Title

External Balance Sheets and the COVID-19 Crisis

Authors

Hale, Galina
Juvenal, Luciana

Publication Date

2023-02-01

DOI

10.1016/j.jbankfin.2022.106570

Peer reviewed

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Journal of Banking and Finance xxx (xxxx) xxx

Contents lists available at ScienceDirect

Journal of Banking and Finance

journal homepage: www.elsevier.com/locate/jbf

External Balance Sheets and the COVID-19 Crisis☆

Galina Hale[a,*], Luciana Juvenal[b,*]

[a] University of California at Santa Cruz, NBER, and CEPR
[b] International Monetary Fund

ARTICLE INFO

Article history:
Received 29 May 2021
Accepted 2 June 2022
Available online xxx

JEL classification:
F32
F34
G15

Keywords:
Currency mismatch
Balance sheet effects
Valuation effects
COVID-19

ABSTRACT

At the onset of the COVID-19 economic crisis, as in other crisis episodes, we observed a rapid appreciation of "safe haven" currencies. We quantify currency-induced balance sheet valuation effects for aggregate external positions as well as for broadly defined asset classes for the first quarter and the full year 2020. To do so, we use new data on the currency composition of cross-border assets and liabilities for 46 countries. In contrast with past financial crises, many emerging markets did not experience losses on their aggregate external balance sheets despite facing a domestic currency depreciation. This was partly due to currency-induced valuation gains on equity positions offsetting losses on debt positions, and partly due to reduced currency mismatch on their external debt positions. We conduct the stock-flow reconciliation of net international investment positions to measure overall valuation effects and compute the proportion that is due to changes in currency values. For about half of the countries in our sample, currency-induced valuation effects were substantial, representing over 50 percent of total valuation effects in 2020Q1 and the full year 2020.

1. Introduction

The sudden onset of the COVID-19 crisis in early 2020 sent a tidal wave across global financial markets in the first quarter of 2020, leading to rapid changes in asset prices, including currency values, and inducing investors to move towards safe assets. Flight to safety in times of economic turmoil is now well documented and understood in the literature (see, for example, Hartmann et al., 2004; Beber et al., 2009).[1] Akin to other crisis experiences, during the early stages of the COVID-19 crisis in the first quarter of 2020 (2020Q1), flight to safety was accompanied by a rapid appreciation of "safe haven" currencies, especially the U.S. dollar.[2] As a counterpart, values of many emerging economies' currencies have declined considerably (Corsetti et al., 2020). By the end of 2020, many global asset markets recovered their initial losses, but some currencies continued to depreciate against major global currencies (Figure 1).

History teaches us that sharp unexpected changes in exchange rates and other asset prices are likely to produce significant valuation changes in net foreign asset positions.[3] Such valuation changes have a direct impact on a country's cost of capital and ability to borrow, with indirect and persistent effects on the real economy, largely through their effect on investment (Aguiar, 2005; Caballero, 2021; Gertler et al., 2007; Ghironi et al., 2015). In anticipation of such effects, countries with substantial currency mismatches on their external balance sheets may exhibit fear-of-floating in their exchange rate policies (Georgiadis and Zhu, 2021).

☆ We are grateful to the editor and two anonymous referees for valuable comments. We thank Roland Beck, Kristin Forbes, Şebnem Kalemli-Özcan, Michael Klein, David Kohn, Gian Maria Milesi-Ferretti, and seminar participants at the American Economic Association Conference 2022, the IADB, the International Macro/Finance and Sovereign Debt Workshop at Sogang University 2021, the CEPR 6th International Macroeconomics and Finance Conference 2021, the BdF-ECB Workshop on International Capital Flows 2020, and the IMF Annual Research Conference 2020 for suggestions, constructive conversations, and helpful comments. We are grateful to Ted Liu for his research assistance. All errors are ours. The views in this paper are solely of the authors and do not necessarily represent the views of the International Monetary Fund, NBER, or CEPR.

* Both authors contributed to the paper equally at all stages of the research, analysis, drafting, and revision of the paper.

E-mail addresses: gbhale@ucsc.edu (G. Hale), ljuvenal@imf.org (L. Juvenal).

[1] This is also documented in Baele et al. (2019).

[2] Flight to safety at the onset of the COVID-19 crisis was documented in many asset markets (see, for example, Chari et al., 2020; LAwen et al., 2021; Ozili and Arun, 2020). In addition, flight to U.S. assets resulted in the shortage of U.S. dollar liquidity, which partly contributed to the U.S. dollar appreciation (see Aizenman et al., 2021).

[3] Balance sheet effects of currency depreciations, in particular, drew attention following the Asian financial crisis in 1997-98 (see, for example, Corsetti et al., 1999).

https://doi.org/10.1016/j.jbankfin.2022.106570
0378-4266/

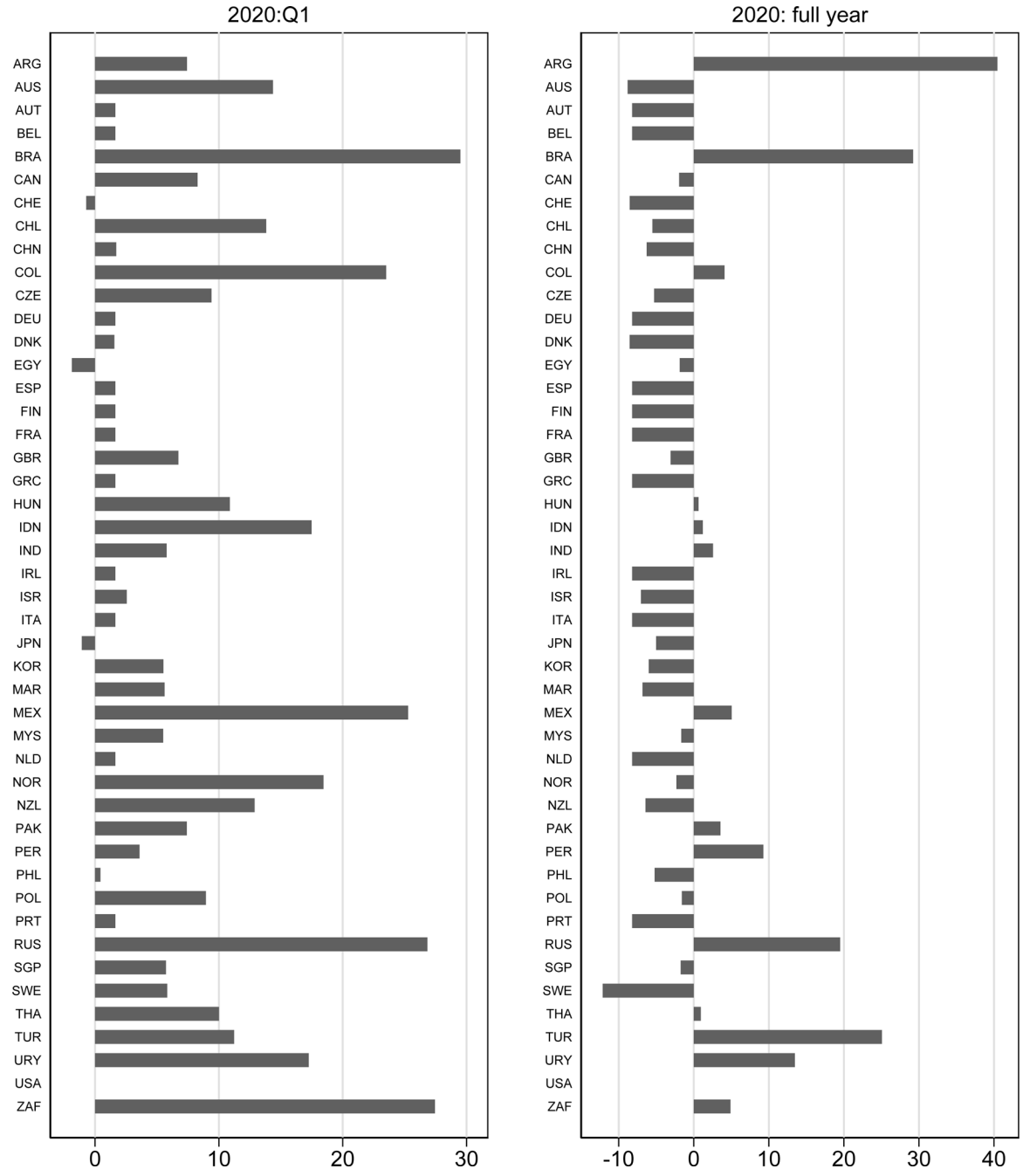

Fig. 1. Exchange Rate Dynamics.
Notes: The bars represent the percentage depreciation of the currency of each listed country against the U.S. dollar. The left panel reports the depreciation from close of January 1, 2020 through close of March 31, 2020 while the right panel shows the depreciation from close of January 1, 2020 through close of December 31, 2020. 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. Exchange rates are sourced from Datastream.

Until recently, it was hard to measure the contribution of exchange rate movements to changes in aggregate external balance sheets at a global scale due to the lack of information on the currency breakdown of external asset and liability positions.[4] A recent data set (Bénétrix et al., 2019) containing the currency composition of assets and liabilities positions makes this exercise possible. This data set is largely based on non-confidential actual data compiled from a survey the IMF sent to country authorities and complemented with other sources of actual data: (i) the currency composition of portfolio equity and debt assets are from the IMF's Coordinated Portfolio Investment Survey (CPIS); (ii) the currency breakdown obtained from the Bank of International Settlements (BIS) international debt issuance statistics; (iii) the currency composition of banks cross-border positions reported to the BIS available through its Locational Banking Statistics (LBS); and (iv) estimations based on the geography of cross-border positions as explained in Lane and Shambaugh (2010). We rely on this data set to accurately measure currency-induced valuation effects, which

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

also allows us to compute the contribution of asset price-induced valuation effects through a reconciliation of the stocks of external balance sheet positions and flows implied by the current account (Lane and Milesi-Ferretti, 2001; Gourinchas and Rey, 2007; Gourinchas et al., 2014; Forbes et al., 2017).

We analyze separately two time periods: 2020Q1 (from January 1 to March 31) and the full year 2020. This is because in 2020Q1 there was a significant drop in most asset prices accompanied by a flight to safety and resulting appreciation of the U.S. dollar, the Japanese yen, and, to a lesser extent, other safe-haven currencies. Many but not all of these trends reversed starting April 2020, making March 31, 2020, a natural demarcation point for the analysis.[5] We study aggregate external balance sheet positions as well as stocks of assets and liabilities of broadly defined asset classes for 46 economies, both advanced and emerging. The breakdown by asset class includes debt, which we further separate into portfolio debt, direct investment debt, and other investment (mostly representing bank lending and borrowing); and equity, which we separate into portfolio and direct investment. Aggregate positions also include official foreign currency reserves, and we report our calculations with and without official foreign currency reserves included.

Exchange rate movements tend to have different effects on different asset classes. Many countries' external debt balance sheets tend to have net foreign currency debt liabilities, resulting in currency-induced losses following a domestic currency depreciation. The opposite, however, is true for equity: 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 valuation losses on debt positions and currency-induced improvements in equity positions on countries' external balance sheets. A currency appreciation will have the opposite effect.[6]

We calculate changes in external net liabilities resulting from exchange rate movements between January 1, 2020, and March 31, 2020, as well as between January 1, 2020, and December 31, 2020. Importantly, in addition to considering changes in domestic exchange rates *vis-à-vis* the U.S. dollar, we also consider movements between four major currencies: the U.S. dollar, the British pound, the euro, and the Japanese yen.[7] We find that during 2020Q1, when the U.S. dollar appreciated with respect to most currencies, the U.S. experienced large currency-induced losses on its external balance sheet positions, mainly driven by equity positions. Other countries with substantial losses were Japan, Switzerland, and Turkey. Most countries experienced either gains or very small overall effects. The situation changed substantially by the end of 2020 when the U.S. dollar depreciated against most currencies in our sample. During the full year of 2020, currency-induced valuation losses were observed on external balance sheets of many countries, while the U.S. showed overall external balance sheet gains, again, due to its equity positions.

Decomposing overall currency-induced balance sheet effects by asset class, we find that in many cases a currency depreciation led to balance sheet losses on external debt positions that were compensated by gains on equity positions. Further, we find that both direct investment and portfolio equity contributed nearly equally for most countries. In terms of the debt components, the contribution of valuation effects on portfolio debt tends to be the largest for most countries, followed by other investment positions (which are mostly bank positions). While in many countries banks are required to avoid currency mismatch on their overall balance sheets, this requirement generally does not apply separately to domestic and foreign positions. This means, for example, that a bank can hold a short foreign currency position against foreign entities which is compensated by a long foreign currency position against domestic counterparts. As a result, it is possible for the banking system as a whole to have a currency mismatch on the aggregate *external* balance sheet even in the presence of regulatory constraints.[8]

Given that in past crises emerging markets proved to be very vulnerable to currency-induced external balance sheet effects, we discuss separately their 2020 experience and compare it to the Asian Financial Crisis of 1997-98.[9] We find that during the Asian Financial crisis Indonesia, Thailand, and South Korea experienced substantial currency-induced valuation losses following rapid depreciations of their currencies. In 2020Q1 these countries experienced either minor changes due to currency-induced valuation effects or gains, despite substantial depreciation of their currencies. In Indonesia, currency gains on foreign exchange reserves were sufficient to almost exactly offset aggregate net losses on debt and equity, while Thailand and Korea experienced valuation gains. That said, given that assets and liabilities in each of the asset classes are likely to be held by different agents in the economy, it is possible that disaggregated exposures to currency movements were still important in 2020.

Next, we test whether cross-country differences in currency depreciation in 2020Q1 were related to currency composition of external balance sheets. To do so, we construct a measure of currency mismatch of each country's external balance sheet to exchange rate movements, following Lane and Shambaugh (2010), as of the beginning of 2020, prior to the onset of the COVID-19 crisis. We find that countries with larger potential balance sheet losses from a weakening of their domestic currency experienced a smaller depreciation in 2020Q1. We then decompose the measure of currency mismatch by asset class, consisting of three types of debt (portfolio, direct investment, and other investment) and total equity. We find that portfolio debt mismatch is in fact associated with a larger depreciation, while direct investment debt and other debt investment mismatches have a negative effect. In contrast, equity mismatch has no effect. This indicates that following prior large depreciation episodes, countries most vulnerable to balance sheet losses made the currency composition of their external balance sheets more resilient by increasing their reliance on equity flows.[10] However, there are still vulnerabilities originating in mismatches in portfolio debt.

Finally, we present a stock-flow reconciliation of net foreign asset positions by combining our calculations of currency-induced valuation effects with information on the changes in net foreign assets and current accounts in 2020Q1, and the full year 2020.[11] The difference between the change in the net foreign assets and the current account is the valuation effect in the external balance

[5] We chose the last date in 2020Q1 rather than a precise turning point for the calculation of the stock-flow reconciliation because net foreign asset positions and current accounts are reported at a quarterly frequency.

[6] Cavallo and Tille (2006) and Gourinchas et al. (2010) show that, as a result of large equity liabilities in the U.S., in times of global economic stress there is a net transfer from the U.S. to the rest of the world on external equity positions.

[7] We count as global currencies the "big four" currencies according to Aizenman et al. (2020a).

[8] Moreover, for some countries we observe net foreign currency exposures held by individual banks, once derivatives are taken into account, as demonstrated for the case of Germany by Abbassi and Bräuning (2021).

[9] In a related paper, Gourinchas et al. (2012) show that during the flight to safety observed during the Global Financial Crisis of 2008-09, China, Russia, Hong Kong, and Singapore experienced substantial currency-induced valuation losses.

[10] In fact, Bénétrix et al. (2015) show that prior to the Global Financial Crisis of 2008-09 many emerging markets shifted towards positive net foreign currency positions.

[11] For a detailed analysis of the capital flows at the onset of the COVID-19 crisis, see Avdjiev et al. (2020).

sheet. Valuation changes could be due to changes in exchange rates (the currency-induced valuation effects we calculated) or changes in the prices of assets and liabilities held in the portfolio. We observe all but asset prices and therefore compute asset-price valuation effects as a residual.[12]

We find that in the U.S., currency-induced valuation losses in 2020Q1 contributed 47 percent to total valuation losses during this time period, once again showing the role of the U.S. as a global insurer during flight-to-safety episodes (Gourinchas et al., 2010). By the end of 2020, these trends changed since there was a shift in the configuration of currencies and asset prices values. Moreover, we find that most countries that experienced excess capital outflows in 2020Q1 experienced valuation gains, which mitigated the impact of outflows on their net external balance sheet positions. In contrast to Bénétrix et al. (2015), however, we do not find that valuation effects, currency-induced or total, had an *overall* stabilizing effect on external balance sheet positions: many countries with excess capital inflows in 2020Q1 also experienced valuation gains.

One important caveat of our analysis is that aggregate positions may mask substantial currency mismatches on balance sheets of individual sectors, institutions, or for more granular asset classes.[13] In particular, in some countries, external liabilities may be predominantly held by the government while external assets may be held by private agents, in which case the currency mismatch problem on *government* balance sheets is still present. Although we do not have access to sectoral or institution-level data, we observe some of these aggregation issues by analyzing separately debt and equity: for many countries, we find that currency-induced valuation effects on debt and on equity offset each other. From the related literature that looks into the effects of currency fluctuations at the firm level, we know that these effects can be economically important (Du and Schreger, 2021; Kalemli-Özcan et al., 2021). Another caveat is that we do not observe the currency composition of derivatives and therefore cannot tell if any currency mismatches are hedged. That said, while derivative markets are growing rapidly and can provide some hedging opportunities, these are still limited to large firms and are expensive or not available at medium and long maturities (Alfaro et al., 2021).

In addition to providing an analysis of the most recent episode of a widespread movement in exchange rates, our paper extends the scope of the literature that analyzes the impact of valuation effects on the external balance sheets while providing a comprehensive analysis of overall external positions with details by asset class. Past studies either relied on estimates of the currency composition of external balance sheets (Lane and Shambaugh, 2010; Bénétrix et al., 2015) or had a limited set of countries in their analysis, such as Forbes et al. (2017). Thanks to the new data set, we are able to use mostly actual data, rather than estimates of the currency composition of external positions by asset class for a large sample of countries.

The remainder of the paper is organized as follows. Section 2 describes the data. Section 3 presents the methodology. The calculations of currency-induced valuation effects are shown in Section 4 and the stock-flow reconciliation is presented in Section 5. Section 6 concludes. The Appendix provides additional details on the data and supplemental charts.

2. Data

Our data set combines information on the stock of assets and liabilities of portfolio debt, other investment, direct investment debt, direct investment equity, portfolio equity as well as foreign exchange reserves, the currency composition of those items, COVID-19 statistics, and exchange rates for a sample of 46 countries.[14]

Stocks data at the end of 2019 and 2020 are from the External Wealth of Nations data set by Lane and Milesi-Ferretti (2007). Exchange rates at daily frequency are from Datastream. COVID-19 statistics and data on government responses are obtained from the Oxford University "COVID-19 Government Response Tracker."[15] Daily data are available and we use March 31, 2020, to measure the extent of COVID-19 spread (proxied by the number of COVID-19 related deaths or COVID-19 cases) and governments' economic response (measured using the index of actual income support to households) in the first quarter of 2020.

The currency composition of gross assets and liabilities builds on a novel data set on currency exposures published as part of an IMF working paper.[16] 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 60 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.

Tables A.1, A.2, and A.3 detail the sources of currency composition data for each country for debt assets, debt liabilities, and equity, respectively. Actual data on the currency breakdown of portfolio debt assets were obtained from the IMF survey and complemented with the data reported in the Coordinated Portfolio Investment Survey (CPIS).[17] For the ten countries for which actual data are not available, estimates from the IMF data set are used.[18]

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. 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.

[12] Note that asset-price valuations will include other changes in the volume of stocks (e.g., economic appearance/disappearance of assets or liabilities, reclassification, measurement issues, etc.), and statistical discrepancies. In the absence of this information, and in line with the literature (see Lane and Shambaugh, 2010), the asset price valuation effects which we consider in the paper include other changes and statistical discrepancies.

[13] By focusing on aggregate external balance sheets we also miss any effects of domestic dollarization emphasized in a recent paper by Bocola and Lorenzoni (2020), and described in Luca and Petrova (2008) and Fidrmuc et al. (2013) for the case of transition economies.

[14] See Tables A.1, A.2, and A.3 in the Appendix for details on the country coverage.

[15] Data are found at https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker.

[16] 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.

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

[18] For a description of the estimation methods see Bénétrix et al. (2019).

We distinguish between the equity and debt components of direct investment. For both items, we use actual data from the IMF Survey and estimated data from Bénétrix et al. (2019). Actual data on the currency breakdown of portfolio equity assets was obtained from the IMF survey and complemented with the currency mix data reported in the Coordinated Portfolio Investment Survey (CPIS).[19] For the ten countries for which actual data are not available, estimates from the IMF data set are used.[20] Equity liabilities (both portfolio and direct investment) are denominated in the currency of the host country, consistent with the methodology in Lane and Shambaugh (2010). In fact, for the countries for which we have information on the currency of denomination of equity liabilities from the IMF survey, we can confirm that they are denominated in domestic currency, consistent with the treatment in the literature. In the appendix to their paper, Lane and Shambaugh (2010) explain that equity issued by a country is denominated in the currency of that country. That is, U.S. stocks are denominated in dollars, British stocks in pounds, and so on. Therefore, the total size of equity liabilities is assumed to be denominated in domestic currency.

There are several of countries that make the currency composition of reserves publicly available. For those countries, actual data on the currency composition of reserves were obtained from non-confidential sources. For the countries for which the currency composition of reserves is confidential, we used estimates from Bénétrix et al. (2019). The following countries publish the currency composition of reserves in publications from their Central Bank or Ministry of Finance (the sources of data are in parenthesis): Canada (Department of Finance Canada), Chile (Central Bank of Chile), Colombia (Banco de la República), Peru (Banco Central de Reserva del Perú), Poland (National Bank of Poland), Sweden (Riskbank), Switzerland (Swiss National Bank), United Kingdom (Bank of England), USA (US Treasury), and Uruguay (Central Bank of Uruguay).[21] The IMF Currency Composition of Official Foreign Exchange Reserves (COFER) keeps track of the currency composition of reserves of its member countries. Although COFER data for individual countries are strictly confidential, since 2016 a small group of countries report an optional SDR breakdown by currency in the reserves template, which is publicly available.[22] These countries are Australia, Belgium, Brazil, Finland, Germany, Ireland, Netherlands, Norway, and Portugal. For these 9 countries, we use the currency breakdown from the reserves template. Finally, for the Czech Republic and Russia, we obtain information on the currency composition of reserves from the ECB publication "The International Role of the Euro."

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.

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

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

[21] For the United Kingdom we use the combined currency shares of the Bank of England and the UK Government (which includes other foreign currency assets such as claims *vis-á-vis* residents); for the U.S. we use the combined currency share of the Open Market Account (SOMA) at the Board of Governors of the Federal Reserve System and the US Treasury Exchange Stabilization Fund (ESF); for Chile we use the combined currency share in the liquidity and the investment portfolio of the central bank. Finally, the Central Bank of Peru reports the US dollar share of reserves and highlight, in their Annual Report, that the reserve assets denominated in currencies other than the US dollar are mostly denominated in euros.

[22] http://data.imf.org/?sk=E6A5F467-C14B-4AA8-9F6D-5A09EC4E62A4.

3. Methodology

The analysis of valuation effects resulting from currency and asset price dynamics is performed in two steps. First, we measure currency-induced valuation effects for overall net foreign liabilities and separately for individual asset classes. Second, we reconcile differences between changes in net foreign asset positions (stocks) and capital flows and obtain total valuation effects. The total valuation effects can be broken down into a currency-induced component, which are our estimates of currency-valuation effects, and valuation effects due to changes in asset prices, which we compute as a residual.

3.1. Measuring Currency-Induced Valuation Effects

In order to evaluate the size of the balance sheet effect of exchange rate changes, we compute a measure of valuation effects on gross stocks of net foreign liabilities (*NL*) as proposed by Lane and Shambaugh (2010):[23]

$$VALNL_{i,t}^{FX,c} = \%\Delta I_{i,t}^{F,c}(A_{i,t-1}^{c} + L_{i,t-1}^{c}), \tag{1}$$

where $VALNL_{i,t}^{FX,c}$ indicates the currency-induced valuation effect on net foreign liabilities (in U.S. dollars) driven by currency movements for country i and asset class c. $\%\Delta I_{i,t}^{F,c}$ is the percentage change in the financial exchange rate index during period t for asset class c and $A_{i,t-1}^{c}$ and $L_{i,t-1}^{c}$ are the end-of-period $t-1$ gross stocks of external assets and liabilities in asset class c expressed in current U.S. dollars.

The financial exchange rate index provides a measure of the sensitivity of a country's external balance sheets to currency movements and is given by

$$I_{i,t}^{F,c} = I_{i,t-1}^{F,c}(1 + \sum_{j} \omega_{ij,t-1}^{F,c} \%\Delta E_{ij,t}), \tag{2}$$

with $\%\Delta E_{ij,t}$ denoting the percentage change in the bilateral end-of-period nominal exchange rate between the currency of country i and foreign currency j between $t-1$ and t, and $\omega_{ij,t-1}^{F,c}$ representing the net liability financial weight of currency j in country i in period $t-1$ for asset class c. This is calculated as

$$\omega_{ij,t-1}^{F,c} = \omega_{ij,t-1}^{L,c} s_{i,t-1}^{L,c} - \omega_{ij,t-1}^{A,c} s_{i,t-1}^{A,c}, \tag{3}$$

where

$$\omega_{ij,t-1}^{L,c} = \frac{L_{ij,t-1}^{c}}{\sum_j L_{ij,t-1}^{c}}, \quad \omega_{ij,t-1}^{A,c} = \frac{A_{ij,t-1}^{c}}{\sum_j A_{ij,t-1}^{c}},$$

$$\text{and } s_{i,t-1}^{L,c} = \frac{L_{i,t-1}^{c}}{A_{i,t-1}^{c} + L_{i,t-1}^{c}}, s_{i,t-1}^{A,c} = \frac{A_{i,t-1}^{c}}{A_{i,t-1}^{c} + L_{i,t-1}^{c}},$$

with $\omega_{ij,t-1}^{L,c}$ ($\omega_{ij,t-1}^{A,c}$) denoting the proportion of liabilities (assets) denominated in currency j for asset class c, $s_{i,t-1}^{L,c} = \frac{L_{i,t-1}^{c}}{A_{i,t-1}^{c}+L_{i,t-1}^{c}}$ indicating the share of liabilities in the country external balance sheet for asset class c, and $s_{i,t-1}^{A,c} = \frac{A_{i,t-1}^{c}}{A_{i,t-1}^{c}+L_{i,t-1}^{c}}$ representing the corresponding share for its assets. By construction $s_{i,t-1}^{A,c} + s_{i,t-1}^{L,c} = 1$.

We conduct our analysis individually for two main asset classes, debt and equity. We further break down these into sub-classes: portfolio and direct investment equity; portfolio debt, direct investment debt, and other investment, which mainly reflects bank transactions. We also analyze total aggregated assets and liabilities, which we denote by dropping superscript c in our notation.

[23] Note that Lane and Shambaugh (2010) compute valuation effects on net foreign assets while we compute the effects on net foreign liabilities, otherwise our measure is identical to theirs.

We evaluate a country's external balance sheet sensitivity to proportional changes of domestic currency values relative to all foreign currencies as $\mathcal{M}_{i,t} = \sum_j \omega^F_{ij,t}$, which simplifies to

$$\mathcal{M}_{i,t} = \omega^L_{i,t} s^L_{i,t} - \omega^A_{i,t} s^A_{i,t} = \sum_j \omega^L_{ij,t} s^L_{i,t} - \sum_j \omega^A_{ij,t} s^A_{i,t}, \quad (4)$$

where the proportion of foreign liabilities and foreign assets denominated in any foreign currency, $\omega^L_{i,t}$ and $\omega^A_{i,t}$, are computed for total assets and total liabilities. We use this measure of external balance sheet sensitivity to exchange rate movements to understand the effect of currency mismatch on the magnitude of exchange rate changes at the onset of the crisis.

We rely on Lane and Shambaugh (2010) approach to measuring valuation effects because this is the approach taken in the international finance literature (see Forbes et al., 2017; Gourinchas et al., 2010). However, given that we observe net foreign liabilities and their currency composition at the beginning of the period in consideration as well as exchange rates at the beginning and at the end of the time period analyzed, we can simply calculate the change in the home currency value of the total portfolio for each country. We show that this simple "accounting" approach yields results that are very similar to the benchmark calculations we use.

In order to assess the importance of the currency-induced valuation effects for each individual country we also compute the measure in equation (1) relative to GDP, as follows:

$$\frac{VALNL^{FX,c}_{i,t}}{GDP_{i,t-1}} = \%\Delta I^{F,c}_{i,t} \frac{(A+L)^c_{i,t-1}}{GDP_{i,t-1}}, \quad (5)$$

where both valuation effects and GDP are measured in U.S. dollars.

The sign of the effects of a currency depreciation depends on whether a country has a long or short position in foreign currency. The magnitude will be determined by the depreciation rate and the size of the external balance sheet.

3.2. Total Effects Using Stock-Flow Reconciliation

By definition, changes in net foreign asset positions (NFA) are composed of international financial transactions, which net out to be equal to the current account (CA), and changes in the valuation of existing positions. There are two sources of valuation changes — those due to changes in asset prices and those due to changes in exchange rates. While we can compute currency-induced valuation effects as discussed in the previous section ($VALNFA^{FX}_{i,t} = -VALNL^{FX}_{i,t}$), we cannot measure asset-price-related valuation changes ($VALNFA^{P}_{i,t}$) due to the lack of asset-level details and because not all assets are valued at market prices. We do, however, observe net foreign asset positions and current accounts, and can therefore compute asset-price-related valuation changes as a residual from the identity

$$NFA_{i,t} - NFA_{i,t-1} = CA_{i,t} + VALNFA^{P}_{i,t} + VALNFA^{FX}_{i,t} \quad (6)$$

for each country in our sample.[24]

4. Currency-Induced Valuation Effects in 2020

At the onset of the COVID-19 crisis, during the first quarter of 2020, we observed a rapid appreciation of "safe haven" currencies, especially the USD. As a counterpart, values of many emerging economies' currencies have declined considerably (left panel, Figure 1). This was a period characterized by substantial turmoil and capital outflows from many emerging economies. Asset markets started to stabilize in April 2020 and the configuration of currencies' depreciation by the end of 2020 is quite different (right panel, Figure 1). Figure 2 depicts these movements in terms of cumulative daily changes in exchange rates during 2020. We can see that the end of 2020Q1 represented, for most countries, the largest cumulative depreciation against the U.S. dollar since January 1, while the end of 2020 showed the smallest depreciation (or in some cases the largest appreciation) relative to January 1. Notable exceptions are Argentina and Turkey, whose currencies depreciated initially by 8 and 12 percent, respectively, and continued to depreciate throughout 2020, ending the year with 40 and 25 percent depreciation, respectively. Another exception is Brazil, for which the depreciation in 2020Q1 and at the end of the year 2020 was roughly the same.

The JPY strengthened slightly initially and continued to strengthen throughout the year, appreciating by 5 percent against the USD for 2020 overall. In contrast, while the euro depreciated initially, by the end of 2020 it gained value against the USD. Some emerging economies' currencies depreciated considerably at the beginning of the COVID-19 crisis but subsequently gained value so that by the end of 2020 their currencies did not suffer a large depreciation. Such is the case, for example, for South Africa, Mexico, and Colombia. These countries witnessed an initial depreciation of over 20 percent and an end-of-year depreciation of less than 5 percent. In other countries, such as Malaysia and Korea, the initial depreciation was more than offset by the end of the year, resulting in an overall appreciation.

Given the differences in the currencies' behavior at the onset of the crisis and by the end of 2020, we compute the currency-induced valuation effects for 2020Q1 as well as for the end-of-year 2020. We then discuss the contribution of different asset classes to the effects on total portfolios: first separating debt and equity and then breaking each of them down into asset sub-classes. In addition, we focus on emerging economies and provide a comparison with the currency-induced valuation effects observed during the 1997-98 Asian crisis. Finally, we test whether the size of the currency depreciation in the first quarter of 2020, at the onset of the COVID-19 crisis, was related to the amount of currency mismatch on external balance sheets, proxied by the Lane and Shambaugh (2010) measure of foreign currency exposure defined as net foreign liabilities denominated in foreign currency as a proportion of the aggregate balance sheet.

4.1. Effects on Aggregate Net Liabilities

We use the measure $VALNL^{FX,c}_{i,t}$ described in equation (1) to compute changes in net liabilities that are due to currency movements between January 1 and March 31, 2020, as well as the entire year 2020. Figure 3 shows our calculations for the change in aggregate net liabilities in billion U.S. dollars for 2020Q1 (left panel) and the full year 2020 (right panel). The results in terms of changes in net liabilities as a percentage of GDP are shown in Figure 4. In both cases, dark and light bars combined depict changes in aggregate net liabilities while the light bars exclude foreign currency reserves. The countries are sorted from largest valuation losses (i.e. increase in net liabilities) to highest gains.

At the onset of the COVID-19 crisis, in 2020Q1, the largest valuation losses in billion U.S. dollars were experienced by the United States ($186 billion). This is consistent with the notion of "exorbitant duty" first documented by Gourinchas et al. (2012), who demonstrate that the U.S. provides insurance to the rest of the world in times of global economic stress. Japan and Switzerland also experienced valuation losses in 2020Q1 ($88 billion and $52 billion, respectively) due to an appreciation of their currencies. The

[24] Note that the measurement of the price valuation terms is subject to measurement error because measures of stock positions and flows are typically based on different sources. Therefore, $VALNFA^{P}_{i,t}$ may include mismeasured valuations, mismeasured flows, mismeasured initial positions, and any errors or revisions (see Gourinchas et al., 2014).

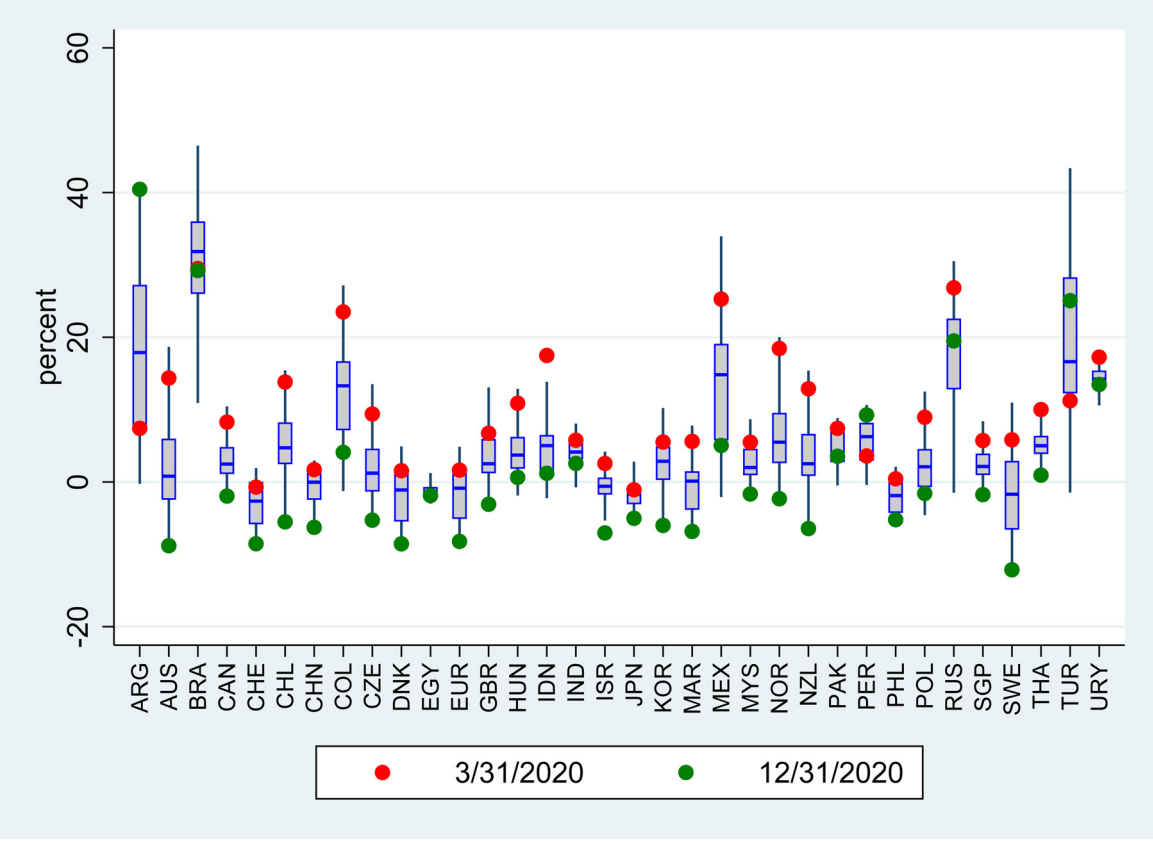

Fig. 2. Distribution of Exchange Rate Changes.
Notes: The boxes represent the percentage depreciation of the currency of each listed country against the U.S. dollar from January 1, 2020 to every day of the year. Horizontal lines represent medians, box limits, and the inter-quartile range. Vertical lines extend to upper and lower adjacent values. Outliers are omitted. Red dots show depreciation from close of January 1, 2020 through close of March 31, 2020 while green dots show the depreciation from close of January 1, 2020 through close of December 31, 2020. Data labels use International Organization for Standardization (ISO) country codes and are listed alphabetically. Exchange rates are from Datastream.

countries with the largest valuation losses have currencies that appreciated at the onset of the crisis in part due to their role as safe havens. The liabilities of these countries are predominantly in domestic currency while their assets are mainly in foreign currencies. Hence a currency appreciation tends to increase the value of their net foreign liabilities. We observe that losses were also present in Turkey ($14 billion), where the depreciation of the domestic currency increased the value of its net foreign liabilities, which are mostly denominated in foreign currency. In contrast, despite the depreciation of their currencies, we find that Russia, the United Kingdom, and Norway enjoyed the largest currency-induced valuation gains.

By the end of 2020, the configuration of exchange rate movements shifted the picture of currency-induced valuation effects. In fact, by the end of 2020, the countries which show the largest currency-induced valuation losses are China, Ireland, Japan, and Switzerland, while the largest valuation gains are registered in the United States, Russia, and Brazil. As with the situation in 2020Q1, the reasons for these effects varied by country. For the United States, the USD depreciation improved its net foreign position due to liabilities mostly denominated in USD and assets composed of multiple currencies. The losses for Ireland and Switzerland were due to the appreciation of the euro and the Swiss franc against the USD. In the case of Brazil, the depreciation of the real against the U.S. dollar increased the value of its foreign exchange reserves.

In order to have a sense of the economic importance of these effects, it is useful to measure the currency-induced valuation effects relative to GDP (Figure 4). We find that relative to GDP the largest currency-induced valuation losses in 2020Q1 were experienced in Switzerland, Turkey, and Japan (7.4, 1.9, and 1.7 percent of GDP, respectively). At the same time, currency-induced valuation gains for Norway, Singapore, and Russia exceeded 10 percent of their respective GDPs. By the end of 2020, the largest currency-induced valuation losses as a share of GDP were observed in Ireland, Switzerland, and the Netherlands (36, 18, and 13 percent of GDP, respectively). The largest gains were more modest in magnitude and were observed in Argentina, Russia, and Uruguay.[25]

We check the sensitivity of our results to an alternative calculation of currency-induced valuation effects using a simple accounting method. We take foreign assets and liabilities at the end of 2019 and compute the difference between their domestic currency values at the beginning and the end of 2020Q1 and 2020. For cross-country comparisons, we convert these values to U.S. dollars using the exchange rates at the end of 2020Q1 and the end of 2020, respectively. Figure 5 plots the results of this calculation (*y-axis*) against the Lane-Shambaugh method based on the calculation of financial exchange rates (*x-axis*). By and large, the results are concentrated around the 45-degree line, suggesting that the two methods produce similar results.

4.2. Results by Asset Class

The aggregate results analyzed above may mask a substantial degree of heterogeneity across asset classes. It could be that some

[25] To limit the number of charts, we present the rest of our measures in billion U.S. dollars. All corresponding charts as a share of GDP are presented in the Appendix.

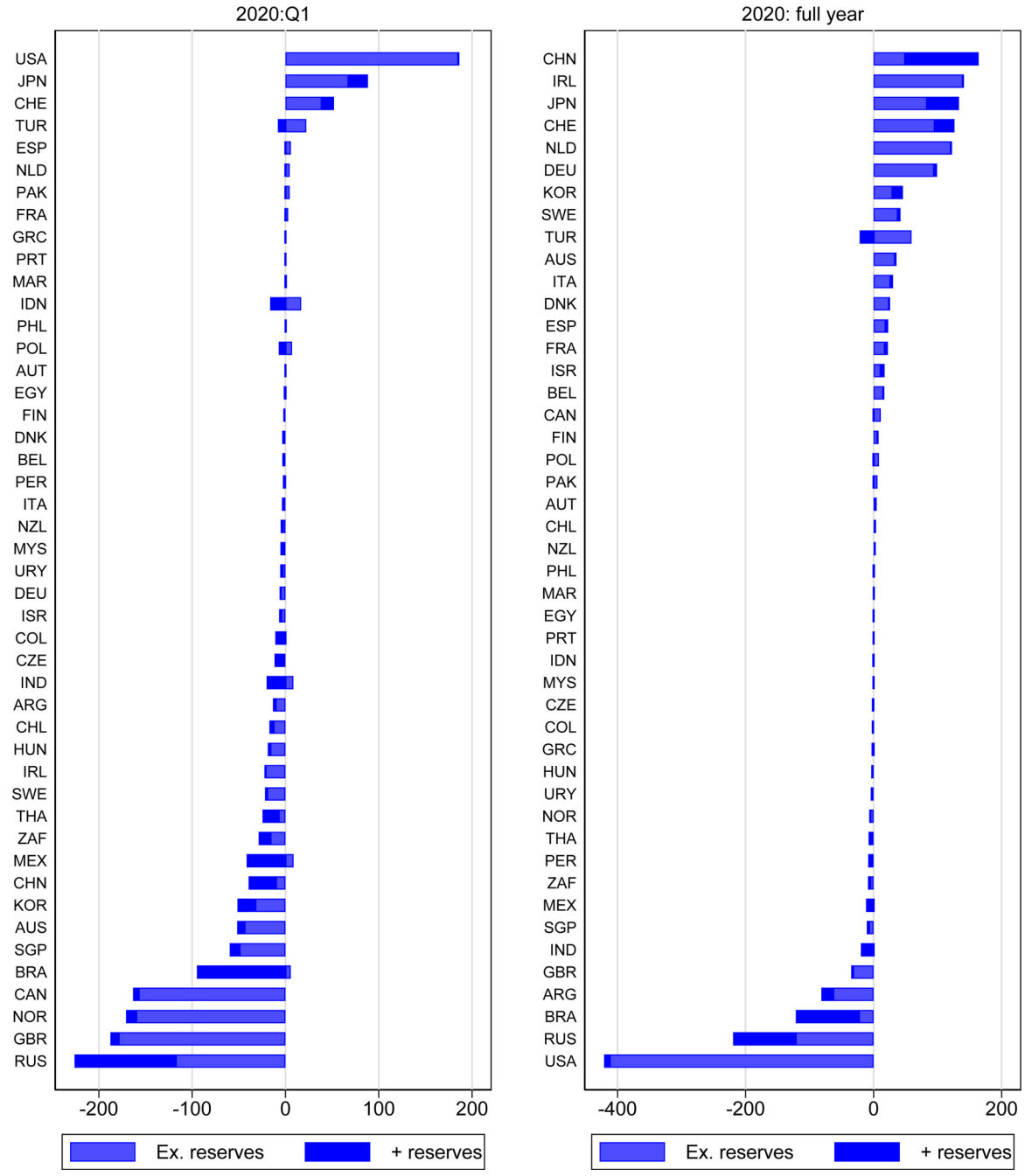

Fig. 3. Change in Aggregate Net Liabilities (Billion U.S. dollars).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects (in billion USD). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel. Light bars exclude reserves and dark bars combined with light bars include them.

countries experienced gains on net equity positions and losses on net debt positions or vice versa. Furthermore, currency exposures for portfolio assets may be different from those of direct investment. Therefore, in this subsection, we present our results disaggregated by asset class. We report our results in terms of billions of U.S. dollars, and the results as a share of GDP are reported in the Appendix (Figures A.1-A.3).

Figures 6-8 present the currency-induced valuation effects (in billions of U.S. dollars) for different asset classes. Figure 6 presents the breakdown between debt (comprising an aggregate of portfolio debt, other investment and, direct investment debt) and equity (which includes both portfolio and direct investment equity). Figures 7 and 8 include more disaggregated results for debt and equity components, respectively.

Several important features emerge from these charts. For the United States, losses observed at the onset of the COVID-19 crisis (2020Q1) arise from the $248 billion increase in net equity liabilities, nearly equally split between portfolio and direct investment equity. Some of these losses are offset by $63 billion gains on external debt positions, predominantly portfolio debt. This is exactly what we would expect from a broad U.S. dollar appreciation. Because the U.S. dollar depreciated against most major currencies by

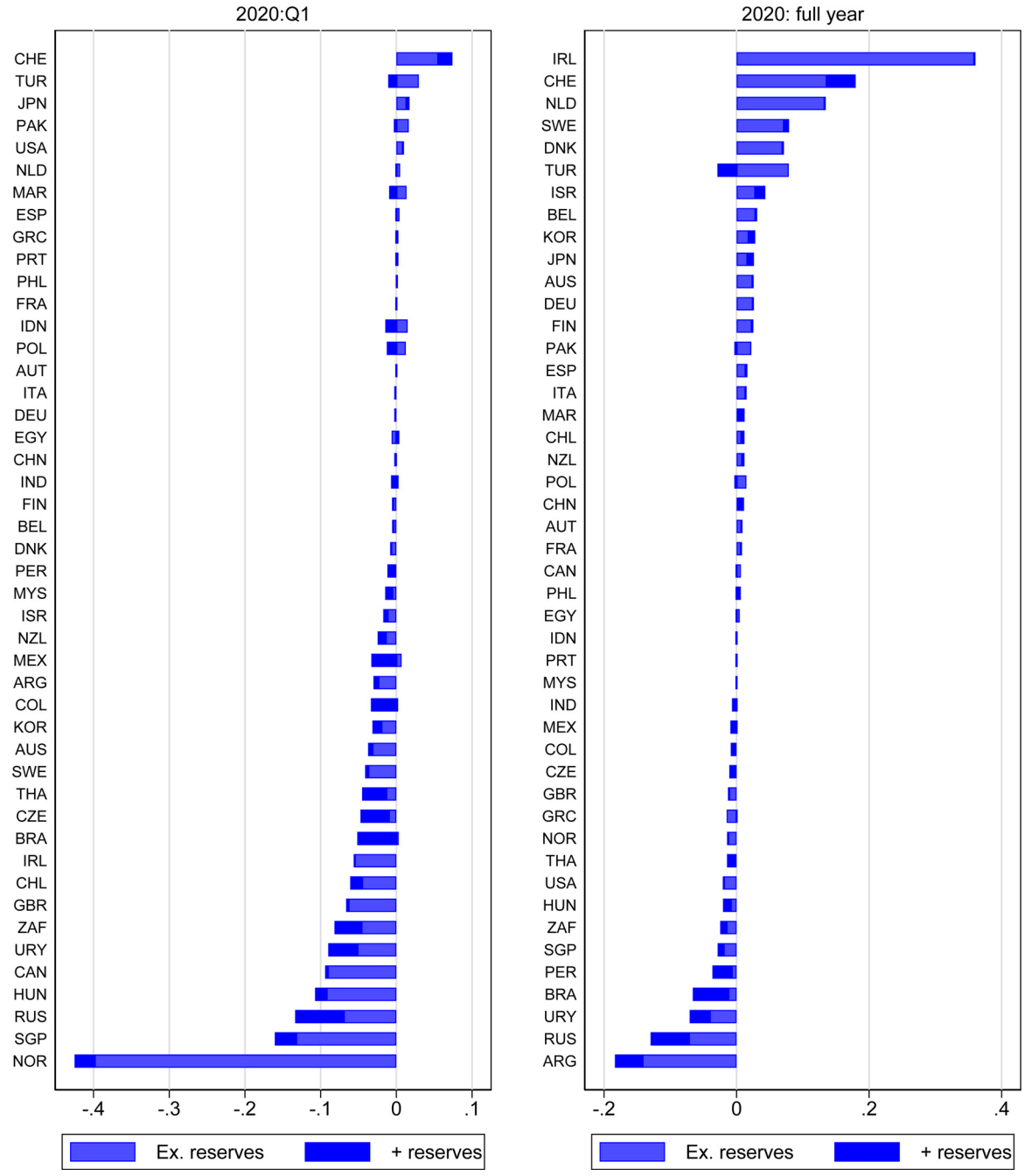

Fig. 4. Change in Aggregate Net Liabilities (Share of GDP).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects (in percent of GDP). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel. Light bars exclude reserves and dark bars combined with light bars include them.

the end of 2020, the pattern of currency-induced valuation effects for the U.S. also reversed, resulting in more than $661 billion gains on external equity positions, partially offset by $249 billion losses on external debt positions.

The pattern of currency-induced valuation effects going in the opposite direction for debt and equity positions is observed for several countries, with gains and losses offsetting each other out for Mexico, Brazil, Colombia, Australia, and Canada. For other countries, such as Japan, Switzerland, and Russia, the currency-induced valuation effects for equity and debt move in the same direction.

In terms of the composition of the valuation effect on external debt positions (Figure 6), both portfolio debt and other investment play an important role, while the role of direct investment debt is very limited. For most countries, the exposure to currency movements for portfolio debt and other investment tend to go in the same direction. A notable exception is the U.K., where the currency-induced valuation effects on portfolio debt and other investment almost exactly offset each other.

Given that equity liabilities are always denominated in domestic currencies while equity assets are mostly denominated in foreign currencies (except in the euro area), currency-induced valua-

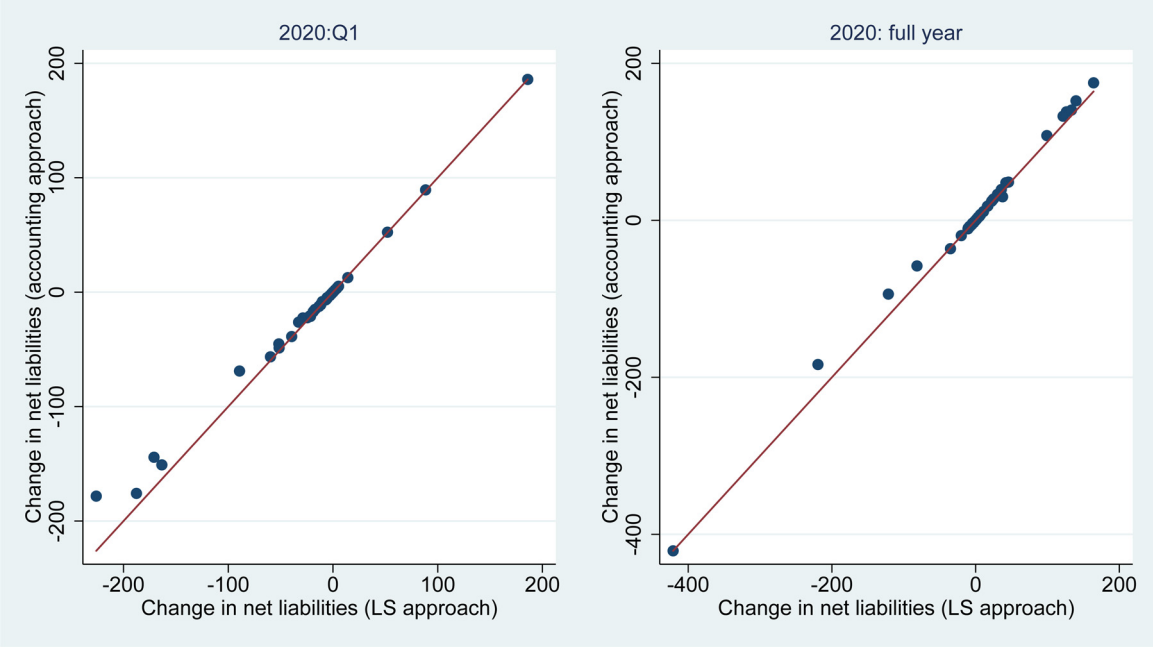

Fig. 5. Comparison of Change in Aggregate Net Liabilities (Billion U.S. dollars).
Notes: The charts compare the changes in net liabilities due to currency-induced valuation effects (in billion USD) using the Lane-Shambaugh methodology (*x-axis*) and an accounting methodology (*y-axis*). The left panel presents the results for 2020Q1 while the right panel includes the full year 2020. See text for methodology and original data sources.

tion gains and losses follow the pattern of currency movements. Interestingly, for most countries, direct investment and portfolio equity positions are almost equally important (Figure 8). Notable exceptions are Russia, Brazil, and Mexico, where direct investment equity positions dominate the effect.

4.3. Emerging Economies and Historical Comparisons

During the COVID-19 crisis, several governments have applied fiscal stimuli to support consumption during the lockdowns (see, for example, Arellano et al., 2020). In this context, emerging economies faced additional challenges given their perennial problem of a large external debt and susceptibility to debt crises. With a history of borrowing heavily in foreign currency (Eichengreen et al., 2007), these trends could raise questions about emerging markets' vulnerability to sharp currency movements. In a scenario of large debt accumulation and high exchange rate volatility, the currency composition of external assets and liabilities could either play a mitigating or amplifying role. A mitigating effect would be present if in response to a domestic currency depreciation a country does not suffer large valuation losses or enjoys valuation gains. An amplifying effect would be present when valuation losses increase the value of external net liabilities, which would exacerbate difficulties in accessing foreign capital markets.

As we have shown in Figures 3-4, the aggregate currency-induced balance sheet losses during the early stage of the COVID-19 economic crisis were modest in magnitude for emerging economies, despite the fact that some currencies depreciated substantially. This is partly due to gains in equity positions offsetting losses in debt positions. The gains in equity positions are unsurprising given that equity liabilities are denominated in domestic currency, while equity assets are mostly denominated in foreign currencies, and currencies of emerging economies depreciated against global currencies.

Consider emerging economies that experienced a large weakening of their domestic currencies in 2000Q1: Brazil, Colombia, Mexico, South Africa, and Turkey. Of these countries, the only one which suffered aggregate valuation losses at the onset of the crisis is Turkey ($14 billion or 1.9 percent of GDP). In other countries, the valuation gains on equity and reserve holdings largely compensated for the valuation losses on debt positions. Turkey, however, exhibited substantial currency-induced valuation losses on their external debt portfolio ($26 billion) and relatively small valuation gains on equity positions ($3.4 billion).[26] In contrast, Brazil showed in absolute terms the largest currency-induced valuation losses on the debt component ($92 billion), but these losses were offset by $86 billion currency-induced valuation gains on equity positions (driven mainly by direct investment equity). Similarly, Mexico had valuation losses on debt positions ($51 billion) driven by an increase in net portfolio debt liabilities, which were offset by $43 billion gains on equity positions. Although Mexico and Brazil have highly dollarized external debt liabilities, they benefit from a substantial amount of direct investment equity, which are liabilities denominated in domestic currency. When the domestic currency depreciates, the resulting losses on debt positions are offset by equity gains.

While these patterns are consistent with emerging economies' foreign debt dollarization, there are some exceptions: despite substantial depreciations, Uruguay, South Korea, and Thailand experienced small currency-induced valuation gains on their external debt positions in 2020Q1, due to a limited amount of currency mismatch on their external balance sheets. Russia displayed gains both on debt and equity positions, similar to Norway, due to their large asset positions in global currencies. Argentina also had some small valuation gains in 2020Q1 as a result of valuation gains in equity and in other investment which offset the losses in portfolio debt. The case of Argentina illustrates that aggregation may mask potential currency mismatches at the sectoral level given that external debt liabilities are mainly owned by the government while

[26] An additional offset came from gains on foreign reserve holdings.

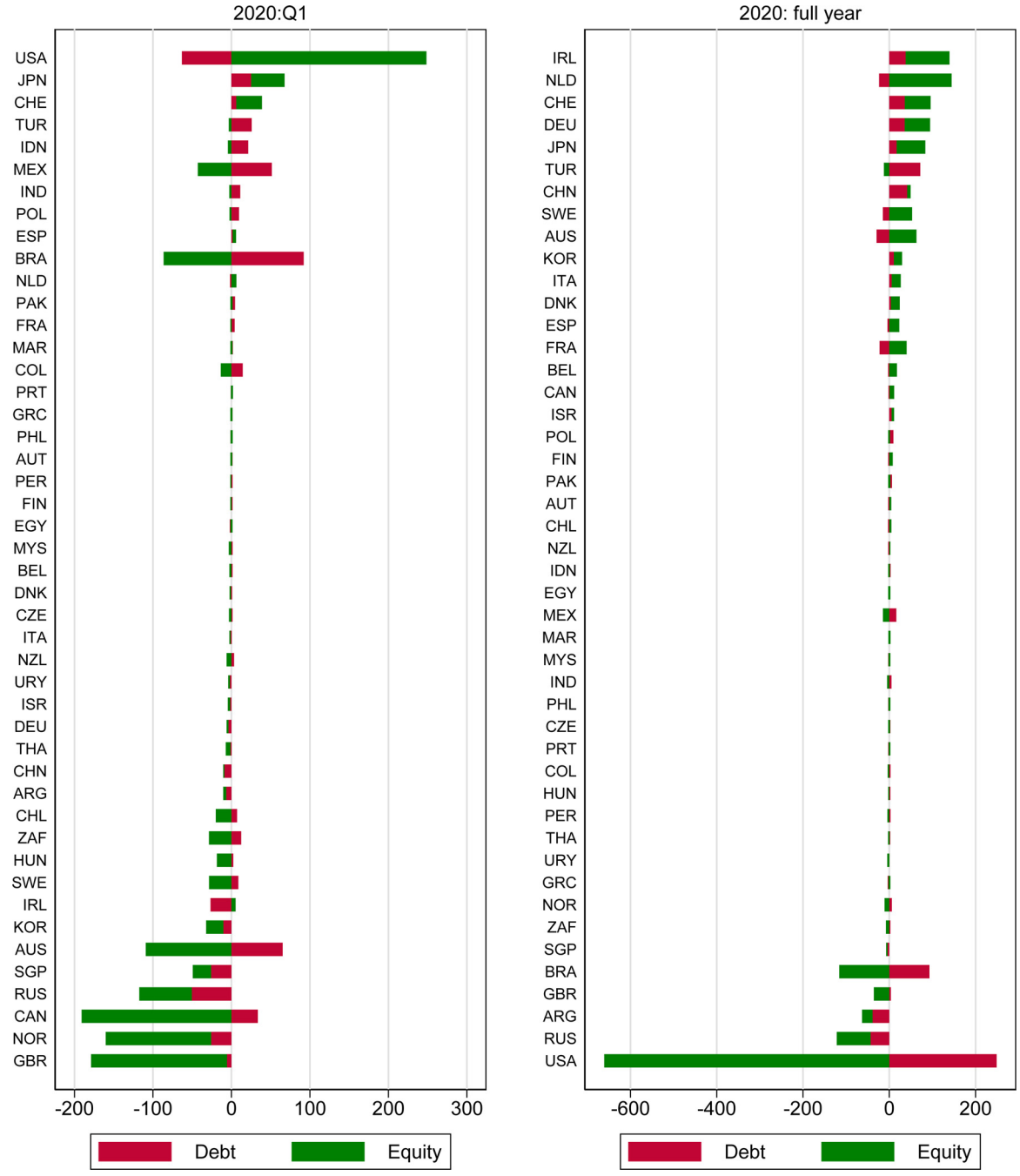

Fig. 6. Change in Net Liabilities. Debt-Equity Breakdown (Billion U.S. dollars).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects (in billion USD). Red denotes changes in debt net liabilities (and includes portfolio debt, other investment, and direct investment debt), while green denotes changes in equity net liabilities (comprising portfolio equity and direct investment equity). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

external debt assets are mostly owned by the private sector. In this way, depreciations can potentially generate large wealth distributions. This is likely to be the case for other emerging markets as well.

It is notable that South-East Asian countries which during the Asian Financial Crisis of 1997-98 suffered large valuation losses (Indonesia, Korea, Philippines, and Thailand), show for the most part moderate currency-induced valuation losses or even gains during the COVID-19 crisis, despite substantial currency depreciations. As a reference, Figure A.4 in the Appendix, shows currency depreciations as well as currency-induced valuation losses for these countries during the 1997-98 Asian Financial Crisis. First, we observe much larger currency depreciations in the 1990s, which resulted from overvalued currencies prior to the collapse of their fixed exchange rate regimes. Second, we see large balance sheet losses due to the dollarization of external liabilities that substantially exceeded the amount of foreign exchange reserves, the fact well documented in the literature (Corsetti et al., 1999; Gertler et al., 2007).

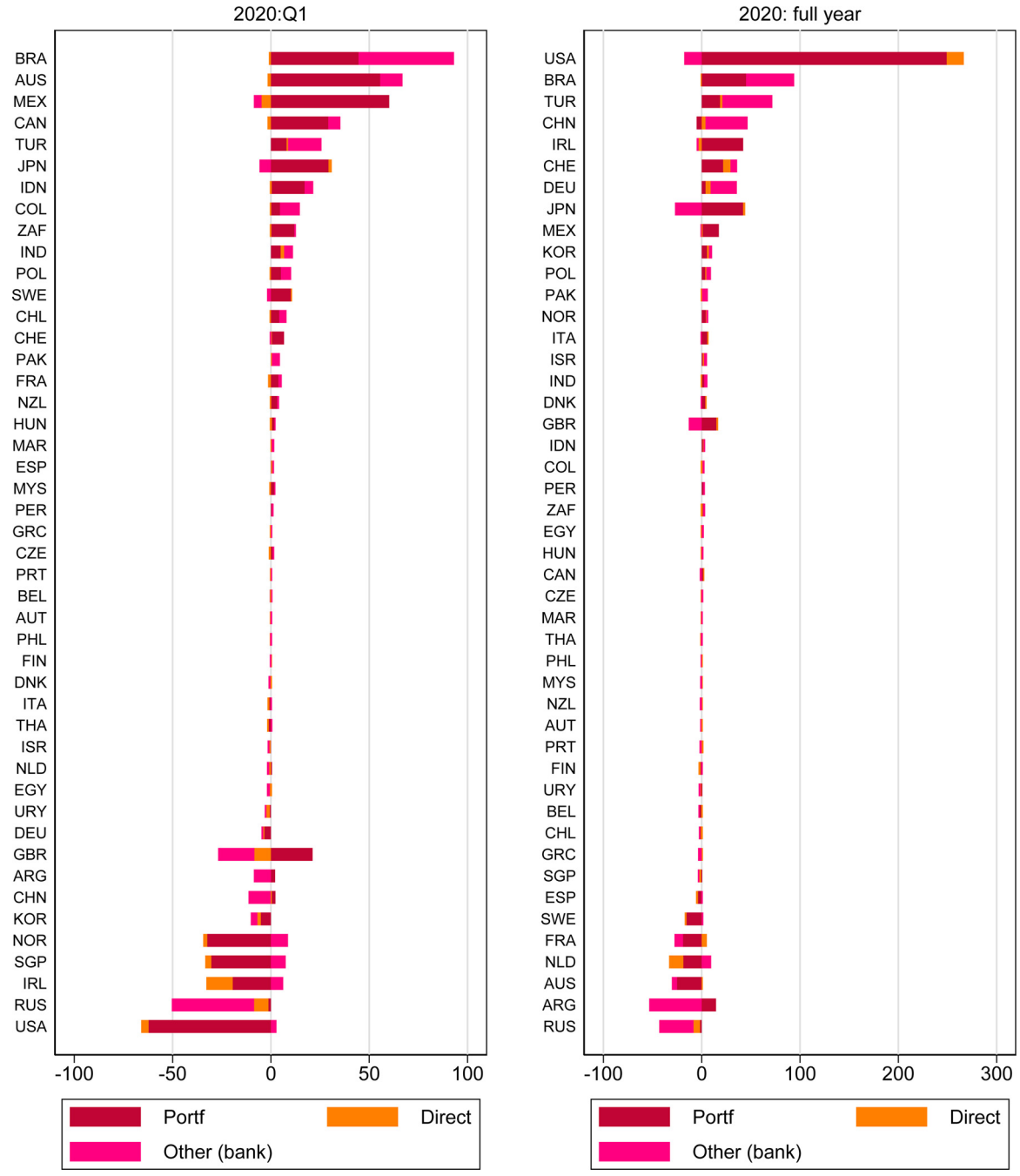

Fig. 7. Change in Debt Net Liabilities (Billion U.S. dollars).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects (in billion USD). Red, pink and orange denote changes in portfolio debt, other investment, and direct investment debt net liabilities, respectively. See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

4.4. Currency Mismatch and Exchange Rate Depreciation

As Figure 1 shows, exchange rate movements in the first quarter of 2020 varied dramatically across countries. Here we test whether the presence of a currency mismatch in external balance sheets prior to the COVID-19 crisis is associated with the magnitude of currency depreciation observed in the first quarter of 2020, before the asset markets were reassured by broad fiscal stimulus measures. We test this hypothesis by estimating the following cross-section regression, in which we control for other covariates:

$$\Delta E_{i,USD} = \alpha + \beta_0 \mathcal{M}_i + \beta_1 CD_i + \beta_2 ES_i + \beta_3 FX_i + \varepsilon_i, \quad (7)$$

where $\Delta E_{i,USD}$ denotes domestic currency i depreciation against the U.S. dollar between December 31, 2019, and March 31, 2020; $\mathcal{M}_i$, defined in equation (4) measures the currency mismatch in the external balance sheet as of the end of 2019, excluding foreign reserves; CD_i is the cumulative count of COVID-19 related deaths in country i on March 31, 2020, which we use to proxy for the spread of COVID-19 in country i; ES_i is the index of cumulative economic support enacted in country i by March 31, 2020; FX_i is the amount of foreign exchange reserves held by country i at the

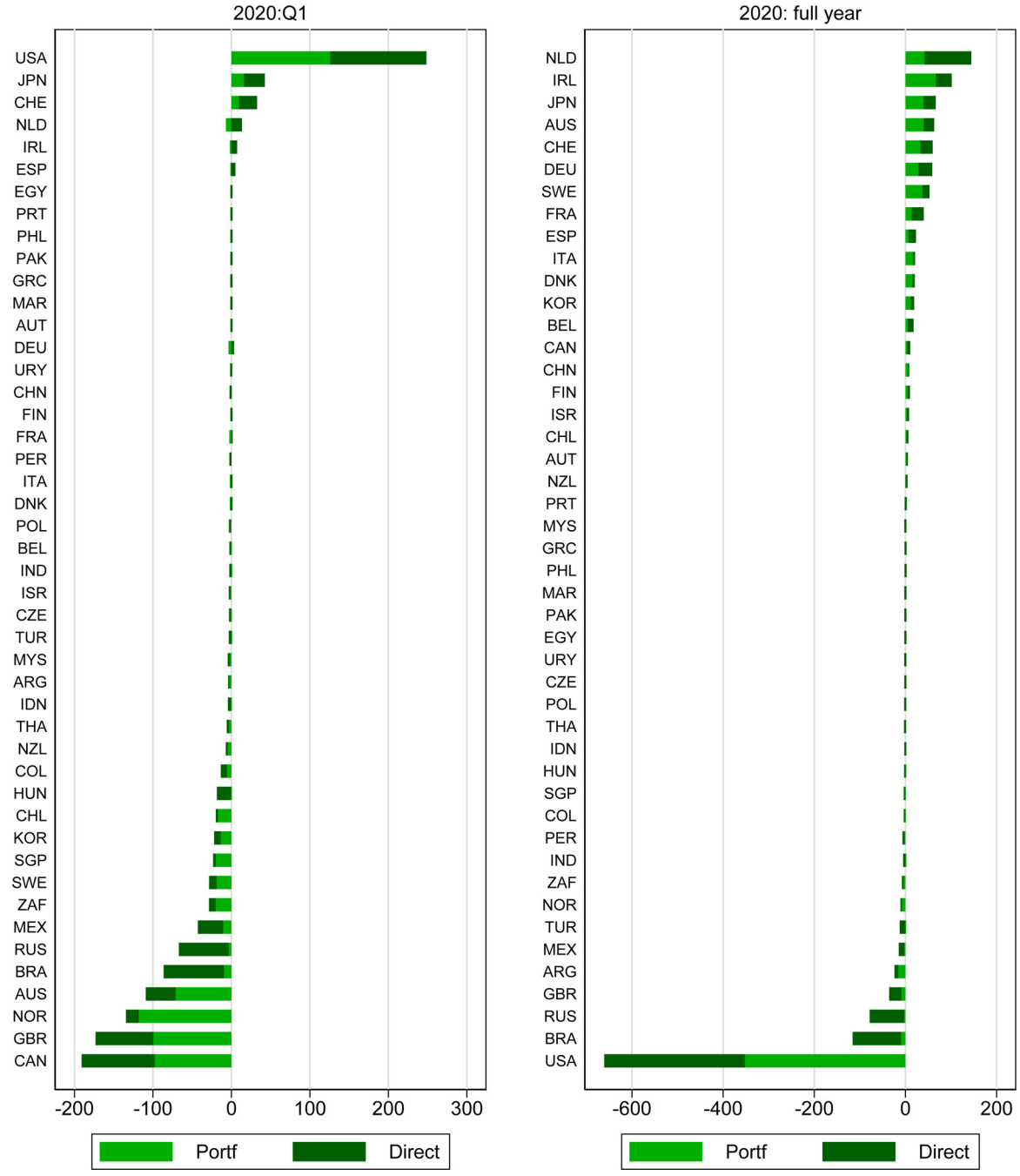

Fig. 8. Change in Equity Net Liabilities (Billion U.S. dollars).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects (in billion USD). Light green denotes changes in portfolio equity net liabilities while dark green indicates changes in direct investment equity net liabilities. See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

end of 2019 relative to the sum of total external assets and liabilities.[27] We limit the cross-section to countries that were net borrowers in terms of their overall foreign asset positions, excluding reserves. We first estimate this regression for $\mathcal{M}_i$ evaluated for total assets and total liabilities, and then we break it down by asset class.

The results are reported in Table 1 and suggest that a higher currency mismatch, i.e. more exposure of net liabilities to currency depreciation, is associated with less depreciation. That is, countries that stood to gain from their home currency depreciation experienced more depreciation than countries that stood to lose. On its own, our measure of currency mismatch of the external balance sheet explains 12 percent of the total variation in the amount of currency depreciation.

This result is robust to controlling for foreign exchange reserves, the number of COVID-19 related deaths, and the economic support

[27] For this part of our analysis we exclude foreign exchange reserves from the measure of currency mismatch because we analyze their impact separately.

Table 1
Currency Mismatch and Depreciation During 2020Q1.

	(1)	(2)	(3)	(4)
Currency Mismatch	-0.15**	-0.15**	-0.13*	-0.13*
	(0.067)	(0.068)	(0.063)	(0.074)
FX Reserves		-0.055		-0.17
		(0.18)		(0.18)
COVID-19 Deaths			-0.009	-0.010*
			(0.005)	(0.005)
Economic Support			-0.069	-0.083*
			(0.041)	(0.043)
Constant	0.099***	0.093***	0.140***	0.160***
	(0.015)	(0.024)	(0.022)	(0.034)
Observations	32	32	32	32
Adjusted R^2	0.12	0.09	0.26	0.25

Notes: This table shows the results of the regression in equation (7). The dependent variable is the domestic currency depreciation against the U.S. dollar from January 1, 2020 to March 31, 2020. Only countries for which total external liabilities exceeded total external assets excluding foreign exchange reserves were included in the sample. Currency mismatch is measured as in Lane and Shambaugh (2010) — aggregate foreign currency exposure presented in equation (4). Foreign exchange reserves are limited to the amount held in foreign currency and are expressed as a share of the sum of external assets and liabilities. The cumulative number of COVID-19 related deaths is in 1000s and the Economic Support Index is between 0 and 1. Both are measured as of March 31, 2020, as provided by the Coronavirus Government Response Tracker. Standard errors are in parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent-level, respectively.

index. The ratio of foreign exchange reserves to the sum of external assets and liabilities does not enter the regression significantly and does not add any explanatory power.[28] The number of COVID-19 related deaths enters the regression with a coefficient that has a counter-intuitive sign but is statistically significant.[29] Finally, the economic support index is, as expected, associated with less currency depreciation. The last two variables increase the explanatory power of the regression substantially.

We explored a variety of other specifications, none of which produced different results. First, we added to the list of control variables an indicator of quantitative easing in local currency conducted by domestic central banks as well as an indicator of the U.S. dollar swap arrangement with the Federal Reserve. We found that these variables had no effect on the magnitude of currency depreciation in 2020Q1 and including them as controls did not alter the effects of other variables. Second, we included controls for the reliability of the currency composition of foreign exchange reserves. The currency composition of foreign exchange reserves is publicly available for some countries, but it is imputed for others. We included an interaction term of an indicator of whether the currency composition of foreign exchange reserves is publicly available with FX_i. Neither the main effect of this indicator nor the interaction terms enter the regression significantly. Finally, we accounted for the possible persistence of the exchange rate dynamics by including the currency depreciation during 2019 as a control variable. The lagged depreciation enters with a low coefficient of 0.12 that is not statistically significant and including it does not alter the results.

To better understand what appears to be a counter-intuitive effect of the external balance sheet mismatch on exchange rate depreciation, we decompose aggregate mismatch measure by asset class: three types of debt (portfolio, direct investment, and other investment) and equity.[30] The results, reported in Table 2, are quite interesting: we find that portfolio debt mismatch is associated with a larger depreciation, as expected, while direct investment debt and other investment (bank debt) have a negative effect, and equity mismatch has no statistically significant effect once we include control variables.[31] Our understanding of these results is that countries that are prone to large currency depreciations during crisis events were able to reduce currency mismatches on balance sheets of their banks, but had limited ability to improve the currency mismatch of portfolio debt.

5. Stock–Flow Reconciliation and Total Valuation Effects

Currency-induced valuation effects are only one part of the total valuation effects which also comprise valuation effects resulting from changes in asset prices. We use equation (6) to compute total valuation effects, which we further break down into $VALNFA^{FX}$ and $VALNFA^{P}$. Note that the latter is calculated as a residual and therefore includes, in addition to valuation effects resulting from asset price movements, any other changes in the volume of stocks (e.g., economic appearance or disappearance of assets or liabilities, reclassification, measurement issues), and statistical discrepancies.[32] This decomposition is known in the literature as a stock–flow reconciliation, because valuation effects account for the difference between changes in net foreign asset positions (changes in stocks) and flows.

Table 3 presents the stock-flow reconciliation for 2000Q1, where for exposition purposes we grouped some countries into regions.[33] The first column shows the current account (*CA*), a flow, in 2020Q1, while the second column reports the changes in net foreign asset positions between the end of 2020Q1 and the end of 2019Q4. The currency-induced valuation effects are presented in columns (3)-(5) and are broken down into those originating from equity positions (direct investment and portfolio equity) and debt positions (direct investment debt, portfolio debt, and other investment). Total currency-induced valuation effects comprise these two categories plus foreign exchange reserves. Asset price valuation effects and total valuation effects are reported in columns (6) and (7), respectively. The last column shows the share of currency-induced valuation effects in total valuation effects.

Two important observations stand out from this table. First, total valuation effects are substantial but there is heterogeneity in terms of how much is due to exchange rate movements *vis-à-vis* asset price effects. For the U.S., which is the country with the largest valuation losses in billion U.S. dollars, currency-induced valuation effects represent 47 percent of the total valuation effects. For some economies, such as the U.K., Russia, and Korea, valuation effects arising from exchange rate fluctuations account for nearly all of the total valuation effects. Second, for some countries losses due to asset price valuation effects were partially offset by gains in currency-induced valuation effects (Canada and Europe outside of the euro area) or vice versa (Switzerland, Japan).

Valuation changes can either have a stabilizing or an amplifying effect on the international investment position.[34] The effects

[28] This result is robust to using other scaling factors for foreign reserves, such as GDP.

[29] We chose the number of deaths because of vast differences in the testing around the world, especially in 2020Q1. However, the results are robust to the use of the number of COVID-19 cases instead of deaths.

[30] Decomposing equity mismatch into the portions that are due to portfolio and direct investment yields the same results.

[31] If we include an aggregate mismatch measure in addition to mismatches by asset class, we still get a negative effect on aggregate mismatch, but the effect of other investment mismatch becomes insignificant.

[32] The errors and omissions component of the balance of payments statistics for 2020Q1 and end of the year 2020, and our measured valuation effects are not correlated. Therefore, they represent noise rather than a bias in our analysis.

[33] The country groups are as follows. Euro Area: AUT, BEL, FRA, DEU, ITA, NLD, FIN, GRC, IRL, PRT, and ESP; Other Europe: CZE, DNK, HUN, NOR, POL, and SWE; Other Advanced: AUS, NZL, and ISR; Emerging Asia: IDN, MYS, PHL, and THA; Other LATAM: ARG, CHL, PER, URY; Rest of the world: EGY, MAR, and PAK.

Table 2
Currency Mismatch by Asset Class and Depreciation During 2020Q1.

	(1)	(2)	(3)	(4)	(5)	(6)
Currency mismatch	0.085**		0.079*	0.084**		0.088**
Portfolio debt	(0.039)		(0.043)	(0.036)		(0.040)
Currency mismatch	-0.51***		-0.49***	-0.38**		-0.39**
Direct investment debt	(0.16)		(0.17)	(0.15)		(0.16)
Currency mismatch	-0.095		-0.088	-0.11**		-0.12*
Other investment	(0.056)		(0.062)	(0.052)		(0.058)
Currency mismatch		-0.11*	-0.020		-0.073	0.017
All equity		(0.061)	(0.064)		(0.064)	(0.065)
FX Reserves	-0.15	0.033	-0.15	-0.33*	-0.17	-0.34*
	(0.17)	(0.18)	(0.18)	(0.17)	(0.19)	(0.18)
COVID-19 Deaths				-0.010*	-0.011*	-0.010*
				(0.005)	(0.006)	(0.005)
Economic Support				-0.063	-0.072	-0.068
				(0.041)	(0.050)	(0.046)
Constant	0.069**	0.069**	0.066**	0.140***	0.140***	0.140***
	(0.026)	(0.026)	(0.028)	(0.038)	(0.042)	(0.044)
Observations	32	32	32	32	32	32
Adjusted R^2	0.26	0.048	0.23	0.37	0.18	0.35

Notes: This table shows the results of the regression in equation (7). The dependent variable is the domestic currency depreciation against the U.S. dollar from January 1, 2020 to March 31, 2020. Only countries for which total external liabilities exceeded total external assets excluding foreign exchange reserves were included in the sample. Currency mismatch by asset class is measured as in Lane and Shambaugh (2010) — foreign currency exposure presented in equation (4). Foreign exchange reserves are limited to the amount held in foreign currency and are expressed as a share of the sum of external assets and liabilities. The cumulative number of COVID-19 related deaths is in 1000s and the Economic Support Index is between 0 and 1. Both are measured as of March 31, 2020, as provided by the Coronavirus Government Response Tracker. Standard errors are in parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent-level, respectively.

Table 3
Stock-Flow Reconciliation (2020Q1).

	Δ NFA	CA	FX valuation			Price Valuation	Total Valuation	FX Valuation/Total
			total	debt	equity			
Japan	87	51	-88	-25	-43	125	36	-243%
Switzerland	41	6	-52	-6	-33	87	35	-149%
Canada	-139	-11	163	-34	191	-291	-128	-128%
Turkey	55	-9	-14	-26	3	78	64	-22%
India	441	1	12	-11	3	429	441	3%
Euro Area	301	31	22	27	-9	249	271	8%
China	132	-40	39	9	1	133	173	23%
Brazil	346	-20	89	-92	86	277	366	24%
Mexico	124	-7	33	-51	43	99	132	25%
South Africa	65	-1	29	-12	29	36	65	44%
United States	-489	-97	-186	63	-248	-206	-392	47%
Colombia	14	-3	10	-14	14	6	16	62%
Singapore	89	14	60	26	23	15	75	79%
United Kingdom	180	-23	188	6	173	15	203	93%
Russia	266	23	226	50	67	16	242	93%
Korea	65	13	51	10	22	1	52	98%
Other Europe	-118	27	226	5	189	-371	-145	-156%
Rest of the world	14	-4	-3	-4	0	22	19	-18%
Emerging Asia	212	8	29	-22	14	175	204	14%
Other Advanced	138	11	64	-67	118	63	126	50%
Other Latin America	15	0	39	1	26	-24	15	253%

Notes: This table shows the stock-flow reconciliation described in equation 6. The *CA* denotes the current account in 2020Q1; Δ NFA is the change in net foreign assets positions between 2019Q4 and 2020Q1; FX Valuation includes currency-induced valuation effects and are broken down into equity (direct investment equity and portfolio equity), debt (direct investment debt, portfolio debt and other investment), and total which includes the previous two categories plus foreign exchange reserves; Price Valuation includes the valuation effects arising from changes in asset prices as well as other factors; and Total Valuation is equal to the sum of FX Valuation and Price Valuation. The last column shows the share of valuation changes accounted for by exchange rate effects. Euro Area: AUT, BEL, FRA, DEU, ITA, NLD, FIN, GRC, IRL, PRT, and ESP; Other Europe: CZE, DNK, HUN, NOR, POL, and SWE; Other Advanced: AUS, NZL, and ISR; Emerging Asia: IDN, MYS, PHL, and THA; Other LATAM: ARG, CHL, PER, URY; Rest of the world: EGY, MAR, and PAK. Columns (1)-(7) are in billion U.S. dollars.

will be stabillizing if capital outflows are accompanied by valuation gains or capital inflows are accompanied by valuation losses. Figure 9 plots the relationship between the change in the current account balance between 2020Q1 and 2019 (a proxy for capital flows) *vis-à-vis* total and currency-induced valuation effects. We can see that most countries that experienced a deterioration of their current accounts, i.e. capital outflows, in 2020Q1, displayed valuation gains in their external positions, which for these countries mitigated the impact of capital outflows on their external bal-

[34] For example, Bénétrix et al. (2015) found a mitigating, or stabilizing, effect during the Global Financial Crisis.

Fig. 9. Capital Flows and Valuation Effects.
Notes: Horizontal axes on both charts show the difference between current account to GDP ratio in 2020Q1 (annualized) and its value in 2019 for each country. Vertical axis on the top chart is the ratio of currency-induced valuation effects reported in Table 3 with respect to 2019 GDP. Vertical axis on the bottom chart is the ratio of total valuation effects reported in Table 3 with respect to 2019 GDP. Green dots indicate emerging markets, blue dots indicate advanced economies. Country names are reported as ISO codes.

ance sheet positions. Notable exceptions are Denmark, Turkey, and Switzerland. This by itself, however, does not mean that all valuation effects were stabilizing. In fact, most countries that show a relative improvement in their current accounts, i.e. capital inflows, in 2020Q1 also exhibited valuation gains, both of which improved their net international investment positions. As a result, regression lines, drawn separately for advanced and emerging economies, show no correlation between changes in the current account and valuation effects.

In Table 4 we present the stock-flow reconciliation for the full year 2020. Because of the different patterns of exchange rate changes and asset prices values, we observe a change in the contributions of currency-induced and price-induced valuation effects compared to the results reported in Table 3. Most notably, for the U.S., which by the end of 2020 is the country with largest valuation losses in billion U.S. dollars, currency-induced valuation effects shifted from losses in 2020Q1 to gains by the end of 2020, with overall losses driven by asset price-induced valuation effects.

Table 4
Stock-Flow Reconciliation (2020).

	Δ NFA	CA	FX valuation			Price Valuation	Total Valuation	FX Valuation/Total
			total	debt	equity			
Switzerland	113	28	-126	-36	-60	211	84	-150%
India	-6	33	20	-5	5	-59	-39	-51%
United States	-2877	-616	421	-249	661	-2682	-2261	-19%
Canada	302	-30	-11	-1	-11	343	332	-3%
Japan	165	164	-133	-17	-66	134	0	-
Singapore	269	60	11	4	3	199	209	5%
South Africa	71	7	9	-2	8	56	64	14%
Colombia	1	-10	3	-3	4	8	11	25%
Mexico	56	26	10	-16	15	19	30	35%
Korea	-53	75	-46	-11	-19	-82	-128	36%
China	-178	274	-164	-41	-8	-288	-452	36%
United Kingdom	-23	-95	35	-4	36	37	72	48%
Brazil	175	-26	121	-93	116	80	201	60%
Turkey	-88	-37	-38	-72	13	-13	-51	74%
Euro Area	137	376	-460	-18	-421	222	-238	193%
Russia	117	36	219	43	79	-138	81	270%
Other Europe	204	97	-62	-5	-58	169	107	-58%
Emerging Asia	149	40	7	-1	2	102	109	6%
Rest of the world	-35	-16	-8	-8	0	-12	-19	41%
Other Advanced	-72	53	-55	25	-71	-70	-125	44%
Other Latin America	25	8	91	41	24	-73	18	518%

Notes: This table shows the stock-flow reconciliation described in equation 6. The *CA* denotes the current account in 2020; Δ NFA is the change in net foreign assets positions between 2019 and 2020; FX Valuation includes currency-induced valuation effects and are broken down into equity (direct investment equity and portfolio equity), debt (direct investment debt, portfolio debt and other investment), and total which includes the previous two categories plus foreign exchange reserves; Price Valuation includes the valuation effects arising from changes in asset prices as well as other factors; and Total Valuation is equal to the sum of FX Valuation and Price valuation. The last column shows the share of valuation changes accounted for by exchange rate effects. The country groups are as follows. Euro Area: AUT, BEL, FRA, DEU, ITA, NLD, FIN, GRC, IRL, PRT, and ESP; Other Europe: CZE, DNK, HUN, NOR, POL, and SWE; Other Advanced: AUS, NZL, and ISR; Emerging Asia: IDN, MYS, PHL, and THA; Other LATAM: ARG, CHL, PER, URY; Rest of the world: EGY, MAR, and PAK. Columns (1)-(7) are in billion U.S. dollars.

For Korea and China, valuation effects arising from exchange rate fluctuations account for over 30 percent of total valuation effects. In Russia, losses from asset price valuation were more than offset by gains from exchange rate movements. As in 2020Q1, there is no clear pattern with respect to buffering or amplifying effects of valuation changes on the international investment position, as can be seen from Table 4.

6. Conclusion

In this paper, we quantify the magnitude of the valuation effects on aggregate external balance sheets for 46 countries during the first year of the COVID-19 economic crisis. We analyze the onset of the crisis in 2020Q1 separately from the overall effects in 2020. Relying on new data, we are able to measure the valuation effects that are due to currency movements, by broad asset classes.

We find that, although valuation losses were large for some countries (the U.S., in particular, served its role as a global insurer in 2020Q1), many emerging markets fared better than in the past flight-to-quality episodes, with some even experiencing valuation gains. This was partly due to an increased share of equity assets and liabilities, which serve as a hedge against currency depreciation. While for a subset of countries a currency depreciation led to balance sheet losses on external debt positions, they were compensated by gains on equity positions. In terms of debt, for many emerging markets currency-induced valuation losses were modest and typically concentrated on the portfolio debt component. It may be the case that overcoming the "original sin" by both governments and private-sector borrowers and the tightening of foreign exchange regulations in recent decades helped reduce currency mismatches on external balance sheets for many countries (Ahnert et al., 2021; Aizenman et al., 2020b; Hale et al., 2020; Tobal, 2018). We leave the investigation of the dynamics of currency mismatch and asset class composition of external balance sheets in the last two decades to future research.

We also test whether currency mismatch was associated with the magnitude of currency depreciation in 2020Q1. At the aggregate level, we find that countries with larger currency mismatch experienced a smaller depreciation in 2020Q1. However, when we decompose the measure of currency mismatch by asset class our results show that currency mismatch in portfolio debt is associated with a larger depreciation, potentially implying that there are still vulnerabilities originating in mismatches in this component. As an additional step, we compute the stock-flow reconciliation of net foreign assets by combining information on the change in net foreign assets and current accounts in 2020Q1, and the full year 2020. This allows us to break down valuation effects into those due to changes in exchange rates and those due to changes in the prices of assets and liabilities held in the portfolio. In about half of the countries in our sample, currency-induced valuation effects accounted for over fifty percent of total valuation effects.

Although our results are encouraging, it is important to keep in mind that our analysis is aggregated. Therefore, it does not account for the impact of currency depreciation on individual institutions that may have had large currency mismatches on their balance sheets at the beginning of 2020 and were likely to have experienced substantial losses, given the large and unexpected depreciation of some currencies. It remains to be seen whether the experience of early 2020 will lead to further changes in the currency composition of external assets and liabilities. For example, a recent paper by Aldasoro et al. (2021) shows that U.S. dollar funding of non-US banks increased in 2020.

Appendix A

Table A1
Debt Assets and Reserves. Sources of Data.

Country	Portfolio Debt Assets		Other Investment Assets		Direct Investment Debt Assets		Reserves	
	Actual Data	Estimated Data	Actual Data	Synthetic Data	Actual Data	Synthetic Data	Actual Data	Estimated Data
Argentina	CPIS			BISLBS		IMFWP		IMFWP
Australia		IMFWP		BISLBS		IMFWP	Reserves Template	
Austria	CPIS			BISLBS		IMFWP		IMFWP
Belgium	Survey		Survey	BISLBS	Survey		Reserves Template	
Brazil	CPIS			BISLBS		IMFWP	Reserves Template	
Canada	Survey		Survey			IMFWP	Dept. Finance	
Chile	CPIS			BISLBS		IMFWP	CB	
China		IMFWP		BISLBS		IMFWP		IMFWP
Colombia	CPIS		Survey		Survey		CB	
Czech Republic	Survey		Survey		Survey		Int. Role of the Euro	
Denmark	Survey		Survey		Survey			IMFWP
Egypt	CPIS			BISLBS		IMFWP		IMFWP
Finland	Survey			BISLBS		IMFWP	Reserves Template	
France	Survey		Survey		Survey			IMFWP
Germany	Survey		Survey		Survey		Reserves Template	
Greece	Survey			BISLBS		IMFWP		IMFWP
Hungary	Survey		Survey		Survey			IMFWP
India	CPIS			BISLBS		IMFWP		IMFWP
Indonesia	CPIS			BISLBS				IMFWP
Ireland		IMFWP		BISLBS		IMFWP	Reserves Template	
Israel	CPIS			BISLBS		IMFWP		IMFWP
Italy	Survey		Survey		Survey			IMFWP
Japan	Survey			BISLBS		IMFWP		IMFWP
Korea	CPIS		Survey			IMFWP		IMFWP
Malaysia	CPIS			BISLBS		IMFWP		IMFWP
Mexico	CPIS			BISLBS		IMFWP		IMFWP
Morocco		IMFWP		BISLBS		IMFWP		IMFWP
Netherlands	Survey			BISLBS		IMFWP	Reserves Template	
New Zealand		IMFWP		BISLBS		IMFWP		IMFWP
Norway		IMFWP		BISLBS		IMFWP	Reserves Template	
Pakistan	CPIS			BISLBS		IMFWP		IMFWP
Peru	Survey	IMFWP		BISLBS		IMFWP	CB	
Philippines	CPIS			BISLBS		IMFWP		IMFWP
Poland		IMFWP		BISLBS		IMFWP	CB	
Portugal	CPIS			BISLBS		IMFWP	Reserves Template	
Russia	CPIS			BISLBS		IMFWP	Int. Role of the Euro	
Singapore		IMFWP		BISLBS		IMFWP		IMFWP
South Africa	CPIS			BISLBS		IMFWP		IMFWP
Spain	CPIS			BISLBS		IMFWP		IMFWP
Sweden	CPIS			BISLBS		IMFWP	CB	
Switzerland	Survey		Survey		Survey		CB	
Thailand	Survey		Survey		Survey			IMFWP
Turkey	CPIS		Survey		Survey			
United Kingdom		IMFWP		BISLBS		IMFWP	CB	
United States	CPIS			BISLBS		IMFWP	US Treasury	
Uruguay	CPIS			BISLBS		IMFWP	CB	

Notes: The table reports the sources of data for the currency composition of debt assets and reserves. Actual data are from the IMF survey and CPIS. Estimates are from the data set on currency composition of the IIP published by the IMF Working Paper (IMFWP) Bénétrix et al. (2019). Synthetic data for other investment are from the BIS Locational Banking Statistics (denoted by BISLBS). CB denotes Central Bank.

Table A2
Debt Liabilities. Sources of Data.

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

Notes: The table reports the sources of data for the currency composition of debt liabilities. Actual data are from the IMF survey. Estimates are from the data set on currency composition of the IIP published by the IMF Working Paper (IMFWP) Bénétrix et al. (2019). 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 BISLBS).

Table A3
Equity Assets. Sources of Data.

Country	Direct Investment Equity Assets		Portfolio Equity Assets	
	Actual Data	Estimated Data	Actual Data	Estimated Data
Argentina		IMFWP	CPIS	
Australia		IMFWP		IMFWP
Austria		IMFWP	CPIS	
Belgium	Survey		Survey	
Brazil		IMFWP	CPIS	
Canada		IMFWP	Survey	
Chile		IMFWP	CPIS	
China		IMFWP		IMFWP
Colombia	Survey		CPIS	
Czech Republic	Survey		Survey	
Denmark	Survey		Survey	
Egypt		IMFWP	CPIS	
Finland		IMFWP	Survey	
France	Survey		Survey	
Germany	Survey		Survey	
Greece		IMFWP	Survey	
Hungary	Survey		Survey	
India		IMFWP	CPIS	
Indonesia		IMFWP	CPIS	
Ireland		IMFWP		IMFWP
Israel		IMFWP	CPIS	
Italy	Survey		Survey	
Japan		IMFWP	Survey	
Korea	Survey		Survey	
Malaysia		IMFWP	CPIS	
Mexico		IMFWP	CPIS	
Morocco		IMFWP		IMFWP
Netherlands		IMFWP	Survey	
New Zealand		IMFWP		IMFWP
Norway		IMFWP		IMFWP
Pakistan		IMFWP	CPIS	
Peru		IMFWP	CPIS	
Philippines		IMFWP	CPIS	
Poland		IMFWP	CPIS	
Portugal		IMFWP	CPIS	
Russia		IMFWP	CPIS	
Singapore		IMFWP		IMFWP
South Africa		IMFWP	CPIS	
Spain		IMFWP	Survey	
Sweden		IMFWP		IMFWP
Switzerland	Survey		Survey	
Thailand	Survey		Survey	
Turkey	Survey		Survey	
United Kingdom		IMFWP		IMFWP
United States		IMFWP		IMFWP
Uruguay		IMFWP	CPIS	

Notes: The table reports the sources of data for the currency composition of equity assets. Actual data are from the IMF survey and CPIS. Estimates are from the data set on currency composition of the IIP published by the IMF Working Paper (IMFWP) Bénétrix et al. (2019).

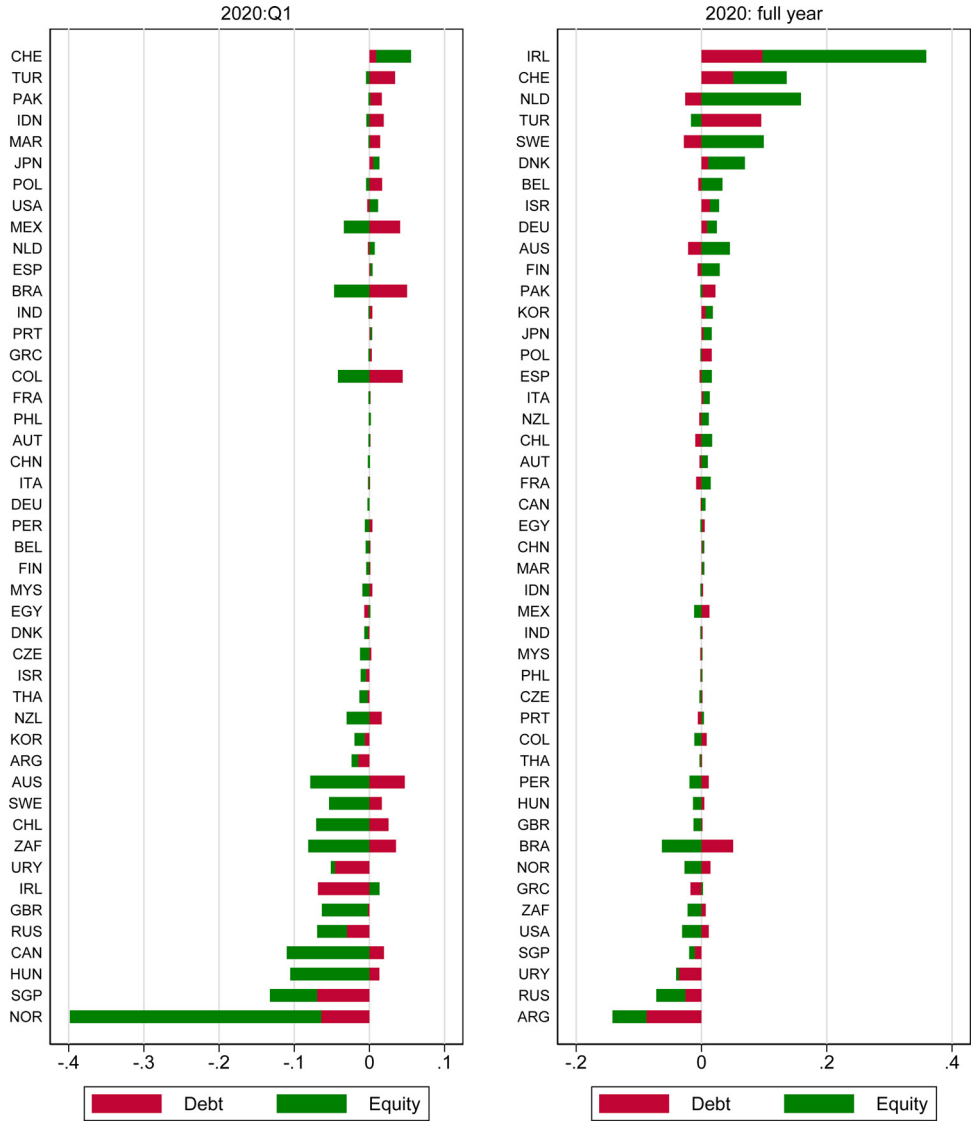

Fig. A1. Change in Net Liabilities. Debt-Equity Breakdown (Share of GDP).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects as a share of GDP. Red denotes changes in debt net liabilities (and includes portfolio debt, other investment, and direct investment debt), while green denotes changes in equity net liabilities (comprising portfolio equity and direct investment equity). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

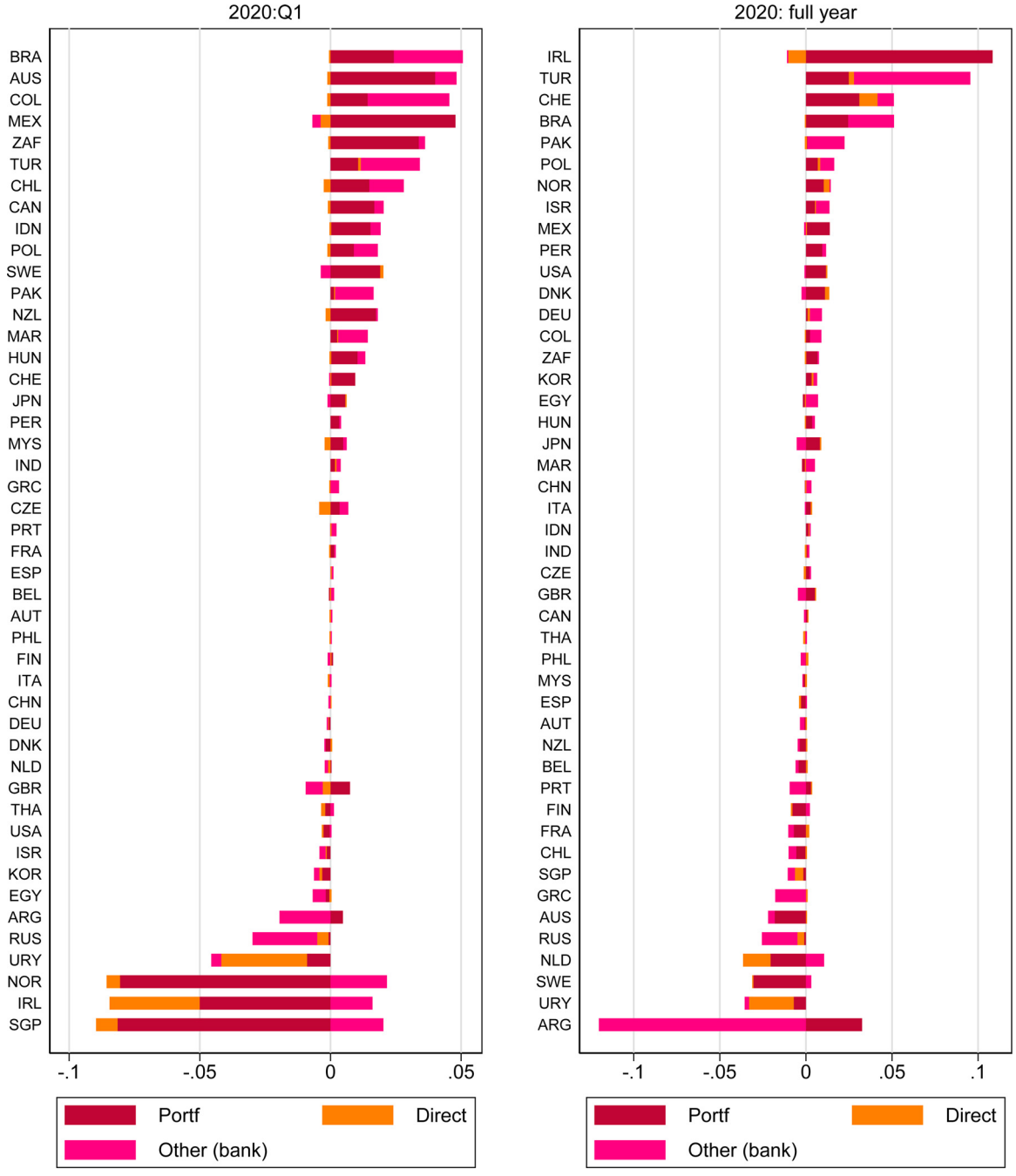

Fig. A2. Change in Debt Net Liabilities (Share of GDP).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects as a share of GDP. Red, pink and orange denote changes in portfolio debt, other investment, and direct investment debt net liabilities, respectively. See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

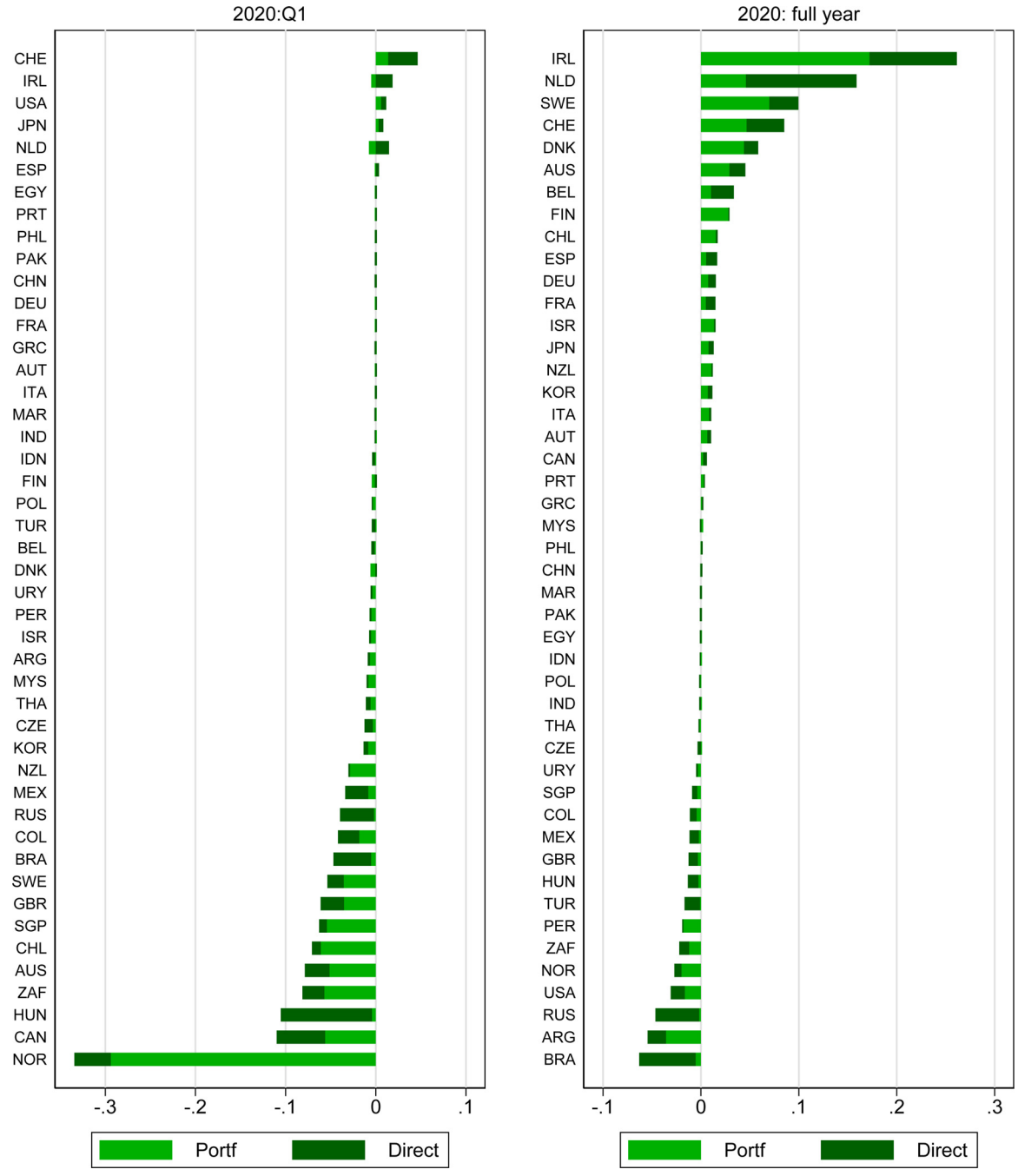

Fig. A3. Change in Equity Net Liabilities (Share of GDP).
Notes: The bars represent changes in net liabilities due to currency-induced valuation effects as a share of GDP. Light green denotes changes in portfolio equity net liabilities while dark green indicates changes in direct investment equity net liabilities. See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Results for 2020Q1 are in the left panel and for the full year 2020 in the right panel.

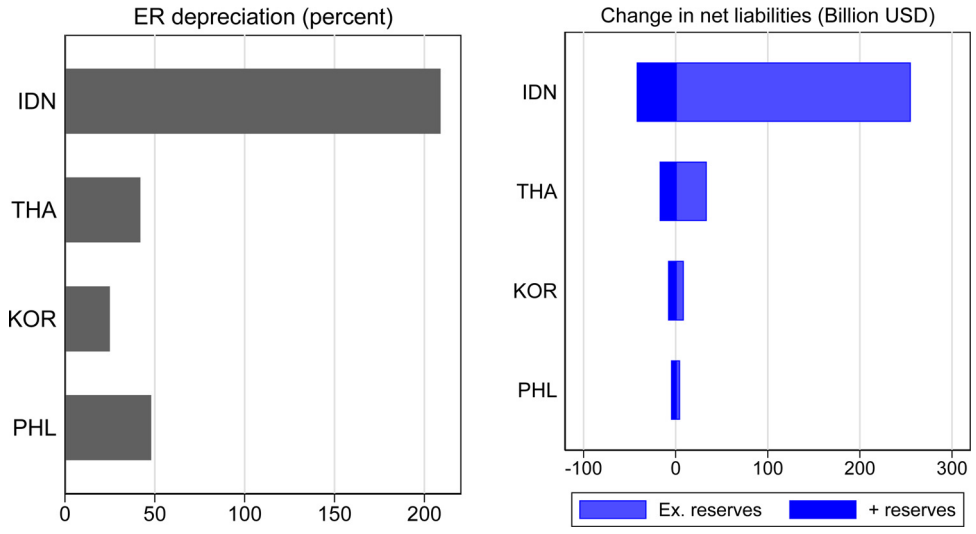

Fig. A4. Asian Financial Crisis 1997-98.
Notes: The bars on the left chart represent the percentage depreciation of the currency of each listed country against the U.S. dollar from June 30, 1997 to December 31, 1998. The bars on the right chart represent changes in net liabilities due to currency-induced valuation effects (in billion USD). See text for methodology and original data sources. Countries' ISO codes are listed in order of the impact of exchange rate changes on net external liabilities so that the largest valuation losses are at the top and the largest valuation gains at the bottom. Light bars exclude reserves and dark bars combined with light bars include them. Exchange rates are sourced from the IMF International Financial Statistics (IFS).

References

Abbassi, P., Bräuning, F., 2021. Exchange rate risk, banks' currency mismatches, and credit supply. Working paper 3483234, SSRN..
Aguiar, M., 2005. Investment, devaluation, and foreign currency exposure: The case of mexico. Journal of Development Economics 78, 95–113.
Ahnert, T., Forbes, K., Friedrich, C., Reinhardt, D., 2021. Macroprudential FX regulations: Shifting the snowbanks of FX vulnerability? Journal of Financial Economics 140, 145–174.
Aizenman, J., Cheung, Y.-W., Qian, X., 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., Ito, H., Pasricha, G.K., 2021. Central bank swap arrangements in the COVID-19 crisis,. Working Paper 28585, National Bureau of Economic Research.
Aizenman, J., Jinjarak, Y., Park, D., Zheng, H., 2020b. Good-bye original sin, hello risk on-off, financial fragility, and crises? NBER Working Papers 27030, National Bureau of Economic Research, Inc..
Aldasoro, I., Eren, E., Huang, W., 2021. Dollar funding of non-US banks through covid-19. BIS Quarterly Review.
Alfaro, L., Calani, M., Varela, L., 2021. Currency hedging: Managing cash flow exposure,. Working Paper 28910, National Bureau of Economic Research.
Arellano, C., Bai, Y., Mihalache, G., 2020. Deadly debt crises: COVID-19 in emerging markets. Staff Report 603, Federal Reserve Bank of Minneapolis.
Arslanalp, S., Tsuda, T., 2014. Tracking global demand for emerging market sovereign debt. IMF Working Papers 14/39, International Monetary Fund.
Avdjiev, S., McGuire, P., Peter, G.V., 2020. International dimensions of EME corporate debt. BIS Quarterly Review.
Baele, L., Bekaert, G., Inghelbrecht, K., Wei, M., 2019. Flights to safety. The Review of Financial Studies 33, 689–746.
Beber, A., Brandt, M.W., Kavajecz, K.A., 2009. Flight-to-quality or flight-to-liquidity? evidence from the euro-area bond market. Review of Financial Studies 22, 925–957.
Bénétrix, A., Gautam, D., Juvenal, L., Schmitz, M., 2019. Cross-border currency exposures: New evidence based on an enhanced and updated dataset IMF working papers 19/299. International Monetary Fund.
Bénétrix, A.S., Lane, P.R., Shambaugh, J.C., 2015. International currency exposures, valuation effects and the global financial crisis,. Journal of International Economics,37th Annual NBER International Seminar on Macroeconomics 96, S98–S109.
Bocola, L., Lorenzoni, G., 2020. Financial crises, dollarization, and lending of last resort in open economies. American Economic Review 110, 2524–2557.
Caballero, J., 2021. Corporate dollar debt and depreciations: Alls well that ends well? Journal of Banking and Finance 106185.
Cavallo, M., Tille, C., 2006. Current account adjustment with high financial integration: a scenario analysis. Economic Review, Federal Reserve Bank of San Francisco 31–45.
Chari, A., Stedman, K.D., Lundblad, C., 2020. Capital flows in risky times: Risk-on/risk-off and emerging market tail risk. Working Paper 27927, National Bureau of Economic Research.
Corsetti, G., Lloyd, S., Marin, E., 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., Pesenti, P., Roubini, N., 1999. What caused the asian currency and financial crisis? Japan and the World Economy 11, 305–373.
Du, W., Schreger, J., 2021. Sovereign risk, currency risk, and corporate balance sheets. Review of Financial Studies, forthcoming.
Eichengreen, B., Hausmann, R., Panizza, U., Edwards, S., 2007. Currency mismatches, debt intolerance, and the original sin: Why they are not the same and why it matters,. Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences, ed. by. Chicago: University of Chicago Press, chap. 3,121–169.
Fidrmuc, J., Hake, M., Stix, H., 2013. Households foreign currency borrowing in central and eastern europe,. Journal of Banking & Finance 37, 1880–1897.
Forbes, K., Hjortsoe, I., Nenova, T., 2017. Current account deficits during heightened risk: Menacing or mitigating? Economic Journal 0, 571–623.
Georgiadis, G., Zhu, F., 2021. Foreign-currency exposures and the financial channel of exchange rates: Eroding monetary policy autonomy in small open economies? Journal of International Money and Finance 110, 102265.
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.
Ghironi, F., Lee, J., Rebucci, A., 2015. The valuation channel of external adjustment. Journal of International Money and Finance 57, 86–114.
Gourinchas, P., Rey, H., 2007. International financial adjustment,. Journal of Political Economy 115, 665–703.
Gourinchas, P.-O., Rey, H., Gopinath, G., Helpman, E., Rogoff, K., 2014. Chapter 10 - external adjustment, global imbalances, valuation effects. Handbook of International Economics. Elsevier, vol. 4 of Handbook of International Economics, 585–645.
Gourinchas, P.-O., Rey, H., Govillot, N., 2010. Exorbitant privilege and exorbitant duty. Bank of Japan, and IMES Discussion Paper Series 10-E-20.
Gourinchas, P.-O., Rey, H., Truempler, K., 2012. The financial crisis and the geography of wealth transfers,. Journal of International Economics.
Hale, G.B., Jones, P.C., Spiegel, M.M., 2020. Home currency issuance in international bond markets,. Journal of International Economics 122, 103256.
Hartmann, P., Straetmans, S., de Vries, C.G., 2004. Asset market linkages in crisis periods. The Review of Economics and Statistics 86, 313–326.
Kalemli-Özcan, c., Liu, X., Shim, I., 2021. Exchange rate fluctuations and firm leverage. IMF Economic Review 69, 90–121.
Lane, P.R., Milesi-Ferretti, G.M., 2001. The external wealth of nations mark: Estimates of foreign assets and liabilities for industrial and developing countries. Journal of International Economics 55, 263–294.
Lane, P.R., Milesi-Ferretti, G.M., 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., Shambaugh, J.C., 2010. Financial exchange rates and international currency exposures. American Economic Review 100, 518–540.

LAwen, C., Kchouri, B., Lehnert, T., 2021. Is this time really different? flight-to-safety and the COVID-19 crisis,. PLOS ONE 16, 1–17.
Luca, A., Petrova, I., 2008. What drives credit dollarization in transition economies? Journal of Banking & Finance 32, 858–869.
Ozili, P.K., Arun, T., 2020. Spillover of COVID-19: Impact on the Global Economy. Working paper 3562570, SSRN.
Tobal, M., 2018. Currency mismatch in the banking sector in latin america and the caribbean. International Journal of Central Banking 52.