GROSS CAPITAL FLOWS BY BANKS, CORPORATES, AND SOVEREIGNS

Stefan Avdjiev
Bank for International Settlements, Switzerland

Bryan Hardy
Bank for International Settlements, Switzerland

Şebnem Kalemli-Özcan
University of Maryland, USA

Luis Servén
Centro de Estudios Monetarios y Financieros (CEMFI), Spain

Abstract
We construct a new quarterly data set of international capital flows broken down by sector—banks, corporates, and sovereigns—and demonstrate the importance of distinguishing capital flows by the sector of domestic borrowers and lenders. We document four new sets of facts. First, banks account for the largest part of the external debt (stocks and flows) in advanced economies, whereas in emerging markets, banks, corporates, and sovereigns have roughly equal shares. Second, the high correlation between total capital inflows and outflows documented in the literature is driven by banking sector flows; that is, domestic banks' borrowing from foreigners is highly correlated with domestic banks' lending to foreigners. Third, sovereign flows behave very differently from and often act as a countervailing force to private sector (banking and corporate) flows, especially in emerging markets. Fourth, different shocks (global financial cycles versus domestic business cycles; banking versus currency versus sovereign crises) generate very distinct patterns of capital inflows and outflows by sector. The stylized facts we document deepen our understanding of the dynamics and behavior of capital flows and have important implications for open economy models. (JEL: F21, F41, O1)

The editor in charge of this paper was Guido Lorenzoni.

Acknowledgments: We thank Luis Catão, Eugenio Cerutti, Stijn Claessens, Branimir Gruic, Gian Maria Milesi-Ferretti, and Philip Wooldridge for useful comments and suggestions, Bat-el Berger for excellent assistance with the BIS IBS data, and Rosa Lim for excellent research assistance. We are grateful to seminar participants at the NBER Summer Institute 2017, CEPII, and the BIS, and to the editors and anonymous referees. All errors are our own. This work was partly funded by the World Bank's Knowledge for Change and Strategic Research programs. Kalemli-Özcan is an affiliate of NBER and CEPR. The views expressed here are ours only and do not necessarily reflect those of the institutions that the authors are affiliated with.

E-mail: stefan.avdjiev@bis.org (Avdjiev); bryan.hardy@bis.org (Hardy); kalemli@umd.edu (Kalemli-Özcan); lserven@econ.lafaena.com (Servén)

Journal of the European Economic Association 2022 20(5):2098–2135
https://doi.org/10.1093/jeea/jvac038

Teaching Slides
A set of Teaching Slides to accompany this article are available online as Supplementary Data.

1. Introduction

The history of international financial crises has taught us that the vulnerability to external shocks can vary greatly depending on which economic sector(s) are on the receiving side of capital inflows. Sovereign debt proved to be the Achilles' heel in the Latin American debt crisis, while private sector debt financed by capital inflows was the key source of fragility in the Asian financial crisis. During the financial crisis of 2008, the culprit in the US was the domestic household debt held by internationally active banks. By contrast, in the European debt crisis of 2010–2012, the external borrowing of sovereigns and banks took center stage.

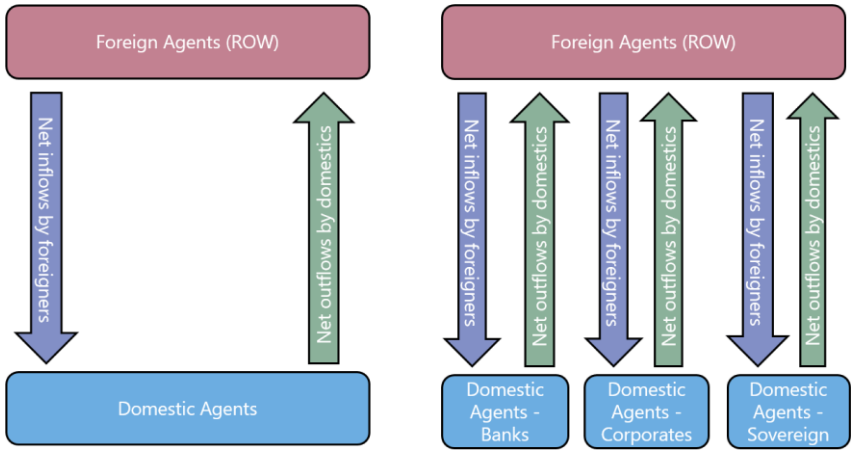
In spite of this anecdotal evidence, breakdowns of gross capital flows by *sector* have received little attention in the empirical literature due to a lack of data for a large set of countries and a long time period at the business cycle frequency. Our paper fills this gap by constructing a new comprehensive dataset based on the residency principle for *gross* capital inflows and outflows at the *quarterly* frequency. Our dataset features a balanced panel of 85 countries for inflows and 31 countries for outflows, starting in 1996q1[1], with sectoral decompositions of both inflows and outflows by the borrowing and lending domestic sector (e.g. inflows into the corporate sector of a country, outflows from the banking sector of a country, etc.).[2]

Our approach is fundamentally different than standard decompositions of capital flows by instrument/asset class, such as portfolio equity (PE), portfolio debt (PD), and other investment flows.[3] Corporates can borrow using all these instruments (equity, bonds, and loans), whereas sovereigns most typically issue bonds and banks mostly use loans. For our purposes, what matters is the *identity* of the borrower and the lender, rather than the instruments through which the borrowing and lending is done. Figure 1 below clarifies how our dataset (AHKS) is different than the existing standard data sets.

1. The balanced sample for outflows starts in 2004q1 for quarterly data and 2002 for annual data, but outflow observations are available back to 1996 in some cases.

2. In our *gross* capital flows data (as in the standard residency principle based International Monetary Fund (IMF)-BOP data), inflows and outflows are stated on a *net* basis, where inflows refer to the (changes in) positions of non-residents and outflows refer to the (changes in) positions of residents. Thus, negative inflows mean foreign investors are "leaving" the country by divesting and negative outflows mean domestic residents are "retrenching" by reducing their external assets.

3. In theory, the IMF BOP data offer a similar sectoral decomposition to our data (government, central bank, bank, and other sectors). In reality, however, this IMF BOP decomposition is either not reported publicly or, when reported, is available for limited years and countries, and hence cannot be used for empirical analysis as we document below.



(a) Existing standard datasets (b) AHKS dataset

FIGURE 1. Gross capital flows data. Authors' elaboration.

Our data are always reported from the perspective of domestic agents. We measure the borrowing from and lending to the rest of the world (ROW) of a given country's banks, corporates, and sovereigns. We intentionally use the standard balance of payments (BOP) definitions and terminology for capital flows (e.g. Forbes and Warnock 2012 and Broner et al. 2013): "inflows" are defined as net inflows from foreign residents into the domestic economy and "outflows" are defined as net outflows from domestic residents to the ROW. Thus, our dataset captures (i) net inflows from the ROW to a given domestic sector (i.e. individual domestic sectors' borrowing from abroad) and (ii) net outflows by a given domestic sector to the ROW (i.e. individual domestic sectors' lending abroad).

Using our dataset, we document four new facts. First, banks account for the largest part of the external debt (stocks and flows) in advanced economies (AEs), whereas in emerging markets (EMs), banks, corporates, and sovereigns have roughly equal shares. Second, the high correlation between total capital inflows and outflows documented in the literature is driven by banking sector flows. This result holds both for unconditional correlations and correlations conditional on global risk appetite (proxied by the VIX) and individual countries' business cycles (GDP growth). While the behavior of cross-border activities of banks has been extensively studied (e.g. Cetorelli and Goldberg (2012) regarding internal capital markets of global banks), to our knowledge, we are the first to show the importance of banking sector flows for the correlation between total capital inflows and outflows.

The third stylized fact is that sovereign flows behave very differently from and often act as a countervailing force to private sector (banking and corporate) flows, especially in EMs. We document this fact in several different contexts (e.g. the 2008 crisis, around banking crises, through business cycles, and conditional correlations with other sectors' flows). There are a number of features that make this stylized fact distinct from similar results on net flows in the literature. First, it is examined in the context

of *gross* flows rather than *net* and at a quarterly frequency instead of annual. Several papers show the opposite behavior of net flows to public and private sectors (relative to GDP growth) at an annual frequency (Ju and Wei 2010; Aguiar and Amador 2011; Gourinchas and Jeanne 2013; Alfaro, Kalemli-Özcan, and Volosovych 2014).[4] Second, we show that active *borrowing* by the public sector from abroad (external liability flows), as opposed to solely reserve accumulation (external asset flows), is an important countervailing force to private sector (banks and corporates) flows. Third, we establish that this relationship holds along a number of different dimensions—relative to cyclical movements (like GDP growth), around crisis events, and even in correlations conditional on GDP growth and global factors (like the VIX), all at a quarterly frequency.

The fourth stylized fact we document is that different types of shocks generate very distinct patterns of capital flows by sector. We document this around different types of financial crises (banking versus currency versus sovereign), around global crises (2008 crisis versus taper tantrum versus COVID-19), and around local and global cycles (domestic business cycle versus global financial cycle).

To establish our stylized facts, we first document descriptive patterns in the data related to the composition and correlation of international capital flows. Then we run quarterly panel regressions of flows in and out of each sector on standard determinants. In the main text, we present results from regressions including countries' own lagged GDP growth (a summary pull factor) and global shocks/financial conditions proxied by the VIX index (a summary push factor). We include country fixed effects, so identification relies on the within variation. We present various alternative setups in the Online Appendix. We focus on debt flows by sector as we document that this is the largest asset class in international capital flows, in spite of the rising shares of PE and FDI flows over the last decade. We also include flows of official reserves and *FDI debt* inflows.

To the best of our knowledge, there are no other existing papers and datasets examining capital flows by sector (for all sectors) at the quarterly frequency, with an extensive coverage both along the cross-sectional dimension (85 countries) and along the time series dimension (starting in 1996). Milesi-Ferretti and Tille (2011) and Cerutti, Claessens, and Puy (2015) separate out the banking sector within the other investment debt (OID) category of the BOP to analyze it on its own, but they do not study other sectors, namely corporates and sovereigns. Other studies examining gross capital inflows using only BOP data sometimes exclude official reserves and IMF credit (and sometimes central bank loans) in order to focus on private inflows but do not study sectoral flows (e.g. Milesi-Ferretti and Tille 2011, Forbes and Warnock 2012, and Bluedorn et al. 2013).[5] In addition, given that a substantial amount of public

4. In addition to these papers, also using annual data in a historical context, Horn, Reinhart, and Trebesch (2020) show that when inflows to the private sector "leave" during wars, natural disasters, and financial crises, official flows to sovereign borrowers "come in".

5. There is also a literature that studies the long-term movements in gross capital flows that culminate into long-term external asset and liability positions such as Lane and Milesi-Ferretti (2001), Gourinchas

sector debt takes the form of portfolio securities, the data in the above studies will still include public flows as they do not separate PD into the components due to the private and public sectors.

In terms of responses to global shocks, several papers document that gross flows respond systematically to changes in global conditions (Milesi-Ferretti and Tille 2011; Forbes and Warnock 2012; Broner et al. 2013; Rey 2018).[6] There is an extensive literature studying push and pull factors driving capital flows in addition to these papers, such as Fratzscher (2012) and Ahmed and Zlate (2014) (see Koepke (2019) for an EMs review). We contribute to this literature by showing how the overall patterns documented therein for flows in and out of countries are driven by the different dynamics of flows in and out of banks, corporates, and sovereigns. For instance, the literature finds positive relationships with GDP growth and negative relationships with the VIX, which we show are driven mainly by banks, and to a lesser extent, by corporates, but public flows tend to push against those relationships.

The papers that are closest to our work in terms of our data construction exercise are Arslanalp and Tsuda (2014b) and Arslanalp and Tsuda (2014a). These authors decompose sovereign/government loan and bond debt by creditor. They employ the IMF and World Bank's Quarterly External Debt Statistics (QEDS) data to distinguish between foreign and domestic creditors. They also use Bank for International Settlements (BIS) data to identify external bank lenders, similar to our approach (described below and in Online Appendix B). Their exercise covers only the sovereign sector for a balanced sample starting in 2005, whereas we consider all three sectors—sovereigns, banks, corporates—and start in 1996.

The rest of the paper is organized as follows: Section 2 describes the construction and coverage of our data set; Section 3 illustrates key descriptive patterns; Section 4 presents the results from our empirical analysis; Section 5 discusses the implications of our findings for the theoretical and empirical literature and concludes.

2. A New Dataset for Capital Flows Research

We construct a new dataset that disaggregates international capital flows by sector in the domestic economy. To ensure clarity, we briefly review the basic definitions and structures for capital flows data, and what our dataset provides.

What is commonly called "gross flows" in the literature is actually more accurately described as " net inflows" and " net outflows" , which are broadly defined as follows:

$$NetInflows = GrossLiabilityFlows - Repayments, \tag{1}$$

and Rey (2007), and Obstfeld (2012) and using annual data, Davis and van Wincoop (2017). We focus on capital flow dynamics at the quarterly business cycle frequency.

6. See also Cerutti, Claessens, and Puy (2015), Caballero (2016), Obstfeld (2012), Catão and Milesi-Ferretti (2014), Borio and Disyatat (2011), Lane (2013), Cerutti, Claessens, and Rose (2018), Barrot and Servén (2018), and Nier, Sedik, and Mondino (2014).

$$NetOutflows = GrossAssetFlows - Disinvestment. \quad (2)$$

Thus, although these measures are often called "gross" , they can be positive or negative. The separation of flows into asset and liability flows allows interpreting liability flows as inflows to the domestic economy from the ROW, and asset flows as outflows from the domestic economy to the ROW. This is the primary working definition of capital flows in the BOP framework, which we use across all our data sources for consistency.

The cornerstone of our dataset is the BOP data produced by the IMF, which is the most comprehensive source of international capital flow data across countries. The BOP data, which is reported to the IMF by national statistical offices, captures capital flows into and out of a given country. The accompanying stock measures of external assets and liabilities are captured in the IMF's International Investment Position (IIP) data.[7]

Figure 2 illustrates the structure of the BOP data. In simple terms, capital flows in the BOP are split into three main categories: direct investment, portfolio investment, and other investment; and an important public sector outflow category, official reserves.[8] Each of these categories, except reserves, can be split into debt and equity components (though other investment equity tends to be negligible for most countries). Thus, inflows and outflows can be summarized as

$$Inflows_t = DIE_t^{in} + DID_t^{in} + PE_t^{in} + PD_t^{in} + OID_t^{in}, \quad (3)$$

$$Outflows_t = DIE_t^{out} + DID_t^{out} + PE_t^{out} + PD_t^{out} + OID_t^{out} + Res_t^{out}, \quad (4)$$

where DIE is direct investment equity, DID is direct investment debt, PE is portfolio equity, PD is portfolio debt, OID is other investment debt, and Res is reserves.

The focus of this paper is on the differentiation of capital flows by sector in the domestic economy. The domestic economy refers to all entities that are resident in that economy, regardless of the nationality of the entity. This rule is known as the "Residency Principle" and is the basis upon which the BOP data is compiled. We follow this principle when combining data sources in order to build our new dataset. The term "sector" is used here to refer to institutional sectors: general government, central banks, depository corporations except the central bank ("banks"), and other sectors ("corporates").[9] Much of the discussion below will focus on the public or sovereign sector, defined as the sum of general government and central bank, though in some instances we will show government and central bank separately for illustration.

7. We focus on the financial account portion of the data and the latest (6th) version of the BOP manual (BPM6). More details on the BOP data, along with its different presentations and versions, are given in Online Appendix A.2. See the 6th Edition Balance of Payments Manual (BPM6) Online Appendix 8 for more details on the differences between the previous edition (BPM5) and BPM6.

8. The remaining category is financial derivatives, which is small and sparsely reported, previously included as a part of portfolio investment.

9. It should be noted that the BOP category "other sectors" is broader than what is captured by the term "corporates". Nevertheless, in most cases, there is a fairly significant overlap between the two categories. That is why, in the rest of this paper, we use the two terms interchangeably for presentational convenience.

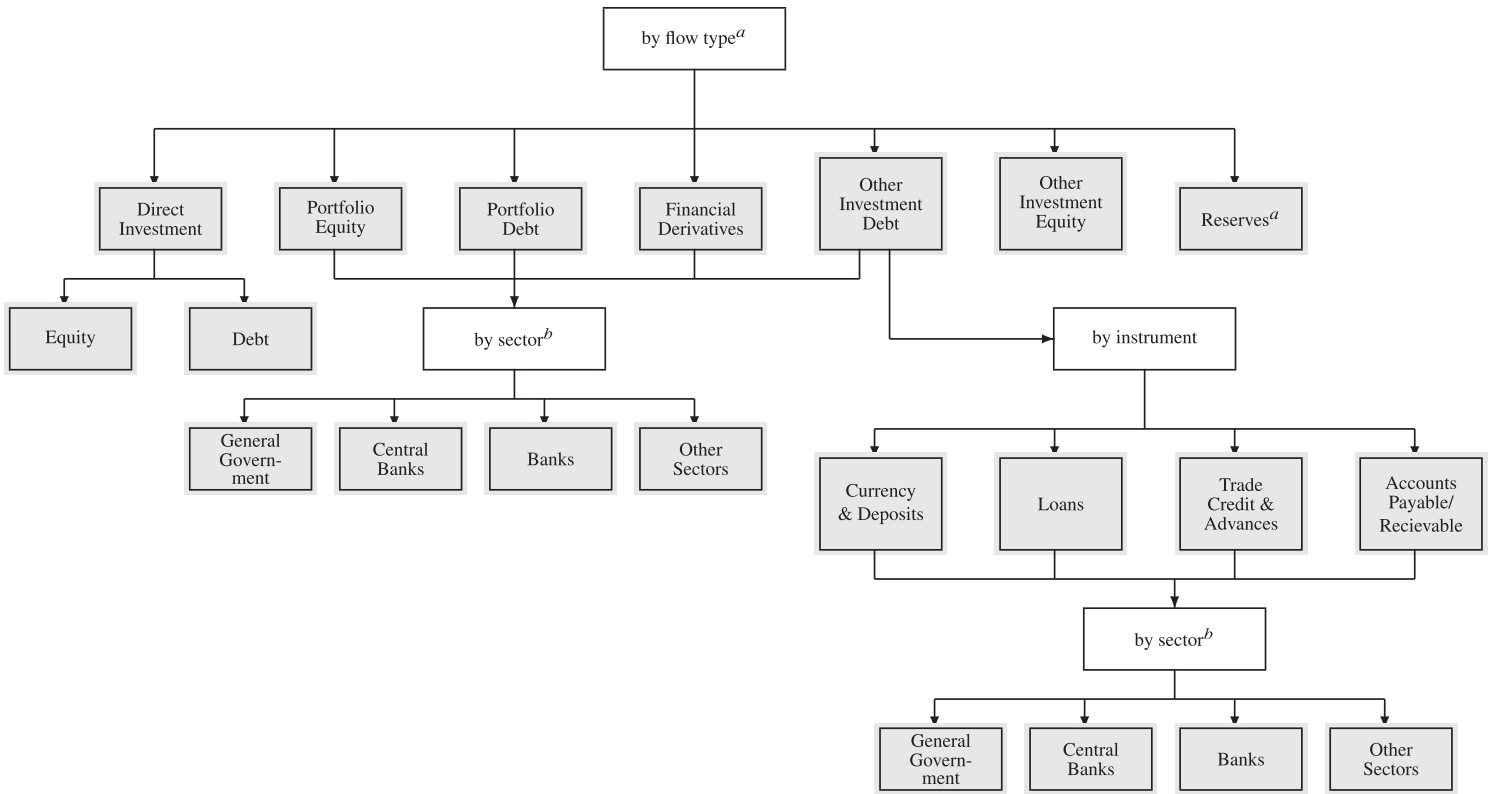


FIGURE 2. BOP data structure. a. This structure is the same for inflows and outflows. Reserves are only classified as outflows. b. The breakdowns of these variables by sector exist in the BOP data but the coverage is sparse for many countries and quarters.

In principle, several of the instrument categories in the BOP can be decomposed by domestic sector, specifically portfolio investment debt, portfolio investment equity, and OID.[10] In theory, each type of capital flow can be disaggregated by domestic sector. In practice, however, the coverage of such disaggregated information in the BOP tends to be sparse, especially for emerging markets and developing economies (EMDEs) and for earlier time periods. To be absolutely clear, capital flow types (asset classes) are generally well reported in *aggregate* terms in the BOP data, and the reporting of the sectoral breakdowns has improved in recent years. Nevertheless, for most EMDEs and most years before 2005, the reporting of the data by sector is much less exhaustive. We document this sparsity in detail below.

To address these gaps, we take two approaches. First, we fill in missing data internally by assigning the difference between the total and the sum of the reported sectors to the unreported sector. This is a fully internally consistent approach. Second, for capital inflow data, we combine and harmonize several publicly available data sources to address the remaining gaps: BOP and IIP statistics of the IMF; Locational Bank Statistics (LBS), Consolidated Bank Statistics (CBS), and International debt Securities (IDS) Statistics from the BIS; and QEDS of the IMF and World Bank (WB).[11] See Online Appendix A for a detailed description of how we use the above data sources in order to construct our novel dataset. We make sure our second approach is also internally consistent, as we describe in detail in the Online Appendix.[12]

Our filling exercise has a very significant impact on the time and country coverage of the inflow data (see Online Appendix Table A.5).[13] A balanced sample requires that

10. OID can also be decomposed by instrument and then by sector. We do not break down portfolio (non-FDI) equity flows by sector due to the lack of available external datasets with which to fill in the missing data. We do, however, examine FDI debt inflows in our sector decomposition. Galstyan et al. (2016) use data starting after 2013 from the IMF's Coordinated Portfolio Investment Survey (CPIS) to examine PD and PE stocks by the sectoral identity of the issuer and holder of the security. While this data has a more granular breakdown, it is only available for recent years, only for portfolio instruments, and only at a semi-annual frequency. In contrast, we focus on all the components of debt, that is, the flow of PD and OID by sector, over a much longer time horizon at a quarterly frequency.

11. In Online Appendix C.3, we also examine data from the Debtor Reporting System (DRS) data of the WB, which splits external debt inflows for EMDEs into public and publicly guaranteed debt versus private non-guaranteed debt.

12. Our methodology is similar to that of the capital flight literature, which also uses techniques of internal filling with the BOP and external filling with other datasets in order to identify unreported private capital outflows from a country (Claessens and Naudé 1993; Chang, Claessens, and Cumby 1997). It should be noted that, even though combining different data sources to complement BOP/IIP statistics is rarely done at the global level, this is exactly what many country-level BOP/IIP compilers do on a regular basis (e.g. they use the BIS IBS data series on banks' cross-border deposit liabilities to the residents of their respective countries in order to enhance their BOP/IIP compilation).

13. Our external filling procedure makes a very big difference, especially for the quarterly data, where it fills 25%–40% of observations for EMs and 75%–90% of the observations for developing countries that were missing under PD. In the case of OID, 11% of observations are filled for EM and 40%–50% for developing countries. Advanced economies have a sizable amount filled externally as well: 20%–30% for PD observations, and 15%–18% of OID. Online Appendix Figures A.1 and A.2 compare the aggregate inflow series derived from our data with those derived solely from the BOP data, and show that the missing observations can have a sizeable impact at times, even for aggregate flows.

TABLE 1. Country correlations: AHKS versus BOP.

		AHKS bank versus BOP OID			AHKS corp versus BOP PD		
		Correlations	Pre-GFC	Post-GFC	Correlations	Pre-GFC	Post-GFC
AEs	US	0.71	0.75	0.61	0.64	0.74	0.50
	Japan	0.72	0.76	0.65	0.09	−0.27	0.34
	Australia	0.30	0.39	0.22	0.28	0.49	−0.14
	Italy	0.51	0.94	0.24	−0.07	0.14	−0.21
	Spain	0.28	0.85	0.04	0.64	0.86	−0.01
	Sweden	0.74	0.90	0.55	0.08	0.20	0.12
EMs	Brazil	0.65	0.55	0.89	0.63	0.70	0.19
	Russia	0.45	0.29	0.86	0.10	0.09	0.11
	India	0.56	0.19	0.78	0.52	0.63	0.48
	China	0.96	0.95	0.97	0.29	0.44	−0.10
	South Africa	0.84	0.83	0.85	0.24	0.16	0.41
	Malaysia	0.86	0.94	0.64	0.50	0.43	0.60

Note: Pre-GFC = 1996–2007 and Post-GFC = 2008–2014.

PD and OID be available for all four sectors in every period for each country. With eight data components required to be available in each period, the probability that at least one is missing is high. If no adjustments are made to the BOP dataset, then it would not yield a balanced sample for any countries at a quarterly frequency (and only for twelve countries at an annual frequency). After our internal fill, our balanced sample of countries increases to 10 in the quarterly data (16 in the annual data). After incorporating the external datasets, our balanced sample increases to 85 countries in the quarterly data (89 in the annual data). Given the significant advantages of a balanced country sample for cross-section and panel regression analysis, the impact of our data filling exercises on sample size is very consequential.[14]

A dataset that directly breaks down capital flows by sector can be very valuable, as it provides a better window into the behavior of flows than does proxying for sectors with the instrument breakdowns of the standard BOP data. For instance, OID flows are often attributed solely to the banking sector, while PD flows are sometimes assumed to be dominated by corporates. Table 1 shows the correlation between debt inflows to banks and OID inflows as well as the correlation between debt inflows to corporates and PD inflows for a number of countries. Corporate inflows generally do not track portfolio inflows well, largely because of two major wedges between those two series: (i) a large share of corporates' borrowing from abroad is done through loans and (ii) sovereigns issue most of their debt in the form of debt securities. In a small number of cases (e.g. China, the US, and Japan), the OID series and the bank flow series track each other reasonably well. However, the correlation of those series dropped off

14. Note that while our inflow and outflow samples are not the same, they are both balanced.

considerably after the global financial crisis (GFC) and even turned negative for certain countries.[15]

We divide our overall sample of countries into three groups by level of development: advanced, emerging, and developing.[16] In our sample of annual capital inflows, we have 89 countries (25 advanced, 34 emerging, and 30 developing).[17] We exclude financial centers (e.g. Panama, Hong Kong, and Bermuda) to avoid distorting the patterns in the data for the typical (non-financial center) economy. Nevertheless, capital flows between financial centers and other countries in our sample are still captured by the respective counterparty countries' flows. At the quarterly frequency, our inflow sample consists of 85 countries (with El Salvador, Mongolia, Montenegro, and Serbia missing relative to the annual inflow sample, mainly due to missing quarterly GDP data, which is used to scale the capital flow series). The outflow sample consists of 31 countries (15 advanced, 16 emerging) at a quarterly frequency spanning 2004q1–2014q4. For the annual data, we have 31 countries (13 advanced and 18 emerging) spanning 2002–2014. Details on the samples are given in Online Appendix A.4.[18]

3. Descriptive Patterns

In this section, we present key patterns and trends observed in our data across countries, sectors, and time. As shown in Online Appendix Figure C.3, debt represents the majority of external liabilities and assets globally: The average share of debt liabilities in external liabilities during our sample period is 62% of AEs and 51% in EMs.

Employing our new dataset, Figure 3 plots the sectoral share of external debt stocks for each flow type and country group.[19] In AEs, banks account for the lion's share of external debt liabilities. In EMs, corporates, banks, and sovereigns account for roughly equal shares. This first set of facts is interesting since it is generally thought that AE firms and governments are in a better position to access international capital markets directly than their EM counterparts. One possible explanation for this stylized fact is that, since AE banking systems are more developed, they do most of the intermediation of external funds in AEs, while AE corporates and sovereigns can source a larger share

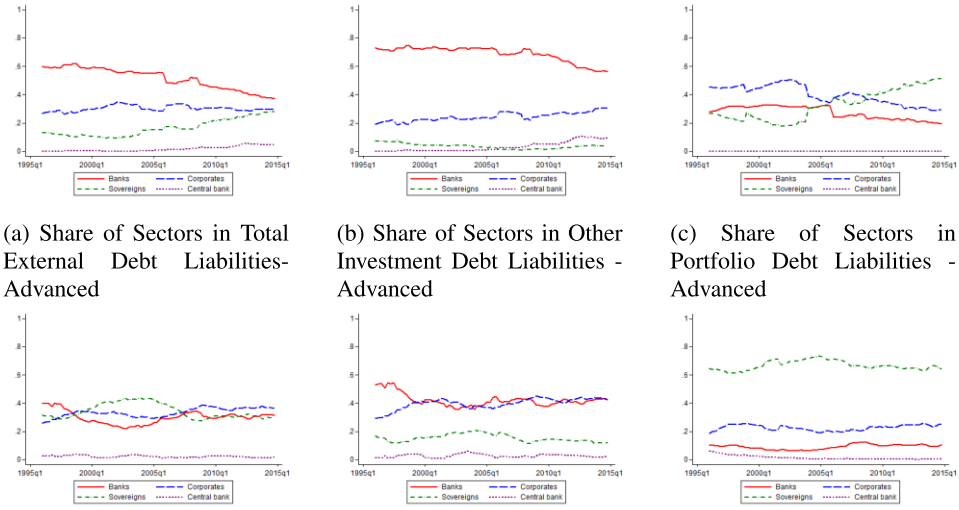
15. Online Appendix Figure C.2 shows average flows relative to trend GDP across countries, along with the correlation of those series.

16. We rely on the 2000 IMF WEO classification to define the group of AEs. Since the WEO does not divide emerging and developing countries into separate groups, we use the MSCI and IEO-IMF classifications to guide the definition of our EM group.

17. The outflow sample is not as large as the inflow sample because data on liabilities owed is more widely reported than data on assets owned, so there are not as many comparable filling series to replace missing outflow values in the BOP. Thus, while our efforts do improve our coverage of outflows, we focus on the contribution to inflow coverage in this section.

18. An updated version of our dataset is posted here.

19. The fact that our sample is fully balanced (i.e. each country has data for all sectors for each period) prevents the entry/exit of countries in the sample from distorting the time series patterns. The flow version of this figure delivers a similar, albeit noisier, picture (Figure C.4 in Online Appendix C).



(a) Share of Sectors in Total External Debt Liabilities-Advanced

(b) Share of Sectors in Other Investment Debt Liabilities - Advanced

(c) Share of Sectors in Portfolio Debt Liabilities - Advanced

(d) Share of Sectors in Total External Debt Liabilities - Emerging

(e) Share of Sectors in Other Investment Debt Liabilities - Emerging

(f) Share of Sectors in Portfolio Debt Liabilities - Emerging

FIGURE 3. Composition of external debt liabilities by debt type and sector. Source: AHKS data.

of their funding in domestic capital markets, which tend to be deeper in AEs. While the sectoral composition is largely stable over time, the GFC appears to have shifted some trends after 2008. Most notably, in its aftermath, there is a clear increase in the external debt share of AE sovereigns and a decline for banks, leading their shares to converge, albeit not yet fully as in EMs.

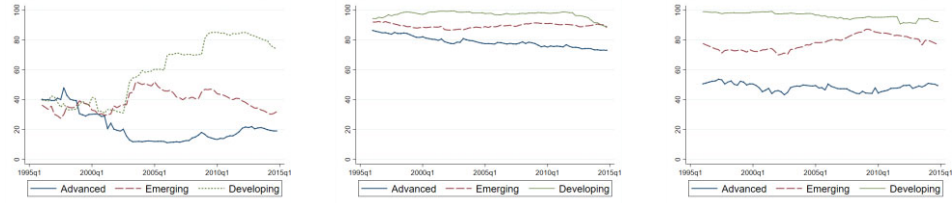
Perhaps more surprising, the conventional wisdom that OID is primarily owed by banks and PD is primarily owed by corporates holds for AEs (especially before the GFC), but not for EMs, as shown in panels (b), (c), (e), and (f). In the latter, most of the PD is attributable to sovereigns, while banks and corporates account for roughly equal shares of OID.

It is also interesting to note that the share of OID in total debt for the sovereign sector has fluctuated considerably over time. Figure 4 shows this is the case for all three country groups we examine (panel (a)). By contrast, the respective shares for banks and corporates are relatively constant over time (panels (b) and (c), respectively).[20]

Figure 5 shows the counterpart of Figure 3 for the composition of external debt assets (as opposed to liabilities), including reserves.[21] In EMs, the public sector is overwhelmingly the main lender to other countries. This is primarily driven by the

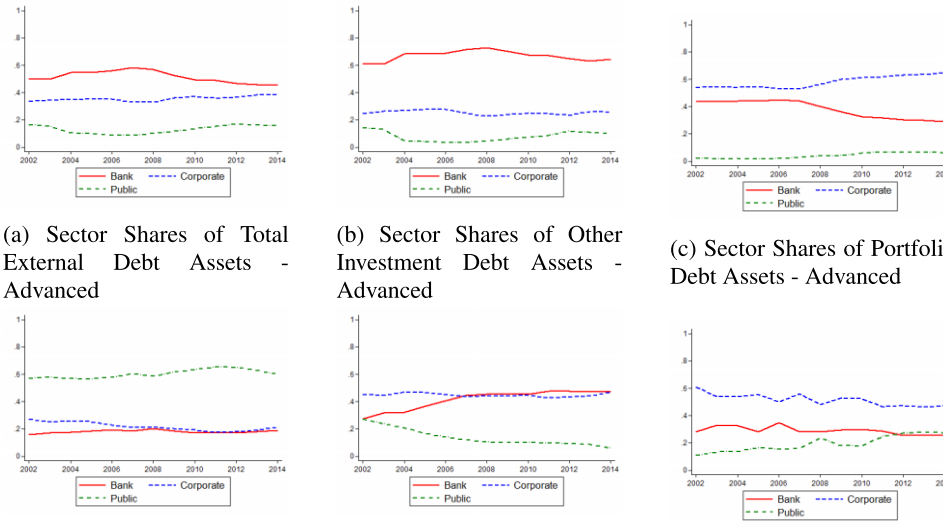
20. The dynamics of the underlying pieces of external debt can be seen in Online Appendix Figure C.5, which plots the aggregate external liabilities by sector in billions of USD, with a split by instrument.

21. There are not enough developing countries in the outflows sample to calculate a meaningful average, so only lines for the advanced and emerging groups are included.



(a) Sovereigns (b) Banks (c) Corporates

FIGURE 4. Share of OID liabilities in total debt. Source: AHKS data, authors' calculations. For each sector, the lines plot OID (outstanding stocks) as a percent of its total external debt stock (PD + OID) for the given country group.



(a) Sector Shares of Total External Debt Assets - Advanced

(b) Sector Shares of Other Investment Debt Assets - Advanced

(c) Sector Shares of Portfolio Debt Assets - Advanced

(d) Sector Shares of Total External Debt Assets - Emerging

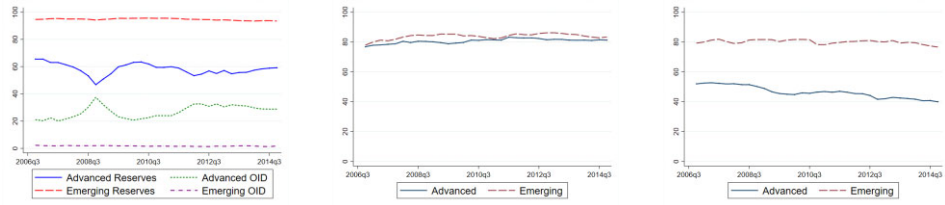
(e) Sector Shares of Other Investment Debt Assets - Emerging

(f) Sector Shares of Portfolio Debt Assets - Emerging

FIGURE 5. Composition of external assets by asset type and sector. Source: AHKS data, authors' calculations. Total debt includes official reserves.

accumulation of reserve assets, which are included in the total debt figure. In AEs, banks do the lion's share of external lending in loans, while corporates account for the largest share of AEs lending in PD assets. Thus, the main AE external debt lending patterns mirror their counterparts on the AE borrowing side. For EMs, banks and corporates account for roughly equal shares of lending in OID, while corporates account for the largest share of PD assets. The sectoral composition of external debt assets is also very stable over time, as in the case of debt liabilities.

As for the instrument composition, the share of AE foreign reserve holdings dipped around the GFC, but bounced back shortly afterward and has remained largely stable



(a) Sovereigns (b) Banks (c) Corporates

FIGURE 6. Share of OID and reserve assets in total debt assets. Source: AHKS data, authors' calculations. Lines plot the aggregate OID (outstanding stocks) for the given country group as a percent of the total external debt stocks (PD + OID). Sample consists of 17 AEs and 12 EMs, balanced over 2006q4–2014q4. Only three developing countries have complete data over this period, so that aggregate is now shown.

since then (Figure 6). EM sovereigns' external assets consist almost exclusively of foreign reserves. The share of external assets held in the form of OID has remained relatively stable, at about 80%, for banks (in both AEs and EMs) throughout our sample period. By contrast, the respective share has been declining for AE corporates, who have been increasing their holdings of PD assets.[22]

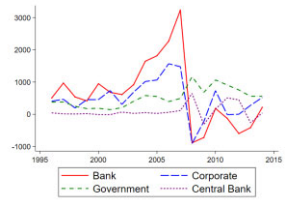
Figure 7 plots the aggregate debt inflows by sector for each country group.[23] The buildup in external debt flows ahead of the 2008 GFC and subsequent collapse is the most striking feature in these plots. An interesting distinction between AEs and EMs is the post-GFC dynamics of flows. While flows to AEs collapsed during the GFC and remained very subdued afterward, flows to emerging and developing countries rebounded relatively quickly across all major sectors.

This figure also illustrates one aspect of our third fact, namely that public sector flows often move opposite private sector flows. In the aggregate, this is clear for AEs in panel (a), where inflows to general government and central bank both increase right as inflows to banks and corporates are collapsing during the GFC. The public sector is often able to borrow from abroad even as such funding dries up for the private sector, as illustrated in this case.[24]

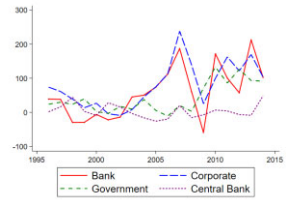
22. The evolution of the volumes by instrument for each sector are shown in Online Appendix Figure C.6.

23. We use the annual version of the dataset for clarity in the figure. See Online Appendix Figures C.7 and C.8 for plots of the median inflows and outflows relative to trend GDP. Online Appendix Figure C.9 additionally shows the average of inflows to GDP.

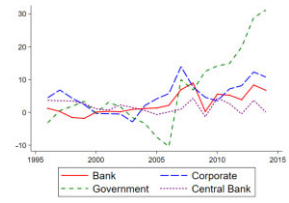
24. Thus far, our figures have plotted aggregate flows, but figures showing the dynamic patterns of average flows to GDP are shown in Online Appendix C. Online Appendix Figure C.12 illustrates the impact of the public sector on an average country using the average of flows to GDP. It plots the cross-country average of total debt flows (PD + OID) to GDP as compared to flows from just the private sectors (banks and corporates) for advanced and emerging countries, with the VIX shown in red (right axis), for reference. For both sets of countries, but especially for EM, the drops in private inflows are larger than the corresponding drops in total inflows, reflecting the role of sovereigns in smoothing out capital inflows, thus reducing the probability of sudden stops.



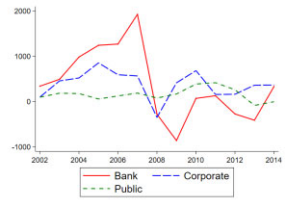
(a) Total Debt Liability Flows, Advanced



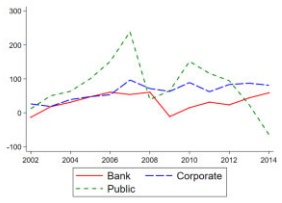
(b) Total Debt Liability Flows, Emerging



(c) Total Debt Liability Flows, Developing



(d) Total Debt Asset Flows, Advanced



(e) Total Debt Asset Flows, Emerging

FIGURE 7. Aggregate external debt flows, billions of 1996 USD. Source: AHKS data, authors' calculations. Total debt is PD + OID. For public sector asset flows, this includes reserves.

AE banks got the lion's share of capital inflows during the buildup to the GFC. However, they saw consistent negative net inflows for several years after 2008, reflecting the post-GFC deleveraging of this sector. The dynamics of inflows to the AE corporates and public sectors are driven to a large extent by PD, as this is their primary vehicle for borrowing. OID plays a larger role for the EM corporate sector and for banks.[25]

Much of the increase in EM private debt after 2008 is attributable to a few large EMs, such as China, India, and Brazil (Online Appendix Figure C.11). Foremost among these is China, which has poor sector coverage in the BOP data, so much of the measured effect is made possible by our data filling exercise (i.e. it is derived from our data filling series). While both bank and corporate inflows to China increased substantially after the GFC, the increase in the former series has been much larger. In India, the corporate sector has been the dominant recipient of debt flows. Flows to banks in the country have also increased considerably after the GFC. In the meantime, Brazil saw a sustained rise in corporate debt inflows, accompanied by somewhat volatile increases in inflows to banks and the government.

25. See Online Appendix Figure C.10. The post-GFC increases in inflows to governments come primarily in the form of bonds, with the exception of developing country governments, which also see an increase in OID funding (i.e. loans). Advanced-economy corporates also have a significant share of their inflows coming in the form of PD. Although EM banks and corporates see an increase in bond flows in the wake of the GFC, the aggregate pattern of their flows is driven primarily by OID. The majority of inflows to banks in all countries also takes the form of OID.

Turning to outflows, panels (d) and (e) of Figure 7 plot the debt asset flows for our sample of 31 countries over 2002–2014. As in the case of inflows, the public sector is defined as the sum of the central bank and the general government sector. Total debt asset flows for the public sector also include the flow of reserves. For advanced countries, the pattern is similar to the one for inflows. More concretely, the dynamics of flows is dominated by the pre-GFC surge and the subsequent collapse of private sector outflows (led by the banking sector,). The public sector plays a relatively small role in AE outflows. By contrast, EM outflows are dominated by the public sector. These are mainly driven by the accumulation of reserves, which rose considerably before the GFC and briefly thereafter, but were drawn down after the 2013 taper tantrum.[26]

4. Empirical Analysis

In this section, we start by documenting the fact that the high correlation between total capital inflows and outflows is explained by within-sector flows, and in particular by the high correlation between banking sector inflows and outflows, especially for advanced-economy banks. Then we move on to characterize the behavior of the inflows and outflows of the various sectors in response to regular business cycle fluctuations and global risk aversion shocks/changes in global financial conditions, as well as in response to different types of crises. In doing so, we also assess if the responses of banking sector inflows and outflows to these factors might contribute to explain the high correlation between banks', and thereby aggregate, inflows and outflows.

4.1. Comovement of Inflows and Outflows

Capital inflows and outflows have been shown in the literature to be highly correlated. In our dataset, the inflow–outflow correlation for debt flows to all sectors is 0.78 for our full country sample, 0.87 for AEs, and 0.59 for EMs. We examine correlations between capital inflows and outflows at the sectoral level to better understand their comovement and what drives the high correlation in aggregate inflows and outflows. Table 2 presents correlations conditional on country fixed effects, lagged GDP growth, and lagged log VIX. The results are very similar for unconditional correlations, as

26. Online Appendix Figure C.13 shows these flows, broken down by instrument type. Portfolio debt outflows from AE bank contracted sharply during the GFC. By contrast, external PD investment by the corporate sector remained stable during the GFC and rose in its immediate aftermath before experiencing a brief contraction shortly after the start of the Eurozone crisis. OID outflows from EM banks and corporates also dipped during the GFC but had a much stronger subsequent rebound than their AE counterparts. Corporate PD outflows also rebounded strongly after the GFC. The EM public sector reduced both portfolio and other investment external assets around the crisis; PD assets recovered after the GFC, but OID assets did not.

TABLE 2. Inflow and outflow conditional correlations by sector.

		Inflows			Outflows		
		Public	Banks	Corporates	Public	Banks	Corporates
Panel A: all countries							
Inflows	Public	1					
	Banks	−0.087***	1				
	Corporates	−0.068***	0.155***	1			
Outflows	Public	0.340***	0.087***	0.019	1		
	Banks	0.142***	0.686***	0.221***	−0.089***	1	
	Corporates	0.048**	0.199***	0.515***	0.036*	0.206***	1
Panel B: advanced economies							
		Inflows			Outflows		
		Public	Banks	Corporates	Public	Banks	Corporates
Inflows	Public	1					
	Banks	−0.112***	1				
	Corporates	−0.077***	0.151***	1			
Outflows	Public	0.351***	0.103***	−0.014	1		
	Banks	0.133***	0.745***	0.258***	−0.037	1	
	Corporates	0.040	0.193***	0.588***	−0.023	0.216***	1
Panel C: emerging markets							
		Inflows			Outflows		
		Public	Banks	Corporates	Public	Banks	Corporates
Inflows	Public	1					
	Banks	−0.121***	1				
	Corporates	−0.065**	0.115***	1			
Outflows	Public	0.405***	0.175***	0.124***	1		
	Banks	0.114***	0.306***	0.058**	−0.105***	1	
	Corporates	0.034	0.069**	0.215***	−0.031	0.033	1

Notes: Correlations conditional on country fixed effects, lagged log VIX, and lagged GDP growth. Sample covers 1997q1–2014q4. Public outflows include reserves. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

shown in Online Appendix Table C.2, although within-sector correlations tend to be somewhat larger.[27]

The strongest inflow–outflow correlations are found within-sector rather than across sectors. This is the case not only in the full country sample but also in the

27. Online Appendix Tables C.3 and C.4 show heatmaps of conditional and unconditional correlations of flows split by both sector and instrument.

AE and EM sub-samples. In the full sample, banks exhibit the highest inflow–outflow correlation at 0.7, and thus represent the main driver of the strong correlation between aggregate inflows and outflows, our second main fact.[28] Closer inspection reveals that banks' inflow–outflow correlation is much larger among AEs than among EMs, tracking the pattern for all flows (where the correlation for AEs is also considerably higher than for EMs). There is also a relatively high correlation (at 0.5) between inflows into and outflows from the corporate sector in the full sample, mainly due to AEs. The public sector inflow–outflow correlations are similar in the two country groups (at 0.4).

Table 2 also provides additional evidence for our third fact, that public sector borrowing acts as a countervailing force to private sector borrowing. The conditional correlation between public and private inflows is negative and highly statistically significant for all pairs and all country groups (all countries, AEs and EMs). It is larger (in absolute terms) for banks than for corporates.

It is also interesting to note that EM public sector outflows (which, as noted above, include the accumulation of reserves) tend to be positively (and statistically significantly) correlated with inflows to all individual sectors. This finding likely reflects the fact that EM sovereigns tend to accumulate reserves when capital is flowing into their countries.[29]

4.2. The Impact of Push and Pull Factors on Sector-Specific Capital Flows

How do the effects of the global financial cycle and the domestic business cycle on the behavior of capital flows vary across sectors? To answer this question, we examine the responses of sectoral capital inflows and outflows to standard push and pull factors and highlight the important differences in response by sector. We also assess how this differential behavior shapes each sector's contribution to the inflow–outflow comovement. The push factor we examine is a proxy for the global financial cycle/global risk appetite (the VIX); the pull factor on which we focus is the domestic business cycle (GDP growth). We do this analysis in a panel regression setup with our quarterly data. We focus on the following simple specification:

$$\frac{FLOW^{j}_{i,t}}{GDP_{i,t}} = \alpha_i + \beta^s \log(VIX_{t-1}) + \gamma^s GDPGrowth_{i,t-1} + \varepsilon^{j}_{i,t}. \qquad (5)$$

28. The aggregate inflow–outflow correlation can be expressed as a weighted sum of the correlations between the inflows and outflows of the different sectors, with the weights given by the product of the respective standard deviations divided by the product of the standard deviations of the aggregates. The standard deviations of bank inflows (10.2) and bank outflows (9.1) in the full sample are much larger than those of either public (5.6 and 6.9, respectively) or corporate (4.5 and 4.9, respectively) flows, in line with the fact noted earlier that banks account for the largest share of external debt stocks and flows. Hence, not only is the inflow–outflow correlation of banks the largest of all sectors, but it is also the one that carries the largest weight in the weighted sum.

29. EMs that are more financially integrated internationally accumulate reserves primarily as insurance against capital flow reversals, beyond what is needed for exchange rate management (Ghosh, Ostry, and Tsangarides 2017). This motivation is consistent with the correlation in the data, according to which public sector outflows increase when private sector inflows increase.

Our dependent variable is capital inflows or outflows as a percent of GDP to sector $j \in \{Public, Banks, Corp., All\}$ for country i in quarter t. The regressions are run separately by sector so that, for each sector, α_i is effectively a country-sector fixed effect. VIX_{t-1} is the option-implied volatility of the S&P 500 index, which enters into the regression in logs. The VIX is often used as a measure of global risk aversion or a proxy for the global financial cycle and global financial conditions, and represents a standard push factor for capital inflows, particularly to EM. $GDPGrowth_{it-1}$ is real year-on-year GDP growth for country i in the previous period, which is a standard pull factor driving foreign capital to a particular country. When we discuss results vis-a-vis GDP, we refer to "procyclical" as moving in the same direction with GDP growth, and "countercyclical" as moving opposite GDP growth. Our standard errors are clustered at the country level.

In order to highlight the differences in results based on our dataset versus the standard data sets and where these differences come from, we will adopt the following labeling. First, results based on our dataset will be labeled as "AHKS". If one takes the view that the missing sector in BOP data is not available because the data is less trustworthy (e.g. the total for that instrument in the BOP may not be accurate), then we can stop short of doing an internal filling when we construct our data and we label those results using the version of our data with no internal fill as "AHKS noIntFill". Another alternative is to take our AHKS data and force the sum of the sectors to match the reported total in the BOP. Thus, this version fully respects the BOP data and only allocates the total reported there into the different sectors. We label results using this version of the data as "AHKS match". Lastly, direct investment debt (DID) may be an important component of debt inflows, especially between corporates. Thus, we can also add DID to the all sectors total, as well as to the corporate sector, and use the label "AHKS+DID".

We present our results using a sample that is balanced across sectors but not across countries. That is to say, we keep country-year observations that have data for all sectors available. Thus, across regressions for different sectors, we have the same set of country-year observations represented. We show robustness to different samples (fully unbalanced, which uses any available data in each regression; fully balanced across both sectors and countries, where we only keep observations for countries with data for all sectors over the entire time period) in the Online Appendix. Our regression sample covers 63 countries: 23 advanced, 31 emerging, and 9 developing over 1997q1–2014q4.[30]

As a comparative baseline and to illustrate our data construction, Online Appendix Table C.5 presents the results for inflows to all sectors (that is, the sum of the four sectors). Due to the missing data, column (1) (Raw BOP) has few observations and thus lacks statistical significance, illustrating the important gap in coverage for the sectoral analysis. Column (2) shows the baseline relationship between our representative push

30. Using quarterly GDP data significantly restricts our sample along both country and time dimensions. Table 4 relaxes this by using annual data. The samples of countries used are detailed in Online Appendix A.4.

and pull factors. Inflows respond negatively to increases in the VIX, while they respond positively to higher GDP growth in the domestic economy. This applies both to the full country sample as well as the AE and EM subsamples. Importantly, our results are robust and consistent across alternative ways of constructing our dataset.[31]

Turning to our main results, Table 3 examines the relationships for inflows by sector, still showing the different constructions of the data, and including for comparison the raw BOP results. Again, the results are largely similar across the different dataset constructions, but largely not significant in the limited BOP only sample.[32]

Capital inflows respond to these factors differently across sectors. Inflows to banks and corporates show similar behavior, but inflows to AE corporates do not respond to domestic GDP growth like inflows to AE banks do. The most notable difference is between the two private sectors and the public sector. There is no response to the VIX for total inflows to the public sector.[33] Inflows to sovereigns react differently to domestic GDP growth in advanced and emerging countries. The response is positive (procyclical) in advanced countries, similar to their bank inflows. By contrast, in EMs, it is negative (countercyclical), going in the opposite direction to the response of the private sector. This result is another manifestation (in a different setting) of the countervailing nature of public inflows (i.e. our third key stylized fact).

The negative relationship between public sector inflows and domestic GDP that we document is likely related to the counter-cyclical nature of fiscal policy. Governments often try to counteract growth slowdowns by implementing expansionary fiscal policies.[34] This increases their budget deficits, which tend to be at least partially financed by borrowing in international markets. As a consequence, capital inflows to the public sector tend to increase when the domestic economy slows down (and vice versa).

To further underscore the importance of using sectoral data, Online Appendix Table C.1 illustrates the differences in our push–pull regression analysis when using our newly constructed sector breakdowns versus BOP proxies. The estimated impact of the VIX on the conventional measure of AE PD flows is not significant, but is significant for our AE corporate flow series. More importantly, while the estimated coefficient of GDP

31. Column (3) shows the outcome if we do not use an internal fill of the BOP data. Column (4) presents the results when we force our data to add up to the BOP total (i.e. the topline items by instrument). And column (5) shows results from adding DID to the AHKS data. Significance and size of coefficients are all similar across different constructions of the AHKS data, for both AEs (panel B) and EMs (panel C).

32. The coefficient on the VIX, when using the raw BOP sample, is significant for inflows to the public sector for all countries and especially EMs. We find this result in a few other specifications as well, which we note in our analysis below.

33. Online Appendix Table C.6 finds a positive coefficient in the period following the great financial crisis. Online Appendix Table C.7 shows a positive response for inflows to EM sovereigns for a fully balanced panel over 2002q4–2014q4. Online Appendix Table C.8 shows that OID inflows to the public sector respond positively. These responses move opposite that of private inflows. Portfolio debt inflows to EM sovereigns respond negatively to the VIX, so EM sovereign bonds appear to be treated the same way as private sector borrowing when it comes to a tightening of global financial conditions.

34. This is the case for many AEs (Aghion and Marinescu 2007), as well as more recently for EMs (Takáts 2012; Jha et al. 2014).

TABLE 3. Inflows by sector.

Panel A: all countries

	Public				Banks				Corporates				
	(1) Raw BOP	(2) AHKS	(3) AHKS noIntFill	(4) AHKS match	(5) Raw BOP	(6) AHKS	(7) AHKS noIntFill	(8) AHKS match	(9) Raw BOP	(10) AHKS	(11) AHKS noIntFill	(12) AHKS match	(13) AHKS +DID
$\text{Log(VIX}_{t-1}\text{)}$	1.337**	0.467	0.483	0.562	−0.708	**−0.418*** **	**−0.423*** **	**−0.668*** **	−0.206	**−0.045*** **	**−0.043*** **	**−0.987*** **	**−0.280*** **
	(0.483)	(0.364)	(0.364)	(0.354)	(1.755)	(0.525)	(0.525)	(0.522)	(0.212)	(0.243)	(0.243)	(0.232)	(0.385)
GDP growth_{it-1}	0.0179	−0.0124	−0.0144	−0.0128	0.0699	0.116***	0.116***	0.112***	0.00823	0.0359***	0.0362***	0.0379***	0.0442***
	(0.0289)	(0.0101)	(0.00991)	(0.0104)	(0.0441)	(0.0270)	(0.0270)	(0.0272)	(0.00791)	(0.00772)	(0.00772)	(0.00795)	(0.00844)
Observations	290	4,020	4,009	4,020	290	4,020	4,009	4,020	290	4,020	4,009	4,020	3,721
R^2	0.015	0.002	0.003	0.003	0.075	0.034	0.034	0.031	0.004	0.025	0.026	0.025	0.025

Panel B: advanced economies

$\text{Log(VIX}_{t-1}\text{)}$	0.493	0.410	0.421	0.590	−0.919	**−0.069*** **	**−0.069*** **	**−0.513*** **	−0.823	**−0.160** **	**−0.157** **	**−0.997** **	−0.446
	(0.962)	(0.791)	(0.793)	(0.760)	(2.050)	(1.074)	(1.074)	(1.031)	(0.847)	(0.476)	(0.476)	(0.445)	(0.803)
GDP growth_{it-1}	0.0376	0.0563***	0.0496**	0.0535**	0.00642	0.209**	0.209**	0.201**	−0.0463	0.0225	0.0226	0.0280	0.0202
	(0.0393)	(0.0190)	(0.0194)	(0.0213)	(0.124)	(0.0784)	(0.0784)	(0.0798)	(0.0476)	(0.0170)	(0.0170)	(0.0179)	(0.0171)
Observations	60	1,656	1,656	1,656	60	1,656	1,656	1,656	60	1,656	1,656	1,656	1,548
R^2	0.016	0.008	0.006	0.007	0.002	0.032	0.032	0.029 R^2	0.020	0.009	0.009	0.009	0.008

Panel C: emerging markets

$\text{Log(VIX}_{t-1}\text{)}$	1.504**	0.438	0.460	0.481	−0.282	**−0.199*** **	**−0.200*** **	**−0.340*** **	−0.284	**−0.956*** **	**−0.957*** **	**−0.976*** **	**−0.179*** **
	(0.545)	(0.263)	(0.266)	(0.268)	(2.241)	(0.535)	(0.535)	(0.567)	(0.211)	(0.291)	(0.291)	(0.286)	(0.392)
GDP growth_{it-1}	0.0127	**−0.0383*** **	**−0.0383*** **	**−0.0377*** **	0.0823	0.0842***	0.0842***	0.0827***	0.0165***	0.0334***	0.0334***	0.0337***	0.0486***
	(0.0336)	(0.00934)	(0.00925)	(0.00938)	(0.0503)	(0.0217)	(0.0217)	(0.0217)	(0.00344)	(0.00598)	(0.00598)	(0.00634)	(0.00814)
Observations	223	2,036	2,036	2,036	223	2,036	2,036	2,036	223	2,036	2,036	2,036	1,919
R^2	0.018	0.025	0.025	0.024	0.154	0.098	0.098	0.094	0.017	0.059	0.059	0.058	0.062

Notes: Sample is from 1997q1 to 2014q4. All regressions include country fixed effects. Errors are clustered at the country level.
** $p < 0.05$, *** $p < 0.01$.

growth on inflows to EM corporates is positive and highly significant, its counterpart in the case of EM PD flows has the opposite (counterintuitive) sign. These differences arise because both sovereigns and corporates play a significant role in overall PD flows. In EMs, sovereign flows can be countercyclical, while corporate flows are procyclical. In advanced countries, sovereign flows are generally not responsive to the VIX, which dampens the response of PD flows in standard data, but not in our corporate flow series.

These differences by sector are robust across a number of alternative specifications. Online Appendix Table C.6 shows that the results are not driven by the 2008–2009 period of the great financial crisis. Online Appendix Table C.7 shows that these results are robust to different ways of balancing the sample: fully unbalanced, fully balanced over 1997q1–2014q4, and fully balanced over 2002q4–2014q4.[35] This last sample includes more countries than the previous fully balanced sample and shows EM public inflows moving positively with the VIX and corporate inflows, including DID, responding positively to GDP and negatively to the VIX. The results are also robust to normalizing by trend GDP instead of contemporaneous GDP (Online Appendix Table C.9).

The above regressions omit many emerging and developing economies that lack quarterly GDP data, even though their quarterly sector-wise flows are available in our dataset. In order to include these countries and analyze their inflows, we utilize the annual version of our dataset and estimate the same regression specification. This adds 4 EMs and 20 developing countries back into our sample, enough that we can present results for developing countries on their own. (In the previous set of results, they were only in the "All countries" regressions.) These are shown in Table 4.

For EMs, the results in the slower moving annual panel are consistent with our previous results at the quarterly frequency. Additionally, the positive coefficient on the VIX for inflows to sovereigns becomes significant, perhaps because these flows respond to larger global shocks rather than more frequent fluctuations. This response to the VIX further highlights how different capital inflows to the public sector are, especially for EMs.

For developing countries, inflows are largely not reactive to the push or pull factors we examine. Nevertheless, inflows to banks in developing economies do appear to be negatively linked to the VIX, as they are for other country groups. This result highlights the importance of banks in connecting developing economies to the international financial system.

Regressions of capital flows on push and pull factors tend to exhibit low R^2 when using quarterly data. When using annual data, however, R^2's tend to be considerably larger (0.2–0.3). This is actually an artifact of the time period, as illustrated in Table 5. Regressions that use mainly data from before the GFC, as would naturally be the case with most of the existing literature, have R^2's of the expected magnitude. This holds for the topline flows from the BOP, as well as for the sector breakdowns in our

35. Fully balanced means that every country in the sample has data for all sectors and both instruments over the whole time frame.

TABLE 4. Annual inflows—emerging and developing economies.

	(1) All	(2) Public	(3) Banks	(4) Corporates
Panel A: emerging markets				
$\text{Log(VIX}_{t-1})$	−0.515***	0.662***	−0.056***	−0.153***
	(0.882)	(0.228)	(0.793)	(0.228)
GDP growth_{it-1}	0.0746***	−0.0320***	0.0706***	0.0365***
	(0.0222)	(0.00731)	(0.0180)	(0.00524)
Observations	628	628	628	628
R^2	0.115	0.043	0.138	0.134
Panel B: developing countries				
$\text{Log(VIX}_{t-1})$	−0.366	−0.407	−0.945**	0.0547
	(1.179)	(0.584)	(0.441)	(1.153)
GDP growth_{it-1}	0.0602	−0.0142	−0.0100	0.0980
	(0.0564)	(0.00731)	(0.0188)	(0.0889)
Observations	516	516	516	516
R^2	0.006	0.007	0.006	0.010

Notes: Sample is annual from 1997 to 2014. All regressions include country fixed effects. Errors are clustered at the country level. $*p < 0.05$, $***$ $p < 0.01$.

TABLE 5. Annual inflows and R^2 by period.

Sample	Regression	1997–2014	1997–2007	2008–2014
Advanced economies	All BOP	0.13	0.19	0.08
	All AHKS	0.09	0.20	0.02
	Public AHKS	0.01	0.03	0.02
	Banks AHKS	0.08	0.19	0.003
	Corporates AHKS	0.05	0.06	0.03
Emerging markets	All BOP	0.12	0.21	0.04
	All AHKS	0.11	0.17	0.04
	Public AHKS	0.04	0.04	0.03
	Banks AHKS	0.14	0.17	0.12
	Corporates AHKS	0.13	0.22	0.03

Notes: Numbers in this table are the within-R^2 for annual regressions of capital inflows (for the indicated sector) on country fixed effects, log VIX, and GDP growth. Sample period indicated by the column.

data, particularly for AE and EM banks and EM corporates. Post-GFC, the capital flow environment is quite different (Amiti, McGuire, and Weinstein 2018). As a consequence, push–pull regressions estimated on a post-GFC sample tend to have much lower explanatory power. Closer inspection reveals that inflows to AE banks and EM corporates are the two items showing the biggest decline in explanatory power of the push and pull factors we examine. Nevertheless, these factors still explain a considerable fraction of the variation in inflows to EM banks during the post-GFC

period. Interestingly, the explained variation is quite low across the board for public inflows as well as flows to advanced-economy corporates.

To dig deeper into the difference in flow environments pre- and post-GFC, we further split these regressions by sample period and by instrument (in addition to our benchmark sector splits). The instrument split is relevant as the post-GFC environment has featured a reduced role for global banks and a more prominent role for bond financing (PD) in global financial intermediation (Shin 2013). These results are presented in Online Appendix Table C.10 for AEs and Online Appendix Table C.11 for EMs.

For inflows to AEs, the VIX is a strong negative factor pre-crisis but not post-crisis, in line with Fratzscher (2012), Amiti, McGuire, and Weinstein (2018), Barrot and Servén (2018), and Kalemli-Özcan (2019). In contrast, inflows to all AE sectors became more procyclical after the crisis. This change is driven by the higher post-GFC procyclicality of OID flows to all sectors. On the other hand, PD flows for banks and corporates showed procyclicality before the GFC but not after.

The global financial cycle remained a relevant factor for EM flows even after the GFC. Similarly to AEs, EMs experienced reduced influence from the global financial cycle after the GFC, particularly for OID flows to corporates. However, the impact of the VIX on inflows to EM banks remained significant even after the GFC, in line with the sustained R^2's discussed above. Inflows to the public sector respond differently depending on the instrument, with tighter global financial conditions having a negative impact on PD inflows (along with inflows to corporates), but a positive impact on OID flows (which includes official lending to sovereigns). Thus, like in AEs, PD inflows to EM banks and corporates became more procyclical after the GFC. OID inflows to banks and corporates remained procyclical in both periods, though PD inflows to sovereigns turned significantly countercyclical after the GFC, driving a stronger countercyclical response of total debt inflows.

The differences between pre- and post-GFC highlight how structural changes in global markets can shift these relationships. The structural trends in flows could bear influence on the baseline relationships that we document. Online Appendix Table C.12 shows results if we apply a Hamilton filter (Hamilton 2018) to remove the structural component of capital flows to each sector, and examine the relationship of push and pull factors with just the cyclical component.[36] We find that our baseline results are largely the same: Private sector flows in all countries respond negatively to the VIX but positively to GDP growth, with public sector flows moving countercyclically in EMs. The only significant change relative to our baseline results is that AE corporate debt inflows do not react significantly to the VIX.

Turning now to outflows in Table 6, we find that total capital outflows (i.e. the sum of the outflows of all sectors) respond similarly to total capital inflows: negative response to the VIX and a positive (procyclical) response to GDP. Emerging market

36. As noted in (Hamilton 2018), the Hodrick-Prescott (HP) filter may not always be appropriate. Nevertheless, our results are largely the same if we use an HP filter.

TABLE 6. Outflows by sector.

	(1) All	(2) Public	(3) Banks	(4) Corporates	(5) Reserves	(6) Total+ reserves	(7) Public+ reserves
Panel A: all countries							
$\text{Log(VIX}_{t-1}\text{)}$	**−0.337*****	**−0**.00978	**−0.438*****	**−0.788*****	**−0**.185	**−0.582*****	**−0**.266
	(0.775)	(0.358)	(0.788)	(0.277)	(0.342)	(0.859)	(0.581)
GDP growth_{it-1}	0.0723***	0.0123**	0.0668**	0.00984	0.0213**	0.0926***	0.0341**
	(0.0261)	(0.00545)	(0.0266)	(0.00531)	(0.0106)	(0.0279)	(0.0129)
Observations	2,620	2,620	2,620	2,620	2,620	2,620	2,620
R^2	0.033	0.002	0.033	0.007	0.003	0.033	0.005
Panel B: advanced economies							
$\text{Log(VIX}_{t-1}\text{)}$	**−0.669*****	0.495	**−0.100*****	**−0.451****	0.606	**−0.148*****	1.067
	(1.486)	(0.757)	(1.467)	(0.532)	(0.483)	(1.721)	(1.087)
GDP growth_{it-1}	0.210***	0.0236	0.219***	0.0122	−0.000451	0.214**	0.0270
	(0.0742)	(0.0118)	(0.0750)	(0.0123)	(0.0114)	(0.0768)	(0.0215)
Observations	1,170	1,170	1,170	1,170	1,170	1,170	1,170
R^2	0.066	0.003	0.077	0.011	0.005	0.058	0.005
Panel C: emerging markets							
$\text{Log(VIX}_{t-1}\text{)}$	**−0.648*****	**−0.560****	**−0.355*****	**−0**.282	**−0.985****	**−0.703*****	**−0.636*****
	(0.389)	(0.215)	(0.339)	(0.242)	(0.456)	(0.580)	(0.502)
GDP growth_{it-1}	0.0107	0.00268	0.00350	0.00877	0.0275	0.0347	0.0293
	(0.0118)	(0.00464)	(0.0109)	(0.00529)	(0.0137)	(0.0190)	(0.0156)
Observations	1,301	1,301	1,301	1,301	1,301	1,301	1,301
R^2	0.020	0.007	0.011	0.006	0.010	0.026	0.014

Notes: Sample is from 1997q1 to 2014q4. All regressions include country fixed effects. Columns (1)–(4) include only PD and OID; columns (5)–(7) add reserves. Errors are clustered at the country level. $**p < 0.05$, $*** p < 0.01$

outflows, however, do not significantly respond to domestic GDP. These patterns hold both for portfolio and OID (column (1)) and when additionally including reserve assets (column (5)). Looking at results by sector in columns (2)–(4), we see that again banks and corporates drive the negative response to the VIX. As for GDP response, outflows from the public sector and from banks are both procyclical.

Flows of official reserves are procyclical (panel A, columns (5) and (7)). While there is no conclusive evidence, some of our results suggest that EMs may drive this relationship. The estimated relationship for AE sovereigns (panel B, column (5)) is negative and small, the coefficient in the EM sample (panel C, column (5)) is significant at the 6% level, and the result for all public sector flows (debt + reserves) is significant for the EM sample when results are normalized by trend GDP (Online Appendix Table C.9). Overall, our results provide evidence that reserves tend to be accumulated when capital is flowing into the economy, as noted in our inflow–outflow correlations above (Table 2). Thus, the public sector's reserve management may be an important way in which it can serve as a countervailing force in terms of capital flows for some countries, building up reserves when times are good and capital is flowing into the private sector.

External factors like the VIX also have a significant impact on EM outflows. Outflows from EM banks and the public sector (including flows of reserves) respond negatively to the VIX. Outflows by corporates do not show a significant response.

Our results are again robust to a number of alternative specifications. Online Appendix Table C.13 shows the outflow regressions for different ways of balancing the sample. There are not enough observations for a large balanced sample extending back to 1997, but a shorter balanced sample from 2002q4 to 2014q4 shows largely similar results. Results are also robust to normalizing by trend GDP (Online Appendix Table C.9), with a few interesting results becoming more significant: Outflows from AE sovereigns are shown to be procyclical, outflows from EM sovereigns, when including reserves, are also procyclical (as mentioned above), and corporate outflows are procyclical for all countries, especially EMs.[37]

While we have examined push and pull relationships with a single factor for each, a number of additional (push and pull) factors could also play a significant role. Table 7 replaces the VIX and GDP growth with a set of alternative push factors (denoted with $t-1$ subscripts) and pull factors (denoted with $i, t-1$ subscripts), which have been explored in the existing literature (Koepke 2019). In this additional set of regressions, as in our benchmark results, public sector flows tend to react to push and pull factors differently from private sector flows. Notably, global GDP growth is a strong driver of inflows to (AE and EM) banks and to the (AE) corporate sector but has no significant impact on flows to the (AE and EM) public sector. These novel, sector-specific results shed new light on one of the more puzzling results in the existing literature, which has found that while global GDP growth has a positive and significant

37. Online Appendix Table C.14 presents results for outflows split by sector and flow type, and shows that the negative response to the VIX for banks and corporates is driven primarily by OID outflows.

TABLE 7. Other push and pull factors.

Panel A: inflows

	Advanced economies					Emerging markets				
	(1) All	(2) Public	(3) Banks	(4) Corporates	(5) Corps +DID	(6) All	(7) Public	(8) Banks	(9) Corporates	(10) Corps +DID
Broad dollar index$_{t-1}$	0.0700	**−0.0930****	0.151**	0.0163	0.0142	−0.0352	0.00972	−0.00907	**−0.0359*****	**−0.0702*****
	(0.0723)	(0.0411)	(0.0606)	(0.0275)	(0.0395)	(0.0199)	(0.0115)	(0.0145)	(0.0117)	(0.0227)
Yield curve$_{t-1}$	−0.409	1.194**	−0.263	−0.357	−0.470	−0.322	0.135	−0.194	**−0.264****	**−0.406*****
	(0.820)	(0.463)	(0.624)	(0.269)	(0.444)	(0.239)	(0.143)	(0.144)	(0.102)	(0.134)
Wu/Xia shadow rate$_{t-1}$	1.234**	0.560**	0.532	0.0527	0.200	−0.0127	−0.0734	−0.00805	0.0688	0.0505
	(0.493)	(0.258)	(0.273)	(0.146)	(0.212)	(0.223)	(0.0911)	(0.123)	(0.0639)	(0.109)
Global GDP growth$_{t-1}$	1.440**	0.212	0.693**	0.344**	0.452***	0.239**	0.0617	0.168***	0.00916	−0.0658
	(0.510)	(0.192)	(0.272)	(0.127)	(0.156)	(0.0979)	(0.0666)	(0.0514)	(0.0454)	(0.0909)
Domestic credit growth$_{it-1}$	0.453	−0.0352	0.507	0.146	0.193	0.226	0.0649	0.0992	0.0616***	0.0609**
	(0.441)	(0.165)	(0.283)	(0.111)	(0.139)	(0.106)	(0.0334)	(0.0608)	(0.0179)	(0.0272)
Exchange rate depreciation$_{it-1}$	**−0.295*****	−0.0206	**−0.258*****	−0.0133	−0.0173	**−0.0998****	−0.00130	**−0.0574****	**−0.0411*****	**−0.0556*****
	(0.0839)	(0.0238)	(0.0634)	(0.0185)	(0.0221)	(0.0458)	(0.0194)	(0.0243)	(0.00760)	(0.0175)
Current account$_{it-1}$	**−0.0920****	**−0.0271****	−0.0443	−0.0122	−0.0187	−0.0675	−0.000394	−0.0326	**−0.0345****	**−0.0418****
	(0.0430)	(0.0101)	(0.0250)	(0.0136)	(0.0163)	(0.0356)	(0.0144)	(0.0196)	(0.0146)	(0.0191)
Capital control (inflow)$_{it-1}$	−0.006	−0.044	−0.919	3.278	4.141	−0.561	**−0.889****	0.403	0.925**	0.785
	(8.274)	(3.113)	(6.973)	(2.494)	(4.264)	(1.131)	(0.858)	(0.644)	(0.358)	(0.580)
Observations	1,331	1,331	1,331	1,331	1,331	859	859	859	859	855
R^2	0.127	0.023	0.114	0.047	0.062	0.143	0.038	0.122	0.171	0.100

TABLE 7. Continued

	Advanced economies					Emerging markets				
	(1) All	(2) Public	(3) Banks	(4) Corporates	(5) Corps +DID	(6) All	(7) Public	(8) Banks	(9) Corporates	(10) Corps +DID
Panel B: outflows										
Broad dollar index$_{t-1}$	0.131**	0.0187	0.0481	0.0676***	0.00141	0.0101	**−0.0177****	−0.00191	0.0291	−0.0552
	(0.0562)	(0.0496)	(0.0549)	(0.0193)	(0.0575)	(0.0162)	(0.00738)	(0.0183)	(0.0132)	(0.0431)
Yield curve$_{t-1}$	−0.469	0.280	**−0.955****	−0.151	0.589	**−0.408****	−0.106	−0.279	−0.183	0.0500
	(0.638)	(0.490)	(0.367)	(0.257)	(0.516)	(0.130)	(0.0609)	(0.141)	(0.0956)	(0.299)
Wu/Xia shadow rate$_{t-1}$	0.721	0.0682	0.696**	0.0518	0.195	−0.0385	0.0142	−0.0206	−0.0897	0.256
	(0.404)	(0.229)	(0.309)	(0.158)	(0.256)	(0.0792)	(0.0233)	(0.0741)	(0.0469)	(0.209)
Global GDP growth$_{t-1}$	1.570***	0.368	1.236**	0.336	0.0678	0.206**	0.0995	0.135	0.0314	−0.0497
	(0.525)	(0.211)	(0.556)	(0.216)	(0.324)	(0.0796)	(0.0950)	(0.0715)	(0.0321)	(0.132)
Domestic credit growth$_{it-1}$	0.258	−0.0298	0.523	0.00702	−0.0518	0.0672	0.00615	0.0445	0.0419	−0.000557
	(0.392)	(0.0515)	(0.565)	(0.0754)	(0.0616)	(0.0422)	(0.00976)	(0.0303)	(0.0281)	(0.0198)
Exchange rate depreciation$_{it-1}$	**−0.210*****	0.00367	**−0.252*****	−0.0135	−0.0000447	**−0.0280****	−0.00236	−0.0194	−0.0162	−0.0486
	(0.0661)	(0.0180)	(0.0765)	(0.0156)	(0.0223)	(0.0118)	(0.00495)	(0.00983)	(0.00839)	(0.0247)
Current account$_{it-1}$	−0.0187	−0.00925	−0.00747	0.0152	0.00754	0.0303	0.0246**	0.0291	−0.00949	0.00247
	(0.0794)	(0.0155)	(0.0719)	(0.0266)	(0.0141)	(0.0321)	(0.00952)	(0.0235)	(0.0221)	(0.0430)
Capital control (outflow)$_{it-1}$	−0.607	3.016	−0.37	1.387	3.174	−0.458	−0.115	0.665	−0.226	0.194
	(4.642)	(1.787)	(5.237)	(1.416)	(1.542)	(0.902)	(0.871)	(0.549)	(0.534)	(1.026)
Observations	996	996	996	996	995	591	591	591	591	591
R^2	0.137	0.017	0.144	0.029	0.008	0.077	0.089	0.049	0.027	0.032

Notes: Sample is from 1997Q1 to 2014Q4. All regressions include country fixed effects. Errors are clustered at the country level.

* $p < 0.05$, *** $p < 0.01$.

impact on PD inflows to EMs, its impact on OID inflows to EMs is ambiguous (Koepke 2019).

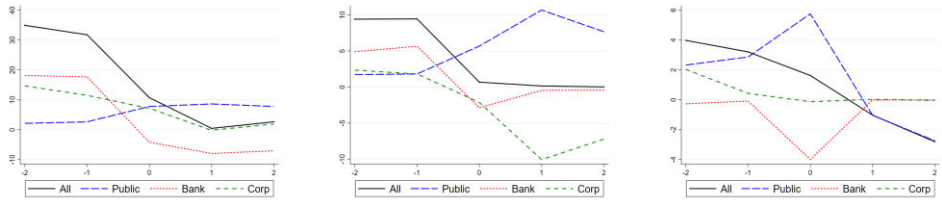
Our sector-specific results also provide new insights into the financial channel of exchange rates (Bruno and Shin 2015a,b; Avdjiev et al. 2019a,b). More concretely, our results demonstrate that while the previously documented negative relationship between the exchange rate and capital inflows holds at the aggregate level (for all sectors), there is significant heterogeneity across sectors in both AEs and EMs. In line with the predictions of the theoretical literature on the subject (Bruno and Shin 2015b), we find that the impact of the exchange rate is strongest for inflows to banks, the only sector for which the estimated relationship is statistically significant for both AEs and EMs. Furthermore, we find that the negative relationship is spread across more sectors in EMs than in AEs, in line with the argument that EM borrowers tend to have larger currency mismatches on their balance sheets due to the more limited availability and higher costs of hedging services in EMs (Bank for International Settlements 2019; Hofmann, Shim, and Shin 2020). Last but not least, we document that the public sector is the only one for which the relationship between exchange rates and capital inflows is insignificant for both AEs and EMs. This is yet another manifestation of one of the main stylized facts we document—namely, that flows to the public sector behave very differently than their private sector counterparts.

As in our benchmark regressions, we find fewer statistically significant results for capital outflows than for capital inflows. Nevertheless, these additional regressions provide further evidence that public sector inflows tend to dance to a different tune than private sector inflows.

In conclusion, our analysis helps shed light on which sectors drive the observed response of flows to push and pull factors and the role of these sectors in a changing capital flow environment. The heterogeneous responses of the main capital flow components to domestic and global shocks highlight the significant variation in the responses of sector-specific capital flows to different shocks (our fourth main stylized fact). Additionally, the strong and significant responses (to the VIX and GDP growth) of inflows into and outflows from the banking sector, particularly in AEs, sheds some light on why banks drive the aggregate (all-sector) inflow–outflow correlations (our second main stylized fact). Bank inflows and outflows tend to respond similarly to the same stimuli, so the high correlation observed even after controlling for these factors likely reflects similar matching behavior of banks' activities to other circumstances. Last but not least, virtually all of the push–pull results presented in this sub-section provide strong evidence that public sector flows respond very differently from private sector flows to country-specific and global shocks (our third main stylized fact).

4.3. The Behavior of Capital Flows around Crises

The behavior of capital flows around crisis events has been the subject of much research. The dynamics of capital flows around crises have usually been characterized by sharp retrenchments, "sudden stops", and reversals. The existing literature has shown that,



(a) Banking Crises (b) Currency Crises (c) Sovereign Debt Crises

FIGURE 8. Crisis types and debt inflows to EMs. Source: AHKS data, Laeven and Valencia (2018), authors' calculations. Data is annual. Each line shows the average debt inflows to GDP around crisis events, where $t = 0$ is the year (or first year) of the crisis. Based on a sample of 46 banking crises in 43 countries, 36 currency crises in 27 countries, and 15 sovereign debt crises in 12 countries.

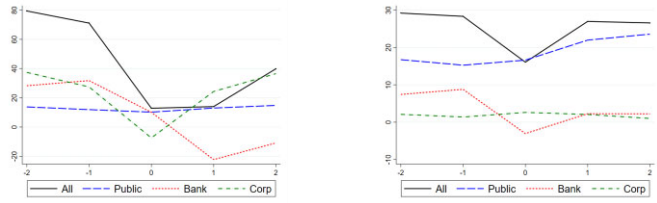
during such episodes, when foreigners tend to "leave" (inflows fall), domestic residents tend to "return" (outflows fall), helping partly to smooth out the external shock. Such volatile gyrations in capital flows can have important macroeconomic and financial consequences. However, little is known about how these flow swings depend on the sector of the domestic agents involved, which has important implications for macro-financial stability and for the policies that can be used to manage it.

In this section, we shed more light on the above questions by examining the behavior of each sector's inflows and outflows around crisis events. This helps illuminate the contribution of different sectors to the capital flow response to crises and deepens our knowledge of capital flow dynamics around these episodes. Behavior around crisis events may also shed light on the high inflow–outflow correlations discussed previously.

We compare average flows relative to trend GDP across all countries around three different types of crisis events: banking crises, currency crises, and sovereign debt crises, as defined by Laeven and Valencia (2018). Since the timing of each episode is not exact, we use annual flows combined with the year indicator for the start of each crisis, centering each crisis date at $t = 0$. Figure 8 plots the results.[38] As expected, banking crises are associated with strong declines in inflows to banks. In addition, we see a smaller decline in inflows to corporates but an increase in inflows to the public sector. Thus, public borrowing from abroad during a banking crisis appears to serve as an important backstop for financial stability. During currency crises, the main decline is in inflows to corporates, while inflows to sovereigns tend to rise. Sovereign crises see a run up in inflows to sovereigns up to the year of the crisis, followed by a large collapse. Inflows to banks take a dip when the crisis hits, but otherwise the private sector is less affected during sovereign crises.

Figure 9 shows summary plots for outflows from EMs around banking and currency crisis events. Due to a more constrained sample with outflows, there were not enough

38. Based on a sample of 43, 27, and 12 countries for banking, currency, and sovereign debt crises, respectively. By design, only countries experiencing a crisis are captured in the figures.



(a) Banking Crises (b) Currency Crises

FIGURE 9. Crisis types and debt outflows out of EMs. Source: AHKS data, Laeven and Valencia (2018), authors' calculations. Data is annual. Each line shows the average debt outflows to GDP around crisis events, where $t = 0$ is the year (or first year) of the crisis. Based on a sample of 20 banking crises in 20 countries and 10 currency crises in 9 countries.

EM sovereign debt crisis events to construct average outflows around them. The graph illustrates that the average EM experiencing a banking crisis sees an immediate decline in corporate outflows and a sustained decline in bank outflows with no significant response from the public sector. For currency crises, the public sector tends to increase their outflows (driven by reserve holdings), while banks see a decline in outflows in the year of the crisis.

These patterns for inflows are largely confirmed by regression analysis with a broader set of countries, shown in Table 8. These regressions are specified by the following equation:[39]

$$\frac{FLOW^{j}_{i,t}}{GDP_{i,t}} = \alpha_i \ + \alpha_t + \sum_{k=0,1,2} (\beta_k BankCrisis_{i,t-k} + \delta_k CurrCrisis_{i,t-k} + \gamma_k BankCrisis_{i,t-k}) + \varepsilon^{j}_{i,t}, \quad (6)$$

where i is country, j indicates the sector, t indicates the year, and the independent variables are country and time fixed effects, and dummy variables for each crisis type (and their lags).

Banking crises are associated with sustained declines in debt inflows in the following two years. Separated by sector, inflows to the public sector increase immediately, while bank and corporate inflows drive the sustained decline. These dynamics again reinforce our third fact of the public sector countervailing the private sector. In the case of currency crises, there is limited evidence for an increase in inflows to the sovereign and a decrease to corporates, but only when including solely contemporaneous effects (columns (1) and (5)). Sovereign debt crises have a large but delayed negative impact on inflows to the sovereign, as the year of the crisis often features large borrowing in the period leading up to the default. Inflows to the private sector are not significantly affected by sovereign debt crises. Hence, capital inflow

39. The dependent variable is multiplied by 100.

TABLE 8. Capital inflows around crises.

	All		Public		Bank		Corporate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank crisis$_t$	0.147	−0.448	3.705***	4.972***	−0.189*	**−0.654****	0.630	−0.766
	(2.683)	(2.851)	(1.193)	(1.620)	(2.413)	(2.614)	(0.873)	(1.158)
Bank crisis$_{t-1}$		**−0.65*****		5.944		**−0.658*****		**−0.940***
		(2.982)		(3.789)		(1.904)		(4.918)
Bank crisis$_{t-2}$		**−0.630*****		3.756		**−0.579*****		−0.808
		(2.922)		(2.384)		(2.959)		(2.963)
Currency crisis$_t$	−0.084	2.067	2.044*	2.684	−0.818	1.114	**−0.310****	−0.732
	(1.979)	(2.230)	(1.113)	(1.795)	(1.535)	(2.032)	(0.907)	(1.061)
Currency crisis$_{t-1}$		3.348		9.167		2.765		−0.583
		(2.900)		(7.156)		(2.335)		(8.194)
Currency crisis$_{t-2}$		−0.749		7.459		−0.595		−0.613
		(2.114)		(6.589)		(1.300)		(7.405)
Sovereign debt crisis$_t$	−0.268	−0.834	3.619	0.806	−0.310	−0.942	0.423	2.302
	(6.793)	(6.310)	(2.430)	(2.978)	(8.660)	(8.396)	(1.242)	(2.135)
Sovereign debt crisis$_{t-1}$		−0.897		**−0.20****		0.379		6.920
		(4.417)		(4.751)		(2.789)		(5.174)
Sovereign debt crisis$_{t-2}$		−0.382		**−0.110****		1.697		5.031
		(3.005)		(3.860)		(1.292)		(4.536)
Observations	1,653	1,566	1,653	1,566	1,653	1,566	1,653	1,566
R^2	0.132	0.155	0.121	0.158	0.160	0.222	0.117	0.108
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YearFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NetBank		0.00209		0.0437		0.000469		0.0873
NetCurr		0.397		0.210		0.521		0.271
NetSov		0.285		0.0550		0.541		0.213

Notes: Annual data, 87 countries, 1996–2014. A total of 45 banking crisis episodes (in 42 countries), 33 currency crisis episodes (in 25 countries), and 15 sovereign debt episodes (in 12 countries). NetBank, NetCurr, and NetSov display the p-values for the joint test that the sum of the coefficients for the crisis dummy and its two lags is different from 0. Crisis dates from Laeven and Valencia (2018). Errors are clustered at the country level. $*p < 0.10$, $**$ $p < 0.05$, $***$ $p < 0.01$.

behavior around crisis events differs markedly both across sectors and across types of crisis.

Table 9 displays the respective results for outflows. In this exercise, we allow the panel to be unbalanced across years in order to gain sufficient observations around crisis events, but ensure that we have data for flows from all three sectors for each country-year observation. There is a significant decline in total debt outflows following banking crises, largely driven by banks and, to a smaller extent, by corporates. Outflows from banks tend to increase following a currency crisis. Although there are only a few sovereign debt crisis events, the results provide some evidence that public outflows decline following a sovereign debt crisis while corporate outflows increase, the latter perhaps due to a portfolio reallocation away from the domestic economy.

4.4. The COVID-19 Crisis

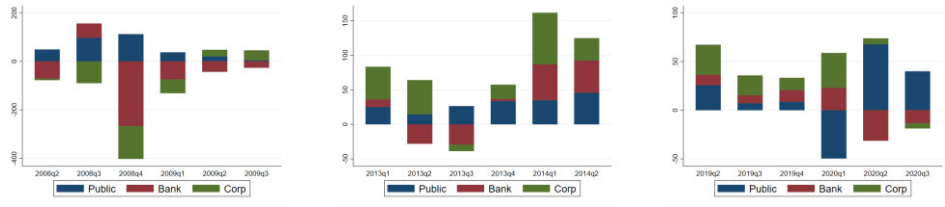
The recent COVID-19 crisis clearly illustrated the importance of separating capital flows by sector, especially because of the heterogeneous impact it had on different sectors in the economy. We briefly compare flows around this crisis event to the two other most recent large global shocks affecting flows to EMs: the 2008 GFC and the 2013 Taper Tantrum. For 34 EMs, Figure 10 plots capital inflows to corporate, bank, and sovereign sectors during the GFC, the Taper Tantrum and the COVID-19 crisis. For the first two episodes, we use inflows from our newly constructed (AHKS) data. For the COVID-19 crisis, we augment the BOP data by applying the internal fill described in the data section and in the Online Appendix. This allows us to obtain a sample of 26 EMs for which the recent BOP is sufficiently reported and use this sample across all the panels.

All of those crises teach the same lesson: At times of external shocks, the behavior of capital flows out of EMs varies significantly across borrowing sectors. During the GFC and the Taper Tantrum, foreign investors primarily pulled out of the banking sector and, to a somewhat lesser extent, the corporate sectors. However, the initial shock from COVID came with a sharp increase in flows to banks and corporates, and a large decline in flows to sovereigns. This reflects the initial dash-for-cash phase of the COVID episode and large inflows from January 2020, driving the private sector flows, and nervousness by investors holding local currency EM sovereign bonds driving the public sector flows. Nevertheless, these patterns reversed in the following quarters, with EM public sectors increasing their borrowing (in part to help fund COVID relief packages) and flows to EM banks declining (in line with previous crises). Since COVID was a global health shock affecting primarily the real economy, it propagated differently than previous stress episodes that were triggered by financial shocks. Foreign investors may also expect higher sovereign defaults given the limited fiscal space of many EM governments, and hence they may again exit the sovereign bond markets. The bottom line is that capital inflows show different patterns across borrowing sectors depending

TABLE 9. Capital outflows around crises.

	All		Public		Bank		Corporate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank crisis$_t$	−0.124	−0.286	−0.764	−0.447	1.963	0.689	−0.324	−0.528
	(4.964)	(5.410)	(3.243)	(3.941)	(2.841)	(2.630)	(1.242)	(1.292)
Bank crisis$_{t-1}$		**−0.74****		−0.595		**−0.180****		−0.968*
		(6.509)		(5.069)		(3.535)		(1.681)
Bank crisis$_{t-2}$		**−0.31****		−0.127		**−0.872****		0.684
		(4.890)		(3.287)		(3.546)		(1.058)
Currency crisis$_t$	−0.342	0.786	0.499	1.350	−0.146	−0.498	−0.695	−0.0662
	(4.801)	(5.987)	(3.228)	(4.141)	(4.048)	(4.517)	(0.685)	(0.949)
Currency crisis$_{t-1}$		10.83		2.922		7.523*		0.385
		(7.352)		(3.983)		(4.383)		(1.375)
Currency crisis$_{t-2}$		2.608		0.745		2.957		−0.095
		(4.917)		(4.956)		(2.070)		(0.876)
Sovereign debt crisis$_t$	−0.59	−0.16	−0.38	−0.99	−0.86	−0.18	8.661*	8.013*
	(27.86)	(26.52)	(16.69)	(16.37)	(15.92)	(14.82)	(4.483)	(4.383)
Sovereign debt crisis$_{t-1}$		−0.91		**−0.953*****		−0.724		−0.237
		(15.04)		(2.762)		(10.58)		(2.991)
Sovereign debt crisis$_{t-2}$		−0.646		−0.532		2.435		−0.549
		(4.286)		(3.692)		(3.650)		(2.200)
Observations	803	781	803	781	803	781	803	781
R^2	0.469	0.491	0.688	0.692	0.205	0.228	0.681	0.692
CountryFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YearFE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NetBank		0.0393		0.353		0.0198		0.171
NetCurr		0.308		0.665		0.266		0.744
NetSov		0.133		0.0784		0.269		0.590

Notes: Annual data, unbalanced panel of 66 countries over 1996–2014. Only country-year observations with flows for all three sectors are kept. A total of 24 banking crisis episodes (in 24 countries), 8 currency crisis episodes (in 7 countries), and 4 sovereign debt episodes (in 4 countries). NetBank, NetCurr, and NetSov display the p-values for the joint test that the sum of the coefficients for the crisis dummy and its two lags is different from 0. Crisis dates from Laeven and Valencia (2018). Errors are clustered at the country level. *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.



(a) Global Financial Crisis (b) Taper Tantrum (c) COVID-19 Crisis

FIGURE 10. Crises and debt inflows to EMs. Source: AHKS data, BOP, authors' calculations. Each bar shows debt (portfolio + other investment) inflows in the given quarter for 26 EMs (excluding China), expressed in billions of USD. Panels (a) and (b) use the AHKS data constructed in this paper. Panel (c) uses BOP data with an internal fill applied, as described in the data section and Online Appendix of this paper.

on the type of shock, which is important for detecting vulnerabilities related to capital flows.[40]

5. Discussion and Conclusion

Our novel dataset for gross capital flows allows us to demonstrate a number of important facts and features of gross capital flows that are important for future research, both empirical and theoretical. First, we use our dataset to document the composition of gross capital flows and external debt positions by sector of the domestic agents involved. This is important for any analysis of capital flows, as the interpretation of any empirical patterns of capital flows crucially depends on which sectors of the economy are more heavily involved. Quantitatively, we find that the banking sector plays the leading role in the flows of AEs, while in EMs, banks, corporates, and sovereigns all play roughly similar roles.

We establish a second fact, showing that the high correlation of capital inflows and outflows is driven primarily by banks. Standard models feature capital flows in only one direction (or a single internationally traded financial instrument), and hence they cannot account for the co-movement of inflows and outflows. There is a certain class of models that try to account for the co-movement, as summarized by Bai (2013). In general, models with financial shocks and frictions, such as Kalemli-Özcan, Papaioannou, and Perri (2013), can generate the positive correlation of banking inflows and outflows found in the data. Models in which domestic financial frictions tighten for certain sectors during bad times can also match our findings, as in Caballero and Simsek (2019).

40. For reference, we also plot PD flows from IIF and EPFR data up through Q1 2020 in Online Appendix Figure C.1. These data do not include loan flows, cover a smaller number of EMs, and are not necessarily collected on a residence basis, as is the BOP data.

Our third fact establishes the countervailing nature of public capital flows relative to private flows, for gross flows at a quarterly frequency. This implies that when modeling capital flow behavior, the incentives and constrains of private agents and governments need to be specified separately. This includes the borrowing behavior of governments as well as the management of reserves. Our fact informs that literature by documenting the general relationship with respect to private inflows, potentially driven by the sovereign's decision to issue more debt in response to the private contraction. It is also highly relevant to the theoretical literature on sovereign debt, which will need to account for these patterns.

Our fourth fact points to the more general observation that the dynamics of capital flows around different crises or events, or even around different economic cycles, differ by sector. This is broadly valuable when evaluating the potential economic impact of future shocks, but is especially useful for future theoretical and empirical work on sudden stops, capital flow dynamics around crises, the impact of the global financial cycle, and the literature on capital flow drivers generally. For instance, banking crises drag down inflows to corporates as well as banks, while currency crises tend to have a stronger impact on inflows to corporates. And while the VIX has lost some explanatory power over capital flows in recent decades, we show that it is still a strong driver for inflows to EM banks and even for PD inflows to EM sovereigns and corporates.

The stylized facts we document have important implications for (existing and future) research on the drivers of international capital flows. Virtually all papers in the existing literature on the drivers of capital flows analyse aggregate flows without distinguishing among the main sectors involved (Koepke 2019). Our paper documents that the existing results on the key drivers of aggregate (all-sector) capital flows conceal a considerable degree of heterogeneity across sectors. More concretely, our novel dataset allows us to demonstrate that the strong negative relationship between the VIX (as a proxy for global risk aversion) and capital flows (to all sectors) documented in a number of papers in the existing literature (e.g. Milesi-Ferretti and Tille 2011; Fratzscher 2012; Broner et al. 2013; Barrot and Servén 2018; Rey 2018) is exclusively due to the private sector (bank and corporate) flows. By contrast, the impact of the VIX on flows to the public sector is not statistically significant. Similarly, flows to banks and corporates are also the exclusive drivers of the positive (procyclical) relationship between domestic output growth and capital flows (to all sectors), such as documented in Broner et al. (2013) and Jeanneau and Micu (2002). By contrast, the relationship between public sector flows and domestic output growth is not significant for AEs and even negative (countercyclical) for EMs, which can help explain ambiguous results found in several papers (Milesi-Ferretti and Tille 2011; Fratzscher 2012; Ahmed and Zlate 2014).

The relationships we document in our paper also provide novel insights into the financial channel of exchange rates (Bruno and Shin 2015a,b; Avdjiev et al. 2019a,b). Most importantly, our sector-specific results reveal that there is significant heterogeneity across sectors behind the previously documented negative relationship between the exchange rate and capital inflows. Appreciation of local currency with

increased capital inflows is strongest for banking sector inflows as modeled by Bruno and Shin (2015b).

The stylized facts and empirical relationships we document using our novel dataset cannot be established using raw BOP data and hence provide important new insights into the dynamics of capital flows. Many of these insights stand in contrast to the majority of the existing theoretical international macroeconomic models, which treat domestic and foreign investors symmetrically and assume a single type of agent who borrows from and lends to the ROW (without accounting for the sector of the agent). As international capital inflows and outflows of different sectors in a given country exhibit different dynamics and respond differently to local and global factors, future theoretical work should model the behavior of agents in different sectors in a manner that accounts for the differences in their behavior that we document empirically in this paper. Our new dataset, which will be updated regularly and shared with the research community, should prove useful for future research on capital flows along these and other lines.

References

Aghion, Philippe and Ioana Marinescu (2007). "Cyclical Budgetary Policy and Economic Growth: What Do We Learn from OECD Panel Data?" *NBER Macroeconomics Annual*, 22, 251–278.

Aguiar, Mark and Manuel Amador (2011). "Growth in the Shadow of Expropriation." *Quarterly Journal of Economics*, 126, 651–697.

Ahmed, Shaghil and Andrei Zlate (2014). "Capital Flows to Emerging Market Economies: A Brave New World?" *Journal of International Money and Finance*, 48, 221–248.

Alfaro, Laura, Şebnem Kalemli-Özcan, and Vadym Volosovych (2014). "Sovereigns, Upstream Capital Flows, and Global Imbalances." *Journal of the European Economic Association*, 12, 1240–1284.

Amiti, Mary, Patrick McGuire, and David Weinstein (2018). "International Bank Flows and the Global Financial Cycle." *IMF Economic Review*, 67, 61–108.

Arslanalp, Serkan and Takahiro Tsuda (2014a). "Tracking Global Demand for Advanced Economy Sovereign Debt." *IMF Economic Review*, 62, 430–464.

Arslanalp, Serkan and Takahiro Tsuda (2014b). "Tracking Global Demand for Emerging Market Sovereign Debt." IMF Working Paper No. 2014/039.

Avdjiev, Stefan, Catherine Koch, Hyun Song Shin, and Valentina Bruno (2019a). "The Dollar Exchange Rate as a Global Risk Factor: Evidence from Investment." *IMF Economic Review*, 67, 151–173.

Avdjiev, Stefan, Catherine Koch, Hyun Song Shin, and Wenxin Du (2019b). "The Dollar, Bank Leverage, and Deviations from Covered Interest Parity." *American Economic Review: Insights*, 1, 193–208.

Bai, Yan (2013). "Discussion on "Gross Capital Flows: Dynamics and Crises" by Broner, Didier, Erce, and Schmukler." *Journal of Monetary Economics*, 60, 134–137.

Bank for International Settlements (2019). "Monetary Policy Frameworks in EMEs: Inflation Targeting, the Exchange Rate and Financial Stability." *Annual Economic Report*, 31–53.

Barrot, Luis-Diego and Luis Servén (2018). "Gross Capital Flows, Common Factors, and the Global Financial Cycle." World Bank Policy Research Working Paper No. 8354.

Bluedorn, John, Rupa Duttagupta, Jaime Guajardo, and Petia Topalova (2013). "Capital Flows are Fickle: Anytime, Anywhere." IMF Working Paper No. 2013/183.

Borio, Claudio and Piti Disyatat (2011). "Global Imbalances and the Financial Crisis: Link or No Link." BIS Working Papers No. 346.

Broner, Fernando, Tatiana Didier, Aitor Erce, and Sergio Schmukler (2013). "Gross Capital Flows: Dynamics and Crises." *Journal of Monetary Economics*, 60, 113–133.
Bruno, Valentina and Shin Hyun Song (2015a). "Capital Flows and the Risk-Taking Channel of Monetary Policy." *Journal of Monetary Economics*, 71, 119–132.
Bruno, Valentina and Shin Hyun Song (2015b). "Cross-Border Banking and Global Liquidity." *Review of Economic Studies*, 82, 535–564.
Caballero, Julian (2016). "Do Surges in International Capital Inflows Influence the Likelihood of Banking Crises?" *Economic Journal*, 126, 281–316.
Caballero, Ricardo and Alp Simsek (2019). "A Model of Fickle Capital Flows and Retrenchment." NBER Working Paper No. 22751.
Catão, Luis and Gian Maria Milesi-Ferretti (2014). "External Liabilities and Crises." *Journal of International Economics*, 94, 18–32.
Cerutti, Eugenio, Stijn Claessens, and Damien Puy (2015). "Push Factors and Capital Flows to Emerging Markets: Why Knowing Your Lender Matters More Than Fundamentals." IMF Working Paper No. WP/15/127.
Cerutti, Eugenio, Stijn Claessens, and Andrew Rose (2018). "How Important is the Global Financial Cycle? Evidence from Capital Flows." NBER Working Paper No. 23699.
Cetorelli, Nicola and Linda Goldberg (2012). "Banking Globalization and Monetary Transmission." *Journal of Finance*, 67, 1811–1843.
Chang, P. H. Kevin, Stijn Claessens, and Robert Cumby (1997). "Conceptual and Methodological Issues in the Measurement of Capital Flight." *International Journal of Finance and Economics*, 2, 101–119.
Claessens, Stijn and David Naudé (1993). "Recent Estimates of Capital Flight." World Bank Policy Research Working Paper No. 1186.
Davis, J. Scott and Eric van Wincoop (2017). "Globalization and the Increasing Correlation between Capital Inflows and Outflows." NBER Working Paper No. 23671.
Forbes, Kristin and Francis Warnock (2012). "Capital Flows Waves: Surges, Stops, Flight and Retrenchment." *Journal of International Economics*, 88, 235–251.
Fratzscher, Marcel (2012). "Capital Flows, Push versus Pull Factors and the Global Financial Crisis." *Journal of International Economics*, 88, 341–356.
Galstyan, Vahagn, Philip Lane, Caroline Mehigan, and Rogelio Mercado (2016). "The Holders and Issuers of International Portfolio Securities." NBER Working Paper No. 22466.
Ghosh, Atish, Jonathan Ostry, and Charalambos Tsangarides (2017). "Shifting Motives: Explaining the Buildup in Official Reserves in Emerging Markets Since the 1980s." *IMF Economic Review*, 65, 308–364.
Gourinchas, Pierre-Olivier and Olivier Jeanne (2013). "Capital Flows to Developing Countries: The Allocation Puzzle." *Review of Economic Studies*, 80, 1484–1515.
Gourinchas, Pierre-Olivier and Hélèn Rey (2007). "International Financial Adjustment." *Journal of Political Economy*, 115, 665–703.
Hamilton, James (2018). "Why You Should Never Use the Hodrick-Prescott Filter." *Review of Economics and Statistics*, 100, 831–843.
Hofmann, Boris, Ilhyock Shim, and Hyun Song Shin (2020). "Bond Risk Premia and the Exchange Rate." *Journal of Money, Credit and Banking*, 52, 497–520.
Horn, Sebastian, Carmen Reinhart, and Christoph Trebesch (2020). "Coping with Disasters: Two Centuries of International Official Lending." NBER Working Paper No. 27343.
Jeanneau, Serge and Marian Micu (2002). "Determinants of International Bank Lending to Emerging Market Countries." BIS Working Paper No. 112.
Jha, Shikha, Sushanta Mallick, Donghyun Park, and Pilipinas Quising (2014). "Effectiveness of Countercyclical Fiscal Policy: Evidence from Developing Asia." *Journal of Macroeconics*, 40, 82–98.
Ju, Jiandong and Shang-Jin Wei (2010). "Domestic Institutions and the Bypass Effect of Financial Globalization." *American Economic Journal: Economic Policy*, 2, 173–204.
Kalemli-Özcan, Şebnem (2019). "U.S. Monetary Policy and International Risk Spillovers." NBER Working Paper No. 26297.

Kalemli-Özcan, Şebnem, Elias Papaioannou, and Fabrizio Perri (2013). "Global Banks and Crisis Transmission." *Journal of International Economics*, 89, 495–510.
Koepke, Robin (2019). "What Drives Capital Flows to Emerging Markets? A Survey of the Empirical Literature." *Journal of Economic Surveys*, 33, 516–540.
Laeven, Luc and Fabian Valencia (2018). "Systemic Banking Crises Revisited." IMF Working Paper No. 18/206.
Lane, Philip (2013). "Risk Exposures in International and Sectoral Balance Sheets." Working paper, IMF Statistics Forum.
Lane, Philip and Gian Maria Milesi-Ferretti (2001). "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Countries." *Journal of International Economics*, 55, 263–294.
Milesi-Ferretti, Gian Maria and Cédric Tille (2011). "The Great Retrenchment: International Capital Flows during the Global Financial Crisis." *Economic Policy*, 66, 289–346.
Nier, Erlend, Tahsin Saadi Sedik, and Tomas Mondino (2014). "Gross Private Capital Flows to Emerging Markets: Can the Global Financial Cycle be Tamed?" IMF Working Paper No. 14/196.
Obstfeld, Maurice (2012). "Does the Current Account Still Matter?" *American Economic Review*, 102(3), 1–23.
Rey, Hélène (2018). "Dilemma Not Trilemma: The Global Financial Cycle and Monetary Policy Independence." NBER Working Paper No. 21162
Shin, Hyun Song (2013). "The Second Phase of Global Liquidity and Its Impact on Emerging Economies." In *Asia Economic Policy Conference*, Federal Reserve Bank of San Francisco.
Takáts, Elöd (2012). "Countercyclical Policies in Emerging Markets." *BIS Quarterly Review*, 25–31.

Supplementary data

Supplementary data are available at *JEEA* online.