Domestic Asset Losses: millions U.S. dollars



Notes: Purple bars are the sum of red and blue bars in Figure 3, presented with the opposite sign. They represent a net decline, in millions of U.S. dollars, in overall external net liabilities due to currency-induced valuation effects. Positive numbers represent a decline in net liability positions (equivalent to a valuation gain). Green bars represent currency-induced losses on hypothetical domestic asset positions denominated in home currency, with negative numbers indicating losses, in millions of U.S. dollars. Countries' ISO codes are listed in order of the total impact of exchange rate changes on total net external liabilities and hypothetical domestic assets. The bars are stacked. See text for methodology and original data sources.

A Appendix

Table A.1: Actual and Synthetic Data

Country	Portfolio Debt Assets		Portfolio Debt Liabilities		Other Investment Assets		Other Investment Liabilities	
	Actual Data	Estimated Data	Actual Data	Synthetic data	Actual Data	Synthetic data	Actual Data	Synthetic data
Argentina	CPIS			AT & BIS		LBS		LBS
Australia		IMF		BIS		LBS		LBS
Austria	CPIS			BIS		LBS		LBS
Belgium	Survey		Survey		Survey		Survey	
Brazil	CPIS			AT & BIS		LBS		LBS
Canada	Survey		Survey		Survey		Survey	
Chile	CPIS			AT & BIS		LBS		LBS
China		IMF		AT & BIS		LBS		LBS
Colombia	CPIS		Survey		Survey		Survey	
Czech Republic	Survey		Survey		Survey		Survey	
Denmark	Survey		Survey		Survey		Survey	
Egypt	CPIS			AT & BIS		LBS		LBS
Finland	Survey		Survey			LBS		LBS
France	Survey		Survey		Survey		Survey	
Germany	Survey		Survey			LBS		LBS
Greece	Survey		Survey			LBS		LBS
Guatemala	Survey		Survey		Survey		Survey	
Hong Kong SAR		IMF		BIS		LBS		LBS
Hungary	Survey		Survey		Survey		Survey	
India	CPIS			AT & BIS		LBS		LBS
Indonesia	CPIS		Survey			LBS	Survey	
Ireland		IMF		BIS		LBS		LBS
Israel	CPIS			BIS		LBS		LBS
Italy	Survey		Survey		Survey		Survey	
Japan	Survey		Survey			LBS		LBS
Korea	CPIS		Survey		Survey		Survey	
Malaysia	CPIS			AT & BIS		LBS		LBS
Mexico	CPIS			AT & BIS		LBS		LBS
Morocco		IMF		BIS		LBS		LBS
Netherlands	Survey		Survey			LBS		LBS
New Zealand		IMF		BIS		LBS		LBS
Norway		IMF		BIS		LBS		LBS
Pakistan	CPIS			BIS		LBS		LBS
Peru		IMF		AT & BIS		LBS		LBS
Philippines	CPIS		Survey			LBS		LBS
Poland		IMF		AT & BIS		LBS		LBS
Portugal	CPIS			BIS		LBS		LBS
Russia	CPIS			AT & BIS		LBS		LBS
Singapore		IMF		BIS		LBS		LBS
South Africa	CPIS			AT & BIS		LBS		LBS
Spain	CPIS			BIS		LBS		LBS
Sweden	CPIS			BIS		LBS		LBS
Switzerland	Survey		Survey		Survey		Survey	
Thailand	Survey		Survey		Survey		Survey	
Turkey	CPIS		Survey		Survey		Survey	
United Kingdom		IMF		BIS		LBS		LBS
United States	CPIS			BIS		LBS		LBS
Uruguay	CPIS			AT & BIS		LBS		LBS

Notes: The table reports the sources of data for each country and each component. Actual data are from the IMF survey and CPIS. Estimates are from the dataset on currency composition of the IIP published by the IMF. Synthetic data for portfolio debt liabilities are from Arslanalp and Tsuda (2014) and the BIS International Debt Issuance Statistics (denoted by AT and BIS, respectively). Synthetic data for other investment are from the BIS Locational Banking Statistics (denoted by LBS).