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Bilateral capital flows: gravity, push, and pull[1]

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Bilateral Capital Flows: Gravity, Push, and Pull

Rogelio Mercado, Jr.[1]

Abstract

Using bilateral capital flows data from 10 advanced reporting economies — with over 186 bilateral country pairs — for 2000 to 2016, this paper provides evidence on the significance of gravity factors, including distance and bilateral trade ties, in explaining cross-border bilateral financial asset flows. This finding is new to the capital flows literature that mostly consider push and pull factors. In addition, this study offers new evidence of regional contagion as bilateral capital flows decrease more for country pairs with closer geographic proximity (or with less information frictions) than those that are farther apart when global risk aversion increases. These findings have policy implications on the importance of information frictions, bilateral trade ties, and regional cooperation on bilateral financial asset flows.

Keywords: bilateral capital flows, gravity factors, global and domestic factors

JEL classification: F21, F36, G10

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Contents

1. Introduction

The asset trade literature informs us that information frictions and economic ties are highly relevant in explaining cross-border capital flows and asset holdings. The seminal works of Portes, Rey and Oh (2001), and Portes and Rey (2005) on bilateral portfolio flows; and Aviat and Coeurdacier (2007), Buch (2005), and Lane and Milesi-Ferretti (2005a and 2005b) on bilateral portfolio and bank holdings provide both theoretical and empirical support on the significance of information frictions and economic ties on cross-border investments. Specifically, Portes, Rey and Oh (2001) and Portes and Rey (2005) suggested that distance is a proxy for information frictions or asymmetries. They argue that countries close to one another transact more through direct interaction such as business ties, frequent travels, media coverage, and language familiarity; than those farther apart. In addition, Coeurdacier (2009), Lane and Milesi-Ferretti (2005a), Rose and Spiegel (2002) and Rose (2005) provided theoretical justification on why economies with stronger economic ties, proxied by bilateral trade, have greater bilateral asset transactions and holdings. Consequently, voluminous papers show empirical support on the role of information frictions and trade ties on bilateral capital flows.[2]

Most empirical studies on asset trade literature focus on the role of information frictions on bilateral holdings in line with the role of information asymmetries on portfolio allocation. However, it is important to differentiate between holdings and flows in the context of information frictions and economic ties as holdings data include both changes in the flows as well as valuation effects. Consider the case when there is no change in bilateral asset purchases of Country A to Country B from time 1 to 2. Assume also that there is no change in exchange rate, if asset returns on existing holdings increase, the stock data will capture the increase in the value of existing stock; whereas transactions data will be zero. Hence, bilateral holdings data might capture the persistence of information frictions, while flows or transactions data reflect actual significance of information frictions at a given time.[3] Assessing the relevance of information frictions on bilateral flows data is of interest to policy makers as varying global and domestic factors might exacerbate information frictions, which bilateral holdings data do not capture. In this regard, Mercado (2018a) provided empirical evidence on the role of information frictions and trade ties on bilateral capital flows using Balance of Payments Statistics data.

But standard capital flows literature points to the relevance of global (push) and domestic (pull) factors as the key determinants of capital flows size, volatilities, and occurrence of extreme episodes. To some extent, contagion factors are considered like geographic location, trade ties and financial openness (Forbes and Warnock, 2012; and Ghosh et al., 2014). Yet none of the empirical papers consider the role of information frictions and economic ties, alongside push and pull factors, due to lack of bilateral capital flows data that reflect aggregate bilateral flows as opposed to those which used specific types. This, then, raises the question: if the asset trade literature provides support on the importance of gravity factors on specific types of

[2] Refer to Section 2 for detailed empirical literature review on the role of gravity factors on bilateral capital flows.

[3] This may explain the emergence of "distance puzzle" in asset trade literature, where the impact of information frictions has grown over time (Brei and von Peter, 2018).

bilateral flows, are capital flows also driven by gravity factors aside from push and pull factors?[4] Providing robust evidence is the primary task of this paper.

But considering gravity factors, alongside push and pull factors, warrants justification. First, using bilateral capital flows data will extract partner domestic factors from global factors, more so if data is available for large advanced economies whose domestic policies affect global financial markets. This ensures that global factors are capturing true global factors and not domestic conditions of large partner economies. Second, more importantly, bilateral capital flows allow us to examine the importance of information frictions, financial centres, and economic ties which segments financial markets. This has profound policy implications as it adds another layer to the extent of domestic policy levers. Consider a case of an emerging economy pursuing a more open economic policy. Existing capital flows literature using the push and pull framework will point to the importance of economic fundamentals and structural reforms that will promote good governance, capital openness, and financial depth. But if information frictions segment international financial markets, policy design will leave out the importance of encouraging information flows which could counter information frictions. Moreover, if bilateral capital flows are responsive to bilateral economic ties, then stronger trade ties should be considered as another means of attracting larger bilateral capital flows. For these reasons, examining the importance of gravity factors with the usual push and pull factors is warranted.

By using bilateral capital flows data, this paper complements existing literature in several ways. First, it extends our understanding of the determinants of size or magnitude of capital flows by considering gravity factors; whereas previous papers consider only push and pull factors. Second, it also contributes to the asset trade literature by providing evidence of financial market segmentation at the aggregated bilateral level; in contrast to other papers which offer strong evidence using specific types of flows. Furthermore, although existing studies using one type of bilateral flows can offer granular analysis, they leave out investor portfolio reallocation across asset types and so we might miss the overall aggregate bilateral trends which are very important on economic outcomes such as exchange rate fluctuations.[5] Third, it provides new insight on how capital flows behave when global uncertainty rises at given levels of distance (or information frictions). One would expect that as global uncertainty rises, the impact of information frictions increases; and financial transactions will decline more for country pairs that are farther apart. By interacting bilateral distance and a measure of global risk aversion, we can assess whether the decline in bilateral capital flows given an increase in global risk uncertainty, varies across distance. Do bilateral flows decrease more when global uncertainty rises the farther country pairs are? Put differently, do gravity factors, such as information frictions, exacerbate the negative impact of an increase in global risk on bilateral capital flows? This is the second question this paper asks.

[4] In this paper, economic ties (proxied by bilateral imports) are considered as gravity factors as they reflect weaker "multilateral resistance", in line with Okawa and van Wincoop (2012). On the contrary, greater distance strengthens "multilateral resistance" due to stronger information frictions or asymmetries.

[5] Consider a sudden move from bank borrowing to bond issuance (or vice versa), an increase in one and a decrease in the other are captured in bank and securities level data. But this scenario might cancel out in an aggregate bilateral level, and so a bilateral surge at a granular level does not inform us of the overall pattern in capital flows.

To address these questions, we proceed as follows. We use bilateral capital flows data from Balance of Payments Statistics of 10 reporting advanced economies, including Austria, Canada, Denmark, Germany, Japan, Korea, Netherlands, New Zealand, Spain and United States. The data set covers the period 2000-2016 and includes 186 bilateral country pairs composing of advanced reporter and advanced partner; and advanced reporter and emerging partner economies.[6] We exclude a large financial centre (United Kingdom) and offshore financial centres (Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Cyprus, and Netherlands Antilles) as bilateral capital flows to these partner economies might be determined by other factors that have nothing to do with gravity, push or pull factors.[7] We assemble data for bilateral financial asset flows along with its component flows including direct, portfolio, other assets, financial derivatives and reserve assets. Although we also compile data on bilateral financial liabilities, our focus is on bilateral financial asset flows to examine the bilateral asset flows of advanced economies. The bilateral capital flows data pertains to domestic resident financial asset flows with its partner economies, whose value can be positive or negative depending on whether domestic residents of reporting economy made net purchase or net sale of financial assets. We scale the bilateral flows data by the reporting economy's nominal GDP to contextual flows in terms of size or magnitude.[8]

Next, we use the standard gravity equation in the asset trade literature to assess the importance of gravity factors. However, unlike Galstyan and Lane (2013), Galstyan, Lane, Mehigan, and Mercado (2016), Hellmanzik and Schmitz (2017), Lane and Milesi-Ferretti (2005a and 2005b), and Mercado (2018a), we exogenize push and pull factors by including global factors and domestic reporter and partner factors; and relying on time-invariant reporter and partner fixed effects to capture other unobserved heterogeneity.[9] Moreover, we use lagged values for some domestic reporter and partner variables to address reverse causality, but we assume that global factors are exogenous, and hence included in the contemporaneous values in our regression specifications (Ghosh et al., 2014). We run a battery of sensitivity tests including sample and period splits; decomposing bilateral asset flows into direct, portfolio, and other asset flows; and using various specifications and global and domestic variables. Lastly, we interact distance with VIX to assess the marginal effects of an increase in global risk uncertainty on bilateral capital flows, at given levels of distance.

The results show that global factors such as global commodity price level and global risk aversion are consistently significant with expected signs. Moreover, reporter and partner domestic governance and reporter capital account openness are, likewise, significant. What is new is that gravity factors including distance and bilateral trade are statistically significant across various tests. However, the sensitivity tests involving period splits and annual regressions indicate that some of the gravity

[6] Refer to Appendix Table A1 for the country classification of advanced and emerging partner economies.

[7] But we still conduct sensitivity test including a large financial centre (United Kingdom) and offshore financial centres. The results hold and are discussed in Section 5.

[8] Alternatively, we could have scaled the bilateral flows data with stock holdings of total foreign assets. However, data for other investment assets would be restricted to banking sector asset holdings. Consequently, we opt to scale the bilateral flows data by reporter country nominal GDP.

[9] In contrast, Galstyan, Lane, Mehigan, and Mercado (2016) and Mercado (2018a) used reporter plus year fixed effects and partner plus year fixed effects to capture time-varying reporter and partner effects.

factors are relevant only in certain periods or years. In addition, by extending the analysis in the context of contagion, the findings offer evidence that an increase in global risk aversion has a uniform negative impact on bilateral capital flows, at different levels of distance. However, the negative impact of an increase in global risk aversion on bilateral capital flows decreases with distance. This means that bilateral capital flows decrease more between economies of closer geographic proximity and weaker information frictions, than those that are farther apart or with greater information asymmetries when global uncertainty rises. This new finding is highly intuitive as bilateral investments tend to be smaller for partner economies at a greater distance, and so the negative impact of an increase in global risk is less.

The contribution of this paper is thus threefold. First, this paper demonstrates an application of the importance of using bilateral capital flows data. Bilateral flows data can, likewise, be applied in the context of policy, risks, and crisis transmissions and spillovers. This will enrich our understanding of the patterns and risks associated with cross-border investments. Second, the results provide strong evidence on the importance of gravity factors in determining cross-border capital flows, which has not been considered in previous studies. The relevance of gravity factors calls for policy initiatives that can improve information flows and promote bilateral trade to attract more bilateral capital flows. These policy implications based on the empirical results of this paper have not been considered in the existing capital flows literature. Lastly, the findings provide new evidence showing that the negative impact of an increase in VIX on bilateral capital flows decreases with distance, offering new evidence of regional contagion, which could serve as a basis for greater regional cooperation at the policy level.

This paper proceeds as follows. Section 2 provides the literature review on the push and pull framework and gravity factors in the context of the determinants of the magnitude of capital flows. Section 3 discusses the bilateral capital flows and presents stylized facts; while Section 4 provides the empirical specifications and data sources. The baseline results and sensitivity tests are presented in Section 5, while the last section provides concluding remarks.

2. Related Literature and Conceptual Framework

Capital flows are driven by push and pull factors.[10] Push factors are global factors which are beyond the control of domestic policy makers, while pull factors are domestic factors within the influence of policy makers. Push factors pertain to supply-side factors influencing cross-border financial transactions. In contrast, pull factors represent demand-side factors that attracts capital inflows. Existing studies on capital flows have tested the relevance of these two factors in determining the magnitude and volatilities of capital inflows and their component flows; occurrence of extreme episodes such as sudden stops and surges; size of capital flows during extreme episodes, and the proportion of variance attributed to each of these factors.[11] The

[10] See Koepke (2018) and Yeyati and Zuñiga (2015) on literature review on capital flows in the context of push and pull factors.

[11] Refer to Ahmed and Zlate (2014), Byrne and Fiess (2016), Fratzscher (2012), Giordani et al. (2017), Mercado and Park (2011), Milesi-Ferretti and Tille (2011), Niel, Sedik, and Mondino (2014), and Wang (2018) on empirical tests of push and pull factors on the size or magnitude of capital flows; Broto et

use of the push and pull framework as an analytical tool in understanding the covariates of capital flows hinges on the policy implications of their significance. If push factors are more relevant, policy makers have little control over capital flows and hence, they must rely on domestic financial resiliency to counter the adverse consequences of huge and volatile capital inflows. On the other hand, if pull factors are more relevant, policy makers have more levers to influence the size, composition, and volatility of cross-border financial inflows. Indeed, this simple framework brings about profound policy implications.

Empirical studies provide strong evidence for the relevance of push or global factors such as global or advanced economy output growth, global or U.S. interest rate, global commodity price levels, and more importantly, global investor risk aversion. Strong global growth improves investor optimism leading to higher cross-border investments, while lower growth in advanced economies increases capital inflows to emerging economies due to greater growth differentials between advanced and emerging economies, which signifies higher potential returns on the latter. Low global or U.S. interest rate initiates the search for higher yields and improves creditworthiness of emerging and developing economies, thereby raising cross-border flows (Fernandez-Arias, 1996; and Calvo et al., 1993). Global commodity price booms tend to channel capital flows to commodity exporting economies, more so in a low global interest rate environment (Reinhart and Reinhart, 2009). Moreover, the global financial crisis (GFC) of 2008-09 illustrates the importance of global investor risk aversion as the key determinant of retrenchment of capital flows back to advanced economies (Milesi-Ferretti and Tille, 2011). But the significance of these push factors varies with country income groups (either advanced or emerging economies or both), type of capital flows (direct investment, portfolio, and/or banking flows), period coverage (long sample versus specific periods such as pre-, crisis, and post-crisis periods), and types of capital flows considered (such as magnitude of gross or net inflows, volatilities of capital flows, and occurrence of extreme episodes).

More recent papers on the determinants of the size of capital inflows show that higher global growth is significantly correlated with higher inflows to emerging economies (Li et al., 2018), while higher global or U.S. interest rate is strongly associated with lower capital inflows to emerging economies (Byrne and Fiess, 2016; Giordani et al., 2017; Ghosh et al., 2014; Koepke, 2018; Li et al., 2018; and Mercado 2018b). Higher commodity prices tend to increase capital inflows to emerging and developing economies (Byrne and Fiess, 2016, Mercado 2018b, and Reinhart and Reinhart, 2009). In addition, greater global risk aversion leads to lower or reversals of cross-border inflows, more so during periods of financial stress (Ahmed and Zlate, 2014; Fratzscher, 2012; Ghosh et al., 2014; and Giordani et al., 2017).

Yet most studies also highlight the importance of pull or domestic factors. Strong output growth, lower macroeconomic risks (such as low domestic inflation), trade and financial openness, quality of governance, and financial depth of receiving economies are associated with larger capital inflows. Higher domestic growth signifies the attractiveness of an economy as an investment destination due to higher potential

al. (2011), Eichengreen et al. (2018), Mercado and Park (2011), and Neumann et al. (2009) on volatilities of capital flows; Calderon and Kubota (2013), Cavallo and Frankel (2008), Forbes and Warnock (2012), and Reinhart and Reinhart (2009) on the occurrence of sudden stops and/or surges; Ghosh et al. (2014), Li et al. (2018) and Mercado (2018a) on the occurrence of surges and associated magnitude of capital flows conditional on surges; Calvo et al. (1993) on global factor principal component analysis; and Cerutti et al. (2015), Chuhan et al. (1998), Puy (2016), Sarno et al. (2016), and Shirota (2015) on variance decompositions of global and domestic factors.

profits (Giordani et al., 2017; and Mercado and Park, 2011). Lower or stable inflation signals macroeconomic policy stability and "discipline effect", while higher domestic interest rate, relative to world or foreign interest rate, relates to higher expected returns (Li et al., 2018). Trade openness lowers the probability of debt default, while financial openness tends to attract more volatile capital inflows as foreign investors can easily repatriate their investments (Byrne and Fiess, 2016; Ghosh et al., 2014; Mercado and Park, 2011; and Mercado, 2018a). Better institutional quality or governance attracts more capital inflows as foreign investors have guarantee that contracts will be honoured, and they can safely repatriate their investments (Byrne and Fiess, 2016; and Mercado and Park, 2011). Financial depth in receiving economies attracts more capital inflows as it offers more opportunities for risk-sharing and consumption smoothing; and improves financial efficiency and resilience to financial shocks.

But empirical support on the relevance of pull factors, alongside push factors, tend to be weaker and more inconclusive as compared to push or global factors. The significance of domestic factors usually depends on specific periods, country coverage, and which factors are considered. For instance, Fratzscher (2012) established that common factors such as global liquidity and risk shocks were the key factors explaining the reduction in net portfolio inflows at the peak of the global financial crisis, although domestic factors like quality of institution, country risk, and strength of fundamentals were more dominant during the recovery period.[12] This illustrates that the significance of domestic factors varies across time periods. Moreover, even studies using variance decompositions of global and domestic factors find that global factors explain the largest share of variation in capital inflows, while domestic factors explain less (Chuhan et al., 1998; Puy, 2016; and Sarno et al., 2016).

Aside from push and pull factors, several papers consider contagion as a relevant factor in determining the magnitude of capital inflows. The literature identifies three channels in which events affecting capital inflows in one country spillovers to another country. These include trade ties, financial linkages and country similarities (including geographic location). For example, Li et al. (2018) showed regional contagion to significantly increase portfolio inflows during surges, whereas Mercado (2018b) found that regional contagion, defined as half of economies in the region experiencing a surge episode, significantly reduces the size of gross capital inflows during surges as foreign investors might have allocated more capital flows to neighbouring economies which, likewise, are experiencing surges.

But contagion variables can be viewed as "gravity" factors because belonging to a geographic region entails shorter distance or closer proximity. In this context, capital inflows to economies that are closer to one another might be driven by similar push factors or might have similar pull factors which attract capital inflows at a given point in time. In the asset trade literature, Portes, Rey and Oh (2001) and Portes and Rey (2005) suggested that distance is a proxy for information frictions or asymmetries. They argue that countries close to one another transact more through direct interaction such as business ties, frequent travels, media coverage, and language familiarity. Several papers provide empirical evidence on the negative relation between distance and bilateral capital flows. Choi et al. (2014), Portes, Rey and Oh (2001); and Portes and Rey (2005) found negative covariation between bilateral portfolio equity flows and distance. Brei and von Peter (2018), Herrmann and Mihaljek

[12] Ghosh et al. (2014) offered similar evidence on the occurrence of surges.

(2013) and Papaioannou (2009) showed the inverse relation between bilateral bank flows using the Bank for International Settlements (BIS) Locational Banking Statistics and distance; while di Giovanni (2005) had similar results for foreign direct investment flows using Thomson Financial data on mergers and acquisitions (M&A) and distance. In contrast, Mercado (2018a) provided robust evidence on the negative covariation between distance and various types of bilateral capital inflows and outflows. His main finding offers new evidence on the importance of gravity factors and transaction costs at the aggregate level of bilateral capital flows, in contrast to other studies which used specific type of bilateral capital flows

Aside from distance, information frictions also include bilateral factors such as common language, common legal origins, and colonial ties. These time-invariant factors suggest the degree of similarity between countries. Common language and legal origins—which increase familiarity between country pairs—reduce information frictions, thereby increasing bilateral asset holdings and transactions. Specifically, common language fosters greater information flows as it reduces translation costs and increases access to available information. Common legal origins facilitate easier settlements and improves contract enforcement; while colonial ties increase similarities between two countries due to similar institutional set-up (Head and Ries, 2008).

Moreover, strong bilateral economic ties (such as bilateral trade) increase bilateral asset holdings. Several theories are proposed in the asset trade literature linking trade ties with asset holdings. Lane and Milesi-Ferretti (2005a) extended the Obstfeld and Rogoff (2000) model to N country case. The intuition is as follows. Country A does not trade with country B. But country A imports from country C. Suppose there is a productivity shock in country C which lower its prices, country A will suffer losses as it will import more from country C. To hedge against its losses, country A should hold portfolio assets of country C. Hence, higher trade leads to higher portfolio holdings. In contrast, Coeurdacier (2009) highlighted the role of lower trade cost, which increases bilateral trade. As trade intensifies, domestic firms face greater competition. To hedge against losses, a country must hold equity of foreign firms which directly compete with domestic firms. This explains the positive relation between trade and asset holdings. The second explanation is in line with Portes and Rey (2005). The intuition goes as follows: a shorter distance reduces information frictions and lowers transaction costs. These lead to higher bilateral trade. As information frictions decline, asset holdings also increase, more so when the equity market expands (Martin and Rey 2004). Third, Rose and Spiegel (2002) and Rose (2005) offered another theoretical framework in the context of debt default. The authors argue that countries fear debt default because it cuts them off from international capital markets and leads to trade reduction, hence output drop. Consequently, creditors favour debtor countries where they have greater trade ties. Several papers provide empirical support on the positive covariation between bilateral trade and bilateral capital flows, including di Giovanni (2005) for foreign direct investment flows; Portes and Rey (2005) on bilateral equity flows; Hermann and Mihaljek (2013) on bilateral bank flows, and Mercado (2018a) on various types of bilateral gross capital inflows and outflows.

However, there remains a gap in the literature. Although Mercado (2018a) offered empirical evidence on the relevance of gravity factors (including trade ties) on bilateral gross capital inflows and outflows (including their compositions), there is no existing study which combines it with push and pull factors. In other words, if capital flows are driven by global and domestic factors, and gravity factors are

relevant in explaining bilateral capital flows, then bilateral capital flows must then be driven by gravity, push and pull factors. This is the main hypothesis in this paper. Combining these two strands of capital flows literature enriches our understanding of the drivers and patterns of capital flows in a bilateral context and provides policy implications as to what extent policy makers have control over capital inflows. Although policy makers do not have control over most gravity factors, they can certainly encourage information flows and economic ties with their partner economies.

3. Data on Bilateral Capital Flows and Stylized Facts

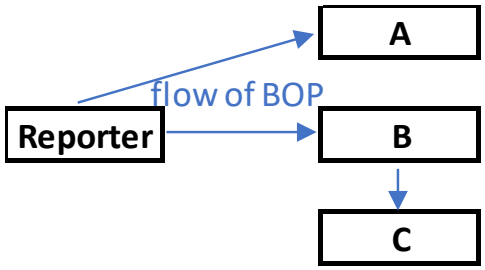
To examine the importance of gravity factors as one of the key determinants of cross-border financial flows, alongside global and domestic factors, this study utilizes bilateral Financial Account data from the Balance of Payments Statistics, following Mercado (2018a). Other studies on bilateral financial flows focus on one type of asset — mostly securities and bank flows — as there is a lack of comprehensive dataset covering all types of capital flows. For instance, Wang (2018) utilized BIS bilateral banking data flows to assess the role of gravity factors and domestic reporter and partner factors. Di Giovanni (2005) exploited Thomson Financials data on bilateral mergers and acquisitions to examine foreign direct investment flows. Choi et al. (2014) and Portes, Rey and Oh (2001) used U.S. Treasury International Capital data; while Portes and Rey (2005) used Cross Border Capital data to test the role of gravity factors on bilateral equity flows.

The main advantage of using bilateral capital flows data is that it provides aggregated total bilateral data comprising all kinds of bilateral investments such as direct, portfolio, and other investment assets. This offers greater understanding of bilateral cross-border investment patterns. For instance, di Giovanni (2005) did not consider bilateral asset transactions involving greenfield investments. Portes, Rey and Oh (2001) and Portes and Rey (2005) focused on bilateral equity flows which did not include bond flows. Wang (2018) excluded bilateral direct exposures of non-bank sectors in her analysis of bilateral banking flows, whereas all sectors are covered in other investment category of the bilateral Financial Account.[13] More importantly, the data are mostly aligned with the Balance of Payments Manual 6 compiling standards, allowing standardised cross-country comparisons. However, there are disadvantages as well. First, there are very few countries which report bilateral Balance of Payments. For those that do, most partner economies are grouped or aggregated at the regional level due to confidentiality reasons. Second, bilateral capital flows mostly capture location of counterparties, which may or may not be the location of the ultimate owner, issuer, or beneficiary of financial transactions. This is particularly true for portfolio flows where cross-border transactions usually involve financial intermediaries and custodians located in financial centres such as London (Warnock and Cleaver, 2003). For this reason, bilateral capital flows data do not capture investor cross-border portfolio choice or allocation, although it informs us of cross-border financial transaction patterns.

[13] Of interest, loans made by non-bank financial corporations to non-bank sector are not captured by the BIS Banking Locational Statistics.

Figure 1 illustrates a schematic diagram showing the complexities of using bilateral capital flows data. Figure 1 shows that some transactions are recorded based on the country of the ultimate issuer of a financial asset. But most bilateral transactions are reported based on the location of transacting counterparty such as those using financial intermediaries and/or custodians. In the latter case, the country location of the ultimate owner, issuer, or beneficiary may or may not be known. For example, if a company in the reporting country A acquires a company in country C through an intermediary in country B, bilateral transactions will be recorded between the reporting country A and country B, even if ownership is in country C. In practice, most countries report bilateral transactions based on the country location of the counterparty involved in that transaction. However, initiatives are made to report some categories of the bilateral Financial Account based on the location of the ultimate owner, issuer or beneficiary, such as the case of the Netherlands. Table 1 summarizes the bilateral capital flows data and indicates whether each functional category of the Financial Account refers to the country location of the transacting counterparty (TC) or the country location of the ultimate owner, issuer or beneficiary (UOIB). The table reveals that most values of the bilateral financial flows pertain to the country location of the transacting counterparty.

Figure 1: Schematic Diagram of Reporting - Bilateral Financial Assets Flows



The bilateral capital flows data are taken from Balance of Payments Statistics of 10 reporting central banks or statistics agencies, including Austria (Österreichische Nationalbank), Canada (Statistics Canada), Denmark (Danmarks Nationalbank), Germany (Deutsche Bundesbank), Japan (Bank of Japan), Korea (Bank of Korea), Netherlands (De Nederlandsche Bank), New Zealand (Stats NZ), Spain (Banco de España) and United States (Bureau of Economic Analysis).[14] Values are mostly presented in local currency units. To standardize across countries, values are converted to US dollar using the average foreign exchange rate taken from the International Financial Statistics of the IMF.[15] The data covers annual values from

[14] There are other countries which could have been included in the data set. For instance, France reports bilateral capital flows for direct and portfolio investments, but not for other investments which could have been supplemented by using bilateral bank flows from the BIS locational banking statistics. However, we opt to restrict our sample to those countries which report the complete functional categories of the Balance of Payments. Nonetheless, the sample size is representative of the global sample given the inclusion of the United States, Japan, and Germany. On the average, the sample accounts for around 25% of world total bilateral holdings of direct and portfolio investments and bank claims.

[15] Given that we used nominal GDP of the reporting country in US dollars, we remove any exchange rate effects in our bilateral capital flows.

2000 to 2016. For some countries, quarterly or monthly data in USD millions are added annually. Confidential and unavailable data are treated as missing values; whereas zeros are included as they are. Reported values follow the Balance of Payments Manual 6 (BPM6), but in cases where values are based on Balance of Payments Manual 5, e.g. Japan for 2000-2013, bilateral assets flows are multiplied by -1 in lieu of BPM6 convention of having a positive sign to indicate an increase in assets. We exclude a large financial centre (United Kingdom) and offshore financial centres (Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Cyprus, and Netherlands Antilles) from the dataset as bilateral capital flows to these partner economies might be determined by other factors. In total, our data set covers 186 bilateral pairs, as reported in Table 1.

Table 1: Summary of Bilateral Financial Flows

	United States	Canada	Austria	Denmark	Germany	Netherlands	Spain	Japan	Korea	New Zealand
Foreign Direct Investments										
Assets (FDIA)	TC	TC	TC	TC	TC	UOIB	TC	TC	TC	TC
Liabilities (FDIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Portfolio Investments										
Assets (PORTA)	UOIB	TC	TC	UOIB	TC	UOIB	TC	TC	TC	TC
Liabilities (PORTL)	TC	TC	(est)	TC	TC	(est)	TC	TC	TC	TC
Financial Derivatives										
Assets (DERA)	×	×	×	TC	TC	TC	×	TC	TC	×
Liabilities (DERL)	×	×	×	TC	TC	×	×	TC	TC	×
Other Investment										
Assets (OIA)	TC	TC	TC	TC	TC	UOIB	TC	TC	TC	TC
Liabilities (OIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Reserve Assets (RESA)	TC	TC	×	TC	TC	×	×	×	×	×
Frequency	Q	Q	Q	M	Q	A	A	Q	A	A
Start Year	2003	2000	2001	2005	2000	2004	2013	2000	2006	2000
End Year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
No. of Counterparty	20	2	13	34	32	22	6	31	3	23

Notes: TC = country location of the transacting counterparty. UOIB = country location of ultimate owner, issuer, and beneficiary. Estimates (est) for Austria and the Netherlands are based on aggregate portfolio liabilities weighted using derived values from the IMF's Coordinated Portfolio Investment Survey. Data classification for Korea is assumed to be based on the country location of the transacting counterparty as no confirmation was given. A = annual, Q = quarterly, and M = monthly. Bilateral financial account flows are sourced from reporting central banks or statistics agencies.

The various types of bilateral capital asset flows include foreign direct investment assets (FDIA), portfolio assets (PORTA), and other investment assets (OIA).[16] If

[16] Reporting economies also report the bilateral breakdown of their financial derivatives and reserve assets and financial account liabilities across various functional categories where available. However, the focus of our analysis is more to the three main components of capital flows. For Austria, foreign

bilateral total assets and liabilities are given, they are used in the data set. If not, total assets are computed as the sum of direct, portfolio, financial derivative, other investment and official reserve assets whenever data are available.[17] Following the naming convention in the capital flows literature, bilateral asset transactions refer to gross capital outflows, which pertains to domestic resident's net financial acquisitions of foreign assets. Bilateral financial account assets and liabilities data are not the mirror image of each other as resident financial transactions with non-resident counterparties are not equal to non-resident financial transactions with resident counterparties.

To preview the data set, Table 2 presents the values of bilateral financial asset flows of selected reporting to partner economies in 2016. The striking pattern we see is that there is huge variation of reporting country asset transactions with its partner economies. For instance, Japanese investors sell off assets in Germany but acquired more asset transactions with the United States in the same year. But Japan's reversal of asset flows to Germany was primarily directed to portfolio and financial derivative assets. This illustrates that the bilateral capital flows capture actual financial transaction flows which informs us of resident investor portfolio rebalancing among different asset types across partner economies in each period.

Table 2: Bilateral Financial Asset Flows, 2016

(in USD billion)

Reporter	Partner	FINA	FDIA	PORTA	DERA	OIA	RESA
United States	Germany	-4.36	5.92	-16.56	…	6.28	…
United States	Japan	71.81	2.27	35.11	…	34.43	-0.01
Germany	United States	57.31	13.35	33.70	0.80	9.46	…
Germany	Japan	2.89	1.02	-3.92	-0.60	6.38	…
Japan	United States	176.41	52.21	163.70	-97.54	58.03	…
Japan	Germany	-1.56	2.33	-5.68	-9.97	11.77	…

Notes: … = data unavailable. Values were converted to USD using average foreign exchange rate from the International Financial Statistics of the IMF. Bilateral financial account flows data are sourced from reporting central banks or statistics agencies.

Table 3 provides descriptive statistics on bilateral capital flows in percent of the reporting economy's nominal GDP. Several observations are noted. For the full sample period of 2000-16, the average bilateral total financial asset flows were about 0.3% of the reporting economy's nominal GDP. Bilateral asset flows were mostly in the form of direct and portfolio assets. In contrast, the relative size of average bilateral asset flows was smallest for other investments at around 0.06%. Total bilateral asset flows to advanced economies were, on average, around 0.4% of reporting economy's

direct investment data mostly include direct investments of Special Purpose Entities (SPEs) and the real estate sector. However, for some economies, reported foreign direct investment assets and liabilities exclude these items.

[17] Data on financial derivative assets and liabilities and reserve assets are available for a limited number of countries. Moreover, financial derivative assets are reported mostly in net terms. For these reasons, analysis involving different types of capital flows are restricted to the main functional categories. Nonetheless, data on derivatives and reserves are included in computing total financial assets flows.

nominal GDP, which was more than twice the total bilateral asset flows to emerging economies. This implies that bilateral financial transactions are larger for advanced partner economies than with emerging partner economies. Across sub-periods, the average bilateral asset flows were highest in the pre-global financial crisis period of 2000-07. In fact, the average bilateral direct and portfolio investment assets flows were around 0.2% of reporting economy's nominal GDP. Compared to the pre-crisis period, both crisis and post-crisis years witnessed a significant decline in bilateral asset flows, particularly for both portfolio and other investment asset flows which include banking flows. However, the decline in bilateral asset transactions was greater for other investments, as compared to portfolio investments.

Table 3: Bilateral Financial Asset Flows - Descriptive Statistics
(% of reporting economy nominal GDP)

Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
	Full Sample Bilateral Pairs					Advanced Partner Economies					Emerging Partner Economies				
Total Financial Account Assets	2,713	0.31	1.36	-12.49	30.62	1,867	0.39	1.59	-12.49	30.62	846	0.13	0.51	-1.64	5.60
Foreign Direct Investment Asse	2,566	0.16	1.06	-18.81	28.60	1,773	0.18	1.24	-18.81	28.60	793	0.10	0.44	-1.76	5.25
Portfolio Investment Assets	2,660	0.12	0.51	-3.87	4.60	1,844	0.16	0.60	-3.87	4.60	816	0.02	0.09	-0.51	1.39
Financial Derivative Assets	1,718	-0.03	0.32	-4.13	6.50	1,188	-0.04	0.39	-4.13	6.50	530	0.00	0.02	-0.14	0.18
Other Investment Assets	2,647	0.06	0.50	-5.29	6.82	1,812	0.08	0.60	-5.29	6.82	835	0.01	0.17	-0.96	2.28
Reserve Assets	716	0.01	0.25	-2.01	2.41	510	0.02	0.29	-2.01	2.41	206	0.00	0.00	0.00	0.02
Total Financial Account Liabilit	2,697	0.16	2.01	-18.03	44.47	1,853	0.22	2.41	-18.03	44.47	844	0.05	0.32	-2.43	2.88
Net Financial Account Assets	2,730	0.15	1.84	-23.12	23.71	1,875	0.18	2.18	-23.12	23.71	855	0.08	0.55	-2.99	5.02

Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
	2000-07					2008-09					2010-16				
Total Financial Account Assets	1,080	0.42	1.44	-4.81	30.62	358	0.21	1.36	-8.95	10.80	1275	0.25	1.28	-12.49	24.00
Foreign Direct Investment Asse	1,012	0.17	1.06	-2.77	28.60	338	0.12	0.75	-7.14	5.53	1216	0.16	1.13	-18.81	24.57
Portfolio Investment Assets	1,048	0.16	0.49	-3.70	3.83	353	0.08	0.50	-2.65	4.30	1259	0.09	0.52	-3.87	4.60
Financial Derivative Assets	658	-0.02	0.20	-2.42	3.09	236	-0.05	0.32	-3.16	1.45	824	-0.03	0.39	-4.13	6.50
Other Investment Assets	1,057	0.11	0.52	-5.29	6.82	347	0.02	0.61	-4.26	4.00	1243	0.03	0.45	-4.21	4.80
Reserve Assets	215	-0.01	0.07	-0.38	0.41	112	0.10	0.36	-0.19	2.41	389	0.00	0.27	-2.01	1.63
Total Financial Account Liabilit	1,070	0.38	2.13	-10.02	44.47	359	0.08	1.72	-12.88	8.03	1268	0.00	1.96	-18.03	16.27
Net Financial Account Assets	1,088	0.04	1.54	-23.12	10.17	360	0.13	1.89	-8.03	13.31	1282	0.24	2.04	-11.27	23.71

Taken together, these stylized facts show bilateral financial asset flows of advanced reporting economies: 1) exhibit significant variation across partner economies; 2) mostly between reporter and partner advanced economies; 3) usually in the form of foreign direct investments; and 4) are very large in the pre-crisis period.

4. Empirical Specifications and Data Sources

To address the first question on the significance of gravity factors, alongside push (global) and pull (domestic) factors, we use the gravity equation from the asset trade literature, following Galstyan and Lane (2013), Galstyan, Lane, Mehigan, and Mercado (2016), Hellmanzik and Schmitz (2017), Lane and Milesi-Ferretti (2005a and 2005b), and Mercado (2018a). However, unlike these papers, we exogenize time-varying

common factors, which are global factors, as well as time-varying reporter and partner factors, which corresponds to domestic reporter and partner factors. Specifically, we estimate the following equation:

$$CF_{ij,t} = \alpha_i + \alpha_j + d_{ij}\theta + h_{ij,t-1}\phi + g_t\beta + r_{i,t}\delta + p_{j,t}\gamma + \varepsilon_{ij,t} \quad \text{Equation (1)}$$

where $CF_{ij,t}$ refers to bilateral capital flows from reporter country i to partner country j at year t. α_i and α_j are time-invariant reporter and partner dummy variables, respectively. $d_{ij}\theta$ is a row vector of bilateral time-invariant gravity variables including distance, common legal origins, and common spoken language. $h_{ij,t-1}\theta$ captures the time-varying bilateral factor, specifically lagged bilateral trade ties. $g_t\beta$ is a row vector of global factors which are common across bilateral pairs but varies by year. $r_{i,t}\delta$ and $p_{j,t}\gamma$ are row vectors of reporter and partner country domestic factors, respectively. $\varepsilon_{ij,t}$ pertains to clustered standard errors at bilateral pair.

The inclusion of time-invariant reporter and partner fixed effects reduces endogeneity by controlling for unobserved heterogeneity in the sample. Moreover, time-varying bilateral factor and reporter and partner domestic GDP growth and interest rate are replaced by their one-year lagged values to address reverse causality. Like Ghosh et al. (2014) and Li et al. (2018), we use contemporaneous values for global factors as these are exogeneous factors. However, unlike Ghosh et al. (2014), we do not use lagged values for some of the domestic reporter and partner factors such as quality of governance, capital account openness, and financial depth as these are slow moving factors in our data set which runs from 2000-16.[18] Equation (1) is consistent with the theoretical model of Okawa and van Wincoop (2012) and the estimation approach suggested by Baldwin and Taglioni (2007). As discussed in the previous section, the time-varying bilateral factor, proxied by bilateral trade, is considered a gravity factor as stronger trade ties mean weaker multilateral resistance between bilateral pairs. We use ordinary least squares estimation with clustered standard errors at the bilateral level.

The bilateral capital flows data are expressed in percent of reporting country's nominal GDP, following Aviat and Coeurdacier (2007) and Mercado (2018a). Scaling bilateral flows in terms of nominal GDP allows us to interpret the coefficients in terms of relative size instead of elasticities as widely used in the asset trade literature. An advantage of using relative magnitude is that it addresses the issue of having zeros and negative values in the data set due to capital flow reversals. The time-invariant gravity factors are measures of information frictions. We expect distance to reduce bilateral flows, while common spoken language and common legal origins to increase bilateral transactions as they proxy for familiarity or similarity between country pairs. The time-varying gravity factor captures trade ties between country pairs. We expect that as economic ties between two economies increase so will their financial

[18] We conduct sensitivity test using lagged values of all the reporter and partner domestic factors. The baseline results hold.

transactions. For time-varying global factors, we consider global GDP growth, global interest rate, global commodity price level, and global risk aversion. We expect bilateral capital flows to increase when global growth is high; when global interest rate is high; when global commodity price levels drop; and when global investor risk aversion is low. For reporter and partner domestic factors, we consider GDP growth and interest rate to capture growth and interest rate differentials between reporter and partner economies as well as between reporter economies and global factors. In addition, we also consider governance, capital account openness, and financial depth. We expect bilateral capital flows to partner countries to increase on better governance, less capital account restrictions, and well-developed financial market.

Data on bilateral capital flows pertain to financial assets flows (FINA) sourced from central banks or statistics agencies of advanced reporting economies. This data captures the advanced economy domestic resident financial asset flows to the partner economy (not bilateral net financial asset flows).[19] Values are scaled by the nominal GDP of the reporting country, taken from the World Economic Outlook Database. Distance (distance) is in log value of the population-weighted distance between country pairs. Common legal origins (legal_origin) is a dummy variable with a value of 1 if a country pair has a common legal origin; and 0 otherwise. Data are sourced from Head, Mayer, and Ries (2010). Common spoken language (common_language) is included as a variable ranging from 0 to 1 where a higher value indicates greater common spoken language between country pairs. The data are taken from Melitz and Toubal (2014). Data on bilateral trade (bilateral_trade) is the lagged values of bilateral imports between reporter and partner countries in percent of reporting country's nominal GDP, sourced from IMF's Direction of Trade Statistics and World Economic Outlook Database.

Global GDP growth (global_growth) is the year-on-year percent change of real global GDP, sourced from IMF's World Economic Outlook Database. Global interest rate (global_interest_rate) refers to the weighted average of long-term interest rate across countries using GDP in constant prices as weights. Data is sourced from Oxford Economics. Global commodity price index (commodity_price) pertains to the All Commodity Price Index, which includes both fuel and non-fuel price indices, with base year set in 2005 (2005 = 100). The annual index is the average value of monthly price index, taken from IMF's Commodity Price Database. Global risk aversion (VIX) is the annual average value of CBOE VIX accessed through Datastream. Domestic reporter and partner GDP growth rates (o_d_growth and p_d_growth) are year-on-year percent change of real GDP, sourced from IMF's World Economic Outlook Database. Domestic reporter and partner interest rates (o_d_interest_rate and p_d_interest_rate) are mostly annual long-term government bond yields of reporter and partner economies sourced from the IMF's International Financial Statistics. If data are unavailable, domestic interest rate refers to lending rate, also taken from the International Financial Statistics. Domestic reporter and partner governance indicators (o_d_governance and p_d_governance) are the unweighted average of percentile ranking of control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, and voice and accountability. Reporter and partner capital account openness indices (o_d_kaopen and p_d_kaopen) are the standardized Chinn-Ito Capital Account Index (Chinn and

[19] We focus on bilateral asset flows and not bilateral net asset flows as the latter will account for bilateral liabilities flows. The interest in this paper is primary on advanced reporting economy's cross-border asset transactions, which is more informative in the perspective of partner economies.

Ito, 2006) scaled to 100. Domestic reporter and partner financial depth indicators (o_d_financial_depth and p_d_financial_depth) refer to domestic credit provided by the financial sector in percent of nominal GDP. Data are taken from the World Bank's World Development Indicators. Table 4 presents summary statistics of the gravity, push and pull factors.

Table 4: Regressors Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
$distance_{ij}$	8.144	1.221	5.483	9.847
$common\_legal_{ij}$	0.231	0.422	0.000	1.000
$common\_language_{ij}$	0.353	0.306	0.000	0.994
$bilateral\_trade_{ij,t-1}$	1.012	2.072	0.001	22.123
$global\_growth_{t}$	3.856	1.387	-0.150	5.558
$global\_interest\_rate_{t}$	4.381	0.875	2.675	5.994
$commodity\_price_{t}$	121.884	46.445	58.246	192.571
VIX_{t}	20.814	6.808	11.560	40.000
$o\_d\_growth_{i,t-1}$	1.643	2.094	-5.563	11.309
$o\_d\_interest\_rate_{i,t-1}$	3.402	1.672	0.350	8.720
$o\_d\_governance_{i,t}$	91.024	5.892	70.757	98.792
$o\_d\_kaopen_{i,t}$	99.256	6.052	41.451	100.000
$o\_d\_financial\_depth_{i,t}$	194.397	65.323	70.940	345.722
$p\_d\_growth_{i,t-1}$	3.009	3.473	-14.814	25.486
$p\_d\_interest\_rate_{i,t-1}$	6.308	9.147	-0.080	183.200
$p\_d\_governance_{i,t}$	74.679	20.819	8.225	99.756
$p\_d\_kaopen_{i,t}$	78.777	30.660	0.000	100.000
$p\_d\_financial\_depth_{i,t}$	129.553	66.503	0.230	345.722

Notes: Distance is taken from CEPII Database. Bilateral trade, global growth, commodity price, domestic growth, and domestic interest rates are taken from various databases of the International Monetary Fund. VIX taken from CBOE. Global interest rate taken from Oxford Economics. Reporter and partner governance and financial depth indicators are sourced from various data sets of World Bank. Capital Openness Index taken from Chinn and Ito (2006).

To address the second question on whether the negative impact of global risk aversion on bilateral financial asset flows varies with distance, we re-estimate Equation (1) without pull factors which are now subsumed in the country fixed effects and add an interaction term for distance and VIX. Specifically, we estimate:

$$CF_{ij,t} = \alpha_i + \alpha_j + d_{ij}\theta + h_{ij,t-1}\phi + g_t\beta + \varphi VIX_t \times dist_{ij} + \varepsilon_{ij,t} \qquad \text{Equation (2)}$$

where $VIX_t \times dist_{ij}$ captures the interaction between global risk aversion and distance. $d_{ij}\theta$ and $g_t\beta$ still include both distance and global risk aversion, respectively. However, unlike standard interaction terms involving continuous and dummy variables, both distance and VIX are continuous variables in Equation (2). This complicates the interpretation of the estimated coefficient of the interaction term φ

. Consequently, we refer to the marginal effects of the estimated continuous interaction term to estimate the amount of change in bilateral financial asset flows with one-unit change in global risk aversion (VIX) while holding bilateral distance at different values. As in the previous specification, we estimate Equation (2) using ordinary least squares with clustered standard errors at the bilateral pair level.

5. Results and Analysis

5.1 Baseline Regressions: Determinants of Bilateral Capital Flows

Baseline Results. Table 5 presents the baseline regressions on the determinants of bilateral financial asset flows. Various specifications are presented, including gravity factors with reporter, partner, and year fixed effects (Column 1); gravity and global factors with reporter and partner fixed effects (Column 2); gravity and domestic reporter and partner factors with time, reporter, and partner fixed effects (Column 3); and gravity, global, and domestic factors of origin and partner economies with reporter and partner fixed effect (Column 4) For each specification, we report marginal R2 to assess the incremental improvement in the explanatory power of the regression model with the inclusion of gravity factors.[20] The reported values for the marginal R2 indicate that gravity factors improved the model's explanatory power by around 20%, suggesting the importance of including gravity factors in explaining total variation in bilateral capital flows.

The baseline results show that bilateral asset flows are highly responsive to information frictions, proxied by bilateral distance (Column 4). This is consistent with existing findings using bilateral transactions data from Brei and von Peter (2018), Choi, Rhee and Oh, 2014, di Giovanni (2005), Mercado (2018a), Portes and Rey (2005), and Portes, Rey and Oh (2001). Specifically, doubling the distance between two economies reduces financial asset flows, on the average, by about 0.03% of the reporting country's GDP.[21] For other familiarity variables, both common legal origins and common spoken language have the correct signs but are insignificant. Moreover, the results offer strong evidence on the significance of bilateral trade ties, such that a one unit increase in bilateral trade raises bilateral asset transactions by around 0.12% of reporting country's nominal GDP.

In terms of global factors, the estimates show that higher global investor risk aversion significantly reduces bilateral financial asset transactions of advanced economies, which is consistent with results using aggregated capital flows data. For instance, a unit increase in VIX reduces bilateral transactions by around 0.01% of reporting economy's nominal GDP. For global commodity price, the estimate is significant but with a negative sign. This implies that as global commodity price levels increase, bilateral capital flows decrease. For domestic factors, the results indicate that better governance in reporting and partner economies significantly covary with higher bilateral financial asset flows. Moreover, there is evidence that more financially open economies have significantly higher financial asset transactions. Although

[20] Marginal R2 is computed as 1-(RSS/RSSc) where RSS is the residual sum of squares in a regression specification with gravity factors, while RSSc is the residual sum of squares in a regression specification without gravity factors.

[21] Calculated as log(2)*-0.107 = -0.03.

insignificant, domestic reporter and partner GDP growth indicate opposing signs. When domestic growth in the reporting country increases, bilateral asset flows tend to be smaller. When domestic growth in partner country increases, bilateral asset flows tend to increase. Such asymmetries, albeit insignificant, are only observed using bilateral capital flows data.

Table 5: Baseline Determinants of Bilateral Financial Asset Flows

	(1)	(2)	(3)	(4)
$distance_{ij}$	-0.107*	-0.106*	-0.108*	-0.107*
	(0.058)	(0.058)	(0.058)	(0.058)
$legal\_origin_{ij}$	0.033	0.032	0.033	0.033
	(0.080)	(0.080)	(0.080)	(0.080)
$common\_languange_{ij}$	0.520	0.516	0.516	0.514
	(0.393)	(0.390)	(0.393)	(0.390)
$bilateral\_trade_{ij,t-1}$	0.122**	0.123**	0.121**	0.122**
	(0.048)	(0.048)	(0.048)	(0.048)
$global\_growth_t$		0.006		0.015
		(0.023)		(0.031)
$global\_interest\_rate_t$		0.083**		0.078
		(0.034)		(0.064)
$commodity\_price_t$		-0.001**		-0.001*
		(0.000)		(0.001)
VIX_t		-0.015**		-0.011**
		(0.006)		(0.006)
$reporter\_growth_{i,t-1}$			-0.009	-0.006
			(0.014)	(0.014)
$reporter\_interest\_rate_{i,t-1}$			-0.066	-0.008
			(0.053)	(0.038)
$reporter\_governance_{i,t}$			0.021	0.028*
			(0.019)	(0.016)
$reporter\_kaopen_{i,t}$			0.020**	0.016*
			(0.010)	(0.009)
$reporter\_financial\_depth_{i,t}$			0.000	-0.002
			(0.003)	(0.002)
$partner\_growth_{i,t-1}$			0.001	0.005
			(0.007)	(0.005)
$partner\_interest\_rate_{i,t-1}$			-0.005	-0.005
			(0.005)	(0.005)
$partner\_governance_{i,t}$			0.016**	0.014*
			(0.008)	(0.007)
$partner\_kaopen_{i,t}$			-0.001	-0.000
			(0.002)	(0.002)
$partner\_financial\_depth_{i,t}$			0.000	0.000
			(0.001)	(0.001)
Observations	2,713	2,713	2,713	2,713
R-squared	0.208	0.205	0.210	0.207
Marginal R-squared	0.045	0.045	0.045	0.045
Country F.E.	Yes	Yes	Yes	Yes
Partner F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	No	Yes	No

Notes: Dependent variables are total bilateral financial asset flows in % of reporting economy nominal GDP. Marginal R2 is computed as 1-(RSS/RSSc) where RSS is the residual sum of squares in a regression specification with gravity factors, while RSSc is the residual sum of squares in a regression specification without gravity factors. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Sensitivity Tests. The relevance of gravity factors, particularly distance and bilateral trade, holds across various specifications and sensitivity tests. First, we test whether the baseline results hold when we decompose bilateral financial account asset flows into its component flows. The standard capital flows literature highlights the importance of considering the composition of capital flows as they are driven by varying determinants. The findings, shown in Table 6, suggest that information frictions remain significant across different types of flows including direct, portfolio, and other asset flows. However, bilateral trade is insignificant for portfolio asset flows, although it is relevant for both direct and other asset flows. Importantly, foreign direct investment flows appear to be highly responsive mainly to gravity factors, whereas portfolio and other investment flows are responsive to both gravity and push factors. These results illustrate the varying sensitivities of various types of investments to gravity, push, and pull factors. Second, we also test whether gravity factors will remain significant when we split the partner economies into advanced and emerging economies. It is possible for information frictions, proxied by distance and other time-invariant bilateral factors, to be more relevant for emerging partner economies, possibly due to more informational flows between advanced reporting and partner economies. Table 7 confirms that information friction is significant between advanced and emerging country pairs, while bilateral trade is relevant for advance reporting and partner country pairs. However, we find that common legal origins between advanced and emerging country pairs to significantly increase bilateral asset transactions. We also run a test removing United States, Japan, and Germany which are the three largest advanced economies that are also financial centres in the sample. The results stay the same.

Next, we split the sample into pre-crisis (2000-07) and post-crisis (2010-16) periods to determine whether gravity factors hold across periods. Moreover, we run annual regressions validating the significance of bilateral distance and bilateral trade. Table 8 indicates that information frictions are more relevant during the pre-crisis; whereas trade ties remain significant across periods. To further validate the baseline results, we run annual regressions in a cross-sectional set-up from 2003 to 2016, where we abstract from global factors. The results indicate that gravity factors do not consistently explain bilateral asset flows. This suggests that information frictions and even bilateral trade ties might have time-varying significance on bilateral asset transactions (flows).

We run several more tests to validate the baseline results. First, instead of clustering standard errors at the bilateral country pair, we use robust standard errors. Second, to further reduce endogeneity due to reverse causality, we use lag values of all domestic regressors including reporter and partner governance, capital account openness, and financial depth. In both tests, the results are mostly the same. Third, when we lagged global factors, gravity factors stayed significant. Global factors also remained significant, although marginally. Fourth, we correct for sample outliers by winsorising bilateral financial asset flows at the bottom and top 10% of the bilateral country sample. In all these tests, both gravity factors, including distance and bilateral trade are significant with the same sign, alongside push and pull factors.

We also conducted sensitivity test by including bilateral pairs where the partner country is a global financial centre (e.g. United Kingdom) or an offshore financial centre (Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Cook Islands, Cyprus, and Netherlands Antilles). Bilateral capital flows might gravitate towards large

financial markets which are centres of financial intermediation such as London; or tax-haven economies. The results concur with the baseline estimates. Gravity factors, including distance and bilateral trade; as well as global and domestic factors are significant.

Gravity factors remain significant, alongside global and domestic factors, under alternative measures on global, and domestic factors. Using advanced economy GDP growth taken from the IMF's World Economic Outlook Database, instead of global GDP growth, produce similar findings. The same is true when we replace global interest rate with global liquidity measure from the Bank for International Settlements. Using global commodity price inflation, instead of price level, show the same results. However, global commodity inflation is insignificant, implying that bilateral flows are responsive to commodity price levels rather than price changes. The main results remain mostly the same when we change governance with political stability, taken from World Bank's World Governance Indicators, although reporter and partner governance lose significance. Using stock market capitalization as a percent of nominal GDP, from World Bank's World Development Indicators, as a measure of financial depth, likewise, yield consistent results. The same is true when we use domestic real interest rate, by taking the difference between nominal interest rate and domestic consumer price inflation sourced from the IMF's World Economic Outlook Database.

In summary, the baseline results show that gravity factors, such as distance and trade ties, are significant determinants of bilateral financial asset flows, alongside push and pull factors like global risk aversion, reporter and partner governance and reporter capital account openness. These results hold across various specifications and sensitivity tests. However, we find evidence that information frictions and bilateral trade ties have time-varying significance.

Table 6: Determinants of Different Composition of Bilateral Financial Asset Flows

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		FDIA			PORTA			OIA	
$distance_{ij}$	-0.061**	-0.060*	-0.061**	-0.079***	-0.080***	-0.080***	-0.019*	-0.019*	-0.020*
	(0.031)	(0.031)	(0.030)	(0.024)	(0.024)	(0.024)	(0.011)	(0.011)	(0.011)
$legal\_origin_{ij}$	0.038	0.039	0.037	0.012	0.012	0.014	0.011	0.011	0.012
	(0.073)	(0.073)	(0.073)	(0.026)	(0.026)	(0.026)	(0.023)	(0.023)	(0.023)
$common\_languange_{ij}$	0.112	0.109	0.109	-0.142	-0.144	-0.144	0.036	0.036	0.035
	(0.280)	(0.276)	(0.276)	(0.107)	(0.106)	(0.106)	(0.072)	(0.072)	(0.072)
$bilateral\_trade_{ij,t-1}$	0.049***	0.050***	0.050***	0.028	0.028	0.028	0.040***	0.040***	0.040***
	(0.018)	(0.018)	(0.018)	(0.024)	(0.024)	(0.023)	(0.007)	(0.007)	(0.007)
$global\_growth_t$		0.012	0.030		-0.006	-0.020*		0.004	0.013
		(0.023)	(0.035)		(0.013)	(0.012)		(0.011)	(0.012)
$global\_interest\_rate_t$		0.006	-0.009		0.014	0.011		0.053***	0.041
		(0.019)	(0.042)		(0.013)	(0.028)		(0.015)	(0.028)
$commodity\_price_t$		-0.000	-0.000		-0.001***	-0.001***		-0.000	0.000
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
VIX_t		-0.005	-0.000		-0.003	-0.006**		-0.008***	-0.005*
		(0.003)	(0.004)		(0.003)	(0.003)		(0.003)	(0.003)
$reporter\_growth_{i,t-1}$			0.015			-0.018***			0.001
			(0.015)			(0.005)			(0.007)
$reporter\_interest\_rate_{i,t-1}$			0.003			0.007			-0.001
			(0.026)			(0.016)			(0.016)
$reporter\_governance_{i,t}$			-0.005			0.020***			0.010*
			(0.011)			(0.006)			(0.006)
$reporter\_kaopen_{i,t}$			0.003			0.005			0.010***
			(0.002)			(0.009)			(0.003)
$reporter\_financial\_depth_{i,t}$			-0.001			-0.000			-0.001
			(0.001)			(0.001)			(0.001)
$partner\_growth_{i,t-1}$			-0.002			0.002			0.003
			(0.003)			(0.002)			(0.003)
$partner\_interest\_rate_{i,t-1}$			-0.004			-0.000			-0.001
			(0.005)			(0.001)			(0.001)
$partner\_governance_{i,t}$			0.002			0.007**			0.006*
			(0.003)			(0.003)			(0.004)
$partner\_kaopen_{i,t}$			-0.001			0.001*			-0.000
			(0.002)			(0.000)			(0.001)
$partner\_financial\_depth_{i,t}$			0.001			-0.000			0.000
			(0.000)			(0.001)			(0.001)
Observations	2,566	2,566	2,566	2,660	2,660	2,660	2,647	2,647	2,647
R-squared	0.107	0.101	0.102	0.234	0.225	0.232	0.089	0.081	0.084
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Partner F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	No	No	Yes	No	No	Yes	No	No

Notes: Dependent variables are bilateral direct investment assets (FDIA), portfolio assets (PORTA) and other investment assets (OIA) flows in % of reporting economy nominal GDP. o_d_ refers to reporting country domestic factor. p_d_ pertains to partner country domestic factor. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Determinants of Bilateral Financial Asset Flows - Partner and Reporter Economy Splits

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Advanced Economy Partner			Emerging Economy Partner			Excl Large Advanced Economy		
$distance_{ij}$	-0.079	-0.078	-0.081	-0.250*	-0.250*	-0.250*	-0.264***	-0.263***	-0.264***
	(0.074)	(0.074)	(0.075)	(0.129)	(0.128)	(0.127)	(0.083)	(0.083)	(0.083)
$legal\_origin_{ij}$	0.039	0.039	0.041	0.465**	0.465**	0.463**	-0.249	-0.250	-0.244
	(0.084)	(0.084)	(0.085)	(0.227)	(0.225)	(0.225)	(0.203)	(0.204)	(0.207)
$common\_languange_{ij}$	0.328	0.322	0.307	-0.712	-0.712	-0.718	0.549	0.539	0.556
	(0.501)	(0.497)	(0.499)	(0.449)	(0.447)	(0.447)	(1.017)	(1.009)	(1.014)
$bilateral\_trade_{ij,t-1}$	0.141***	0.142***	0.141***	0.036	0.037	0.036	0.114**	0.115**	0.113**
	(0.051)	(0.051)	(0.051)	(0.040)	(0.040)	(0.042)	(0.044)	(0.044)	(0.044)
$global\_growth_t$		0.001	0.019		0.016	0.020		0.004	0.017
		(0.033)	(0.045)		(0.015)	(0.021)		(0.048)	(0.063)
$global\_interest\_rate_t$		0.113**	0.036		0.006	0.114		0.145**	0.299*
		(0.047)	(0.098)		(0.041)	(0.080)		(0.063)	(0.158)
$commodity\_price_t$		-0.002**	-0.002**		0.000	-0.000		-0.002**	-0.002
		(0.001)	(0.001)		(0.000)	(0.000)		(0.001)	(0.001)
VIX_t		-0.020**	-0.016**		-0.002	-0.000		-0.023**	-0.014
		(0.008)	(0.008)		(0.003)	(0.003)		(0.011)	(0.011)
$reporter\_growth_{i,t-1}$			-0.014			-0.002			-0.004
			(0.019)			(0.009)			(0.029)
$reporter\_interest\_rate_{i,t-1}$			-0.002			-0.048			-0.101
			(0.049)			(0.051)			(0.079)
$reporter\_governance_{i,t}$			0.025			0.029*			0.021
			(0.022)			(0.016)			(0.042)
$reporter\_kaopen_{i,t}$			0.024*			0.002			0.019*
			(0.013)			(0.003)			(0.010)
$reporter\_financial\_depth_{i,t}$			-0.005			0.002			-0.001
			(0.003)			(0.002)			(0.005)
$partner\_growth_{i,t-1}$			0.014			0.004			0.003
			(0.009)			(0.005)			(0.014)
$partner\_interest\_rate_{i,t-1}$			0.044			-0.005			-0.016
			(0.030)			(0.005)			(0.035)
$partner\_governance_{i,t}$			0.041**			-0.002			0.033*
			(0.016)			(0.007)			(0.017)
$partner\_kaopen_{i,t}$			0.004			-0.001			-0.001
			(0.003)			(0.002)			(0.003)
$partner\_financial\_depth_{i,t}$			0.002			0.002			0.001
			(0.001)			(0.001)			(0.002)
Observations	1,867	1,867	1,867	846	846	846	1,362	1,362	1,362
R-squared	0.213	0.208	0.213	0.261	0.257	0.276	0.220	0.216	0.219
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Partner F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	No	No	Yes	No	No	Yes	No	No

Notes: Dependent variables are total bilateral financial asset flows in % of reporting economy nominal GDP. o_d_ refers to reporting country domestic factor. p_d_ pertains to partner country domestic factor. See country classification list for advanced and emerging economy sample. Large advanced economies include Germany, Japan, and United States. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Determinants of Bilateral Financial Asset Flows - By Period

VARIABLES	(1) Pre-crisis	(2) Post-crisis	(3) Year=2006	(4) Year=2008	(5) Year=2010	(6) Year=2011	(7) Year=2016
$distance_{ij}$	-0.181***	-0.088	-0.303**	-0.140	-0.363*	-0.055	-0.136
	(0.065)	(0.073)	(0.124)	(0.174)	(0.200)	(0.171)	(0.128)
$bilateral\_trade_{ij,t-1}$	0.171***	0.119*	0.388***	0.134	0.116	0.217**	0.004
	(0.029)	(0.068)	(0.052)	(0.095)	(0.107)	(0.097)	(0.130)
Observations	1,080	1,275	179	179	178	178	185
R-squared	0.324	0.183	0.681	0.352	0.380	0.388	0.385
Country F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Partner F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables are total bilateral financial asset flows in % of reporting economy nominal GDP. Pre-crisis include 2000-07; and post-crisis refers to 2010-16. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

5.2 Extension: Interaction Between Distance and VIX

Baseline Results. The results in the preceding section offer strong evidence that bilateral financial asset transactions of advanced economies are driven by gravity factors, alongside push and pull factors. Given that bilateral distance and global risk aversion are both significant in the baseline results and sensitivity tests, we extend the analysis by considering the interaction between these two factors as shown in Equation (2). This will allow us to test whether distance exacerbate the adverse impact of information frictions. As discussed in Section 4, both variables in the interaction term are continuous variables. In Table 9, the presence of the interaction term renders a different interpretation for the distance and VIX. The estimated parameters now act as intercepts when one of the continuous interacted variables takes a value of zero. For instance, the estimated coefficient for distance suggests how much bilateral capital flows will drop when VIX is zero. In contrast, the estimated coefficient for VIX now implies how much bilateral capital flows will fall when distance is zero.

The estimate coefficient of the interacted continuous variables in Column (1) suggest that the greater distance, the larger the impact of VIX on bilateral capital flows, albeit insignificant. But for bilateral other investment asset flows, the estimate is significant as shown in Column (4). Given the we interacted continuous variables, the interpretation of the results is unclear as we do not know the actual impact of higher global risk aversion on bilateral capital flows, given larger distance. Hence, we consider the marginal effects of the interaction term.

Tables 10a-10d present the marginal effects for total bilateral capital flows, bilateral FDI asset flows, bilateral portfolio asset flows, and bilateral other investment asset flows, respectively. For Table 10a, we find that at log distance 6, a unit increase in VIX decreases total bilateral capital flows by around 0.02% of reporting country's nominal GDP, whereas at log distance 9, a unit increase in VIX decreases total bilateral capital flows by around 0.01% of reporting country's nominal GDP. These results are largely in line with other investment asset flows. For instance, at log distance 6, a unit increase in VIX reduces other investment asset flows by around 0.02% of reporting country's nominal GDP, but at log distance 8, a unit increase in VIX decreases other investment asset flows by around 0.01% of reporting country's nominal GDP. The

marginal effects for foreign direct and portfolio investments are mostly insignificant. Figures 2a to 2d show the predictive values of bilateral capital flows given an increase in VIX at varying levels of distance. The figures indicate a uniform negative impact of an increase in VIX on bilateral flows across varying levels of distance, particularly for total bilateral capital flows (Figure 2a) and bilateral other investment asset flows (Figure (2d).

Sensitivity Tests. We conduct some sensitivity tests to validate the results. First, we remove gravity and global factors that are insignificant. Specifically, we remove common legal origins, common spoken language, global growth, and global interest rate. Second, to check whether the results are sensitive to outliers in the data, we winsorise the bilateral capital flows at the bottom and top 10% of the bilateral country sample. In both cases, we confirm the uniform negative impact of VIX across varying levels of distance. Moreover, we validate that the negative impact of VIX on bilateral capital flows diminishes as distance increases. Third, removing crisis years of 2008-2009 yields similar results, i.e. the negative impact of VIX on bilateral capital flows decreases with distance. Lastly, when we hold VIX at given levels, we find uniform negative impact of an increase in distance on bilateral capital flows. Moreover, the negative impact of information frictions on bilateral capital flows decreases as global financial risk increases.

Taken together, the estimates show that although VIX has uniform negative effect on bilateral capital flows, its impact decreases with distance. This is in line with the fact that bilateral asset holdings and transactions decline at greater distance. This means that bilateral capital flows decrease more for economies that are of closer geographic proximity or with less information frictions than those that are farther apart or with more information frictions when global investor risk aversion rises. Hence, information frictions do not exacerbate the negative impact of an increase in VIX on bilateral capital flows. On the contrary, the results provide evidence of regional contagion using bilateral flows data.

Table 9: Determinants of Bilateral Financial Asset Flows - Interaction Between Distance and VIX

VARIABLES	(1) Total	(2) FDIA	(3) PORTA	(4) OIA
$distance_{ij}$	-0.151*	-0.043	-0.059	-0.112***
	(0.085)	(0.059)	(0.044)	(0.042)
$legal\_origin_{ij}$	0.032	0.039	0.012	0.010
	(0.093)	(0.073)	(0.026)	(0.022)
$common\_languange_{ij}$	0.516	0.108	-0.145	0.039
	(0.324)	(0.275)	(0.106)	(0.072)
$bilateral\_trade_{ij,t-1}$	0.123***	0.050***	0.028	0.040***
	(0.031)	(0.018)	(0.023)	(0.007)
$global\_growth_t$	0.006	0.012	-0.006	0.003
	(0.025)	(0.023)	(0.013)	(0.011)
$global\_interest\_rate_t$	0.083**	0.006	0.014	0.053***
	(0.039)	(0.019)	(0.013)	(0.015)
$commodity\_price_t$	-0.001*	-0.000	-0.001***	-0.000
	(0.001)	(0.000)	(0.000)	(0.000)
VIX_t	-0.033	0.002	0.006	-0.046***
	(0.031)	(0.019)	(0.016)	(0.016)
$distance_{ij}*VIX_t$	0.002	-0.001	-0.001	0.005**
	(0.004)	(0.002)	(0.002)	(0.002)
Observations	2,713	2,566	2,660	2,647
R-squared	0.205	0.101	0.225	0.087
Country F.E.	Yes	Yes	Yes	Yes
Partner F.E.	Yes	Yes	Yes	Yes

Notes: Dependent variables are bilateral financial asset flows (FINA), foreign direct assets (FDIA), portfolio assets (PORTA) and other investment assets (OIA) in % of reporting economy nominal GDP, respectively. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Marginal Effects of Distance and VIX Interaction

a) Total Bilateral Capital Flows

Average Marginal Effects	dy/dx	std. err.	t	P>|t|	95% Conf.	Interval
dist = 5	-0.022	0.013	-1.650	0.099	-0.048	0.004
dist = 6	-0.020	0.010	-1.950	0.051	-0.039	0.000
dist = 7	-0.017	0.007	-2.390	0.017	-0.032	-0.003
dist = 8	-0.015	0.006	-2.730	0.006	-0.026	-0.004
dist = 9	-0.013	0.006	-2.200	0.028	-0.025	-0.001
dist = 10	-0.011	0.008	-1.340	0.181	-0.026	0.005

b) Foreign Direct Investment Assets

Average Marginal Effects	dy/dx	std. err.	t	P>|t|	95% Conf.	Interval
dist = 5	-0.002	0.008	-0.240	0.811	-0.019	0.015
dist = 6	-0.003	0.006	-0.440	0.658	-0.016	0.010
dist = 7	-0.004	0.005	-0.800	0.425	-0.013	0.005
dist = 8	-0.005	0.003	-1.380	0.168	-0.011	0.002
dist = 9	-0.005	0.003	-1.740	0.084	-0.011	0.001
dist = 10	-0.006	0.004	-1.480	0.142	-0.015	0.002

c) Portfolio Investment Assets

Average Marginal Effects	dy/dx	std. err.	t	P>|t|	95% Conf.	Interval
dist = 5	0.001	0.008	0.080	0.939	-0.015	0.016
dist = 6	0.000	0.006	-0.070	0.944	-0.013	0.012
dist = 7	-0.001	0.005	-0.320	0.750	-0.010	0.008
dist = 8	-0.002	0.003	-0.780	0.436	-0.009	0.004
dist = 9	-0.004	0.002	-1.510	0.132	-0.008	0.001
dist = 10	-0.005	0.003	-1.760	0.080	-0.010	0.001

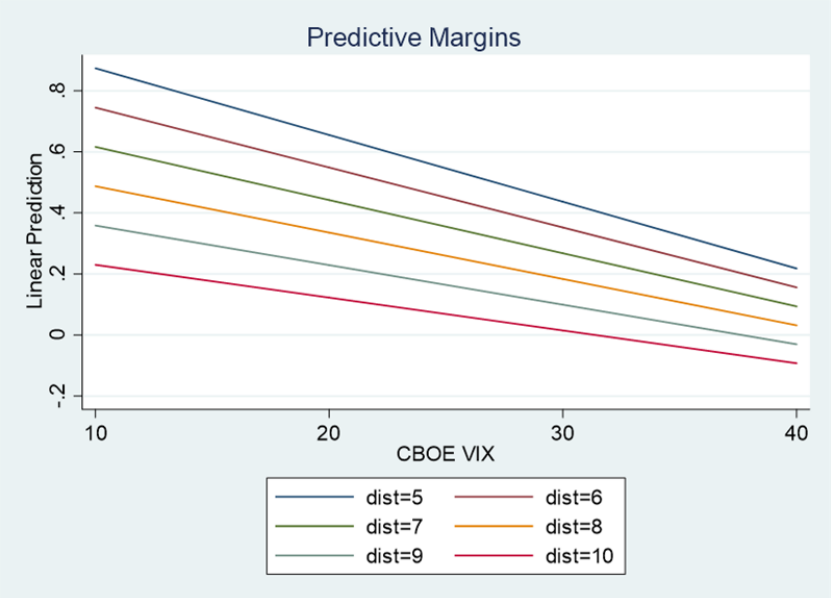
d) Other Investment Assets

Average Marginal Effects	dy/dx	std. err.	t	P>|t|	95% Conf.	Interval
dist = 5	-0.023	0.007	-3.130	0.002	-0.037	-0.008
dist = 6	-0.018	0.006	-3.270	0.001	-0.029	-0.007
dist = 7	-0.014	0.004	-3.390	0.001	-0.021	-0.006
dist = 8	-0.009	0.003	-3.110	0.002	-0.015	-0.003
dist = 9	-0.004	0.003	-1.560	0.120	-0.010	0.001
dist = 10	0.000	0.004	0.070	0.942	-0.007	0.008

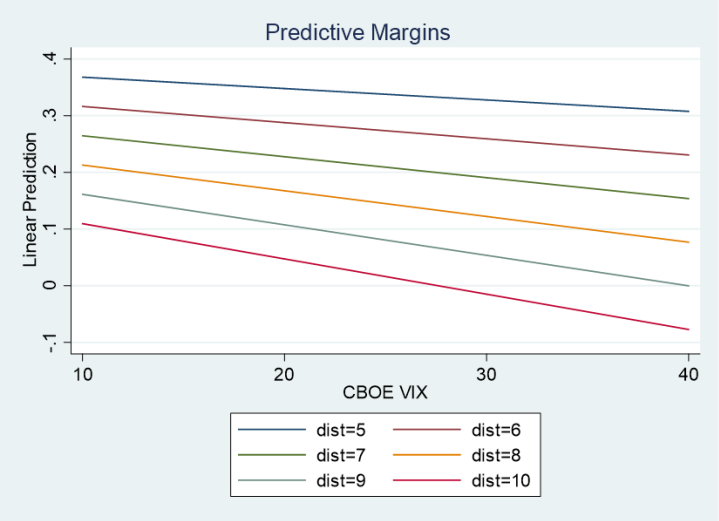
Note: Average marginal effects are partial effects of bilateral financial asset flows with respect to changes in VIX at given levels of distance (dist).

Figure 2: Predictive Margins Plot of Bilateral Financial Asset Flows on Change in VIX at Given Levels of Distance

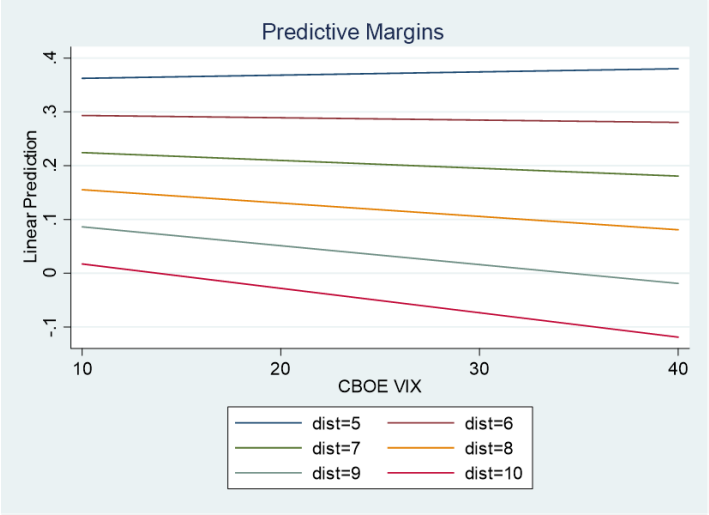
a) Total Bilateral Capital Flows



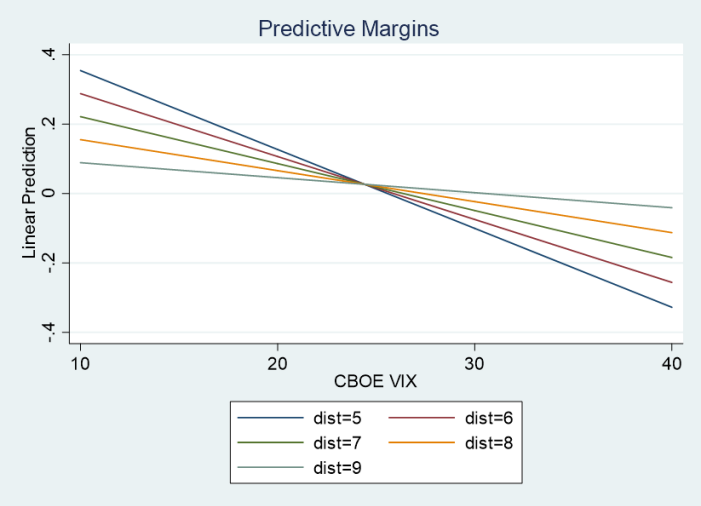
b) Foreign Direct Investment Assets



c) Portfolio Investment Assets



d) Other Investment Assets



Notes: Distance (dist) expressed in log values. Linear predictions are predictive values of bilateral capital flows in % of reporting country nominal GDP.

6. Concluding Remarks

This paper extends the capital flows literature by considering the importance of gravity factors, alongside the traditional push and pull factors, in determining the size of bilateral capital flows. The asset trade literature offers empirical and theoretical support on the importance of gravity forces, such as distance (which proxies for information frictions) as well as economic ties, on bilateral asset transactions and holdings. But since transactions or flows data are technically part of capital flows, it is natural to expect that bilateral capital flows are driven by gravity, push and pull factors. Unfortunately, evidence on this conjecture is constrained by the lack of bilateral capital flows data. This paper fills the gap in this literature by using bilateral Balance of Payments Statistics of 10 advanced reporting economies for the period of 2000 to 2016.

The results are as follows. Global factors such as global commodity price level and global risk aversion are consistently significant with expected signs. Moreover, reporter and partner domestic governance and capital account openness are, likewise, significant. What is new is that gravity factors such as distance and bilateral trade ties are statistically significant across a battery of sensitivity tests. Extending the analysis in the context of contagion, the results offer evidence that an increase in global risk aversion has a uniform negative impact on bilateral capital flows, at given levels of distance. But its negative impact on bilateral capital flows is greater between economies of closer geographic proximity or lesser information frictions, than those that are farther apart or with greater information asymmetries. These findings warrant considering the importance of information frictions and economic ties between economies in understanding the patterns and behaviour of capital flows at academic and policy circles.

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Appendix

Table A1: Bilateral Pairs and Partner Economy Classification

Advanced Economy Partner		Emerging Economy Partner	
Australia	5	Argentina	3
Austria*	4	Brazil	5
Belgium	6	Bulgaria	1
Canada*	6	Chile	1
Czech Republic	3	China	7
Denmark*	1	Croatia	1
Estonia	1	Hungary	3
Finland	2	India	4
France	8	Indonesia	2
Germany*	7	Iran	1
Greece	2	Malaysia	2
Hong Kong, China	5	Mexico	4
Ireland	3	Papua New Guinea	1
Italy	7	Philippines	2
Japan*	7	Poland	3
Korea*	5	Romania	2
Latvia	1	Russia	4
Lithuania	1	Saudi Arabia	1
Luxembourg	5	South Africa	3
Malta	1	Thailand	2
Netherlands*	7	Turkey	1
New Zealand*	1	United Arab Emirates	2
Norway	2	Venezuela	1
Portugal	3	Vietnam	1
Singapore	5	**Bilateral Pairs**	**57**
Slovakia	2		
Slovenia	3		
Spain*	5		
Sweden	3		
Switzerland	6		
Taipei, China	4		
United States*	8		
Bilateral Pairs	**129**		

Notes: Economy classification based on WEO country classification. * denotes reporting economy.

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Bilateral Capital Flows:
Gravity, Push, and Pull

Conference on External Statistics: "Bridging Measurement Challenges and Analytical Needs of External Statistics: Evolution or Revolution?"

Lisbon, 17-18 February 2020

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Outline

1) Bilateral capital flows dataset
2) Research applications
3) Bilateral capital flows in the context of capital flow covariates
4) Concluding remarks

Bilateral Capital Flows Dataset

- Few economies report the geographic breakdown of their Balance of Payments Statistics.
- Bilateral capital flows pertain to the geographic breakdown of the Financial Account Balance.
- Data are available for 10 reporting central banks or statistics agencies, including Österreichische Nationalbank, Statistics Canada, Danmarks Nationalbank, Deutsche Bundesbank, Bank of Japan, Bank of Korea, De Nederlandsche Bank, Stats NZ, Banco de España, and Bureau of Economic Analysis.

Table 1: Bilateral Capital Flows Data

	United States	Canada	Austria	Denmark	Germany	Netherlands	Spain	Japan	Korea	New Zealand
Foreign Direct Investments										
Assets (FDIA)	TC	TC	TC	TC	TC	UI	TC	TC	TC	TC
Liabilities (FDIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Portfolio Investments										
Assets (PORTA)	UI	TC	TC	UI	TC	UI	TC	TC	TC	TC
Liabilities (PORTL)	TC	TC	(est)	TC	TC	(est)	TC	TC	TC	TC
Financial Derivatives										
Assets (DERA)	×	×	×	TC	TC	TC	×	TC	TC	×
Liabilities (DERL)	×	×	×	TC	TC	×	×	TC	TC	×
Other Investment										
Assets (OIA)	TC	TC	TC	TC	TC	UI	TC	TC	TC	TC
Liabilities (OIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Reserve Assets (RESA)	TC	TC	×	TC	TC	×	×	×	×	×
Frequency	Q	Q	Q	M	Q	A	A	Q	A	A
Start Year	2003	2000	2001	2005	2000	2004	2013	2000	2006	2000
End Year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
No. of Counterparty	21	3	15	36	33	25	7	33	3	30

Source: Mercado (2018).

Bilateral Capital Flows Dataset

- Bilateral capital flows data include direct investment assets, portfolio assets, financial derivative assets, other investment assets and official reserve assets (whenever data are available).
- Data captures bilateral financial *transactions i.e.* location of counterparty.
- Data mostly consistent with Balance of Payments Manual 6.
- Reported bilateral data between country pairs do not match.
- The sample accounts for around 25% of reported world bilateral holdings of direct and portfolio investments; and banking sector claims.

Table 1: Bilateral Capital Flows Data

	United States	Canada	Austria	Denmark	Germany	Netherlands	Spain	Japan	Korea	New Zealand
Foreign Direct Investments										
Assets (FDIA)	TC	TC	TC	TC	TC	UI	TC	TC	TC	TC
Liabilities (FDIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Portfolio Investments										
Assets (PORTA)	UI	TC	TC	UI	TC	UI	TC	TC	TC	TC
Liabilities (PORTL)	TC	TC	(est)	TC	TC	(est)	TC	TC	TC	TC
Financial Derivatives										
Assets (DERA)	×	×	×	TC	TC	TC	×	TC	TC	×
Liabilities (DERL)	×	×	×	TC	TC	×	×	TC	TC	×
Other Investment										
Assets (OIA)	TC	TC	TC	TC	TC	UI	TC	TC	TC	TC
Liabilities (OIL)	TC	TC	TC	TC	TC	TC	TC	TC	TC	TC
Reserve Assets (RESA)	TC	TC	×	TC	TC	×	×	×	×	×
Frequency	Q	Q	Q	M	Q	A	A	Q	A	A
Start Year	2003	2000	2001	2005	2000	2004	2013	2000	2006	2000
End Year	2016	2016	2016	2016	2016	2016	2016	2016	2016	2016
No. of Counterparty	21	3	15	36	33	25	7	33	3	30

Source: Mercado (2018).

Bilateral Capital Flows Dataset

Table 2: Descriptive Statistics, % of reporter nominal GDP

Capital Flows	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
		2000-2016					2000-2007			
Total Financial Assets	2,972	0.343	1.757	-13.212	36.141	1,183	0.545	2.141	-4.806	36.141
Total Financial Liabilities	2,962	0.323	2.508	-18.030	44.473	1,178	0.562	2.601	-10.017	44.473
FDI Assets	2,825	0.190	1.240	-18.810	28.599	1,120	0.220	1.337	-2.765	28.599
FDI Liabilities	2,700	0.152	1.230	-9.321	41.127	1046	0.233	1.653	-3.908	41.127
Portfolio Assets	2,910	0.122	0.511	-3.868	4.601	1,153	0.180	0.516	-3.699	3.831
Portfolio Liabilities	2,803	0.160	1.991	-18.086	23.835	1,126	0.223	1.494	-9.857	15.820
Other Investment Assets	2,899	0.066	0.778	-13.176	16.365	1,165	0.176	0.878	-5.295	16.365
Other Investment Liabilities	2,873	0.063	0.807	-11.668	14.215	1,154	0.166	0.816	-2.667	14.215
Capital Flows	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
		2008-2009					2010-2016			
Total Financial Assets	391	0.098	1.506	-8.947	10.796	1,398	0.239	1.410	-13.212	24.000
Total Financial Liabilities	392	0.145	2.015	-12.881	16.446	1,392	0.170	2.538	-18.030	20.818
FDI Assets	370	0.128	0.775	-7.143	5.529	1,335	0.181	1.261	-18.810	24.569
FDI Liabilities	352	0.098	0.751	-8.599	5.855	1302	0.101	0.885	-9.321	15.937
Portfolio Assets	384	0.069	0.490	-2.651	4.295	1,373	0.088	0.508	-3.868	4.601
Portfolio Liabilities	371	0.136	1.823	-13.124	15.992	1,306	0.113	2.375	-18.086	23.835
Other Investment Assets	379	-0.090	1.046	-13.176	3.999	1,355	0.015	0.555	-5.673	4.800
Other Investment Liabilities	379	-0.038	0.782	-5.215	5.512	1,340	0.004	0.796	-11.668	6.737

Source: Mercado (2018).

Research Applications

The geographic breakdown of capital flows will allow us to assess the significance of ***bilateral factors*** on *bilateral transactions*.

- Bilateral factors include distance (information frictions) and trade ties (economic ties).
- By using bilateral transactions data, we capture actual bilateral flows instead of bilateral holdings (stocks) which may exhibit persistent effects.
- Most studies on bilateral financial transactions focus on specific type of investment flows (Portes and Rey, 2005 on *equity flows*; Brei and von Peter, 2018; Herrmann and Mihaljek, 2013; on *bank flows*; and di Giovanni, 2005 on *mergers and acquisitions*.
- Mercado (2018a) used total bilateral capital flows across types of investments and found the significance of gravity factors.

Table 3: Bilateral Capital Flows and Gravity Factors

	(1) FINA	(2) FDIA	(3) PORTA	(4) OIA
$Distance_{ij}$	-0.262***	-0.154**	-0.064**	-0.039
	(0.078)	(0.051)	(0.019)	(0.040)
$Financial\ Centre_{j}$	3.408**	1.201**	1.492***	1.047
	(1.197)	(0.394)	(0.432)	(0.685)
$Trade_{ij,t-1}$	0.137***	0.061**	0.026	0.044
	(0.037)	(0.019)	(0.016)	(0.024)
R^2	0.375	0.284	0.458	0.364
Obs	2939	2788	2875	2867

Note: Bilateral capital flows are in % of reporter GDP. Trade refers to bilateral imports in % of GDP.
Source: Mercado (2018).

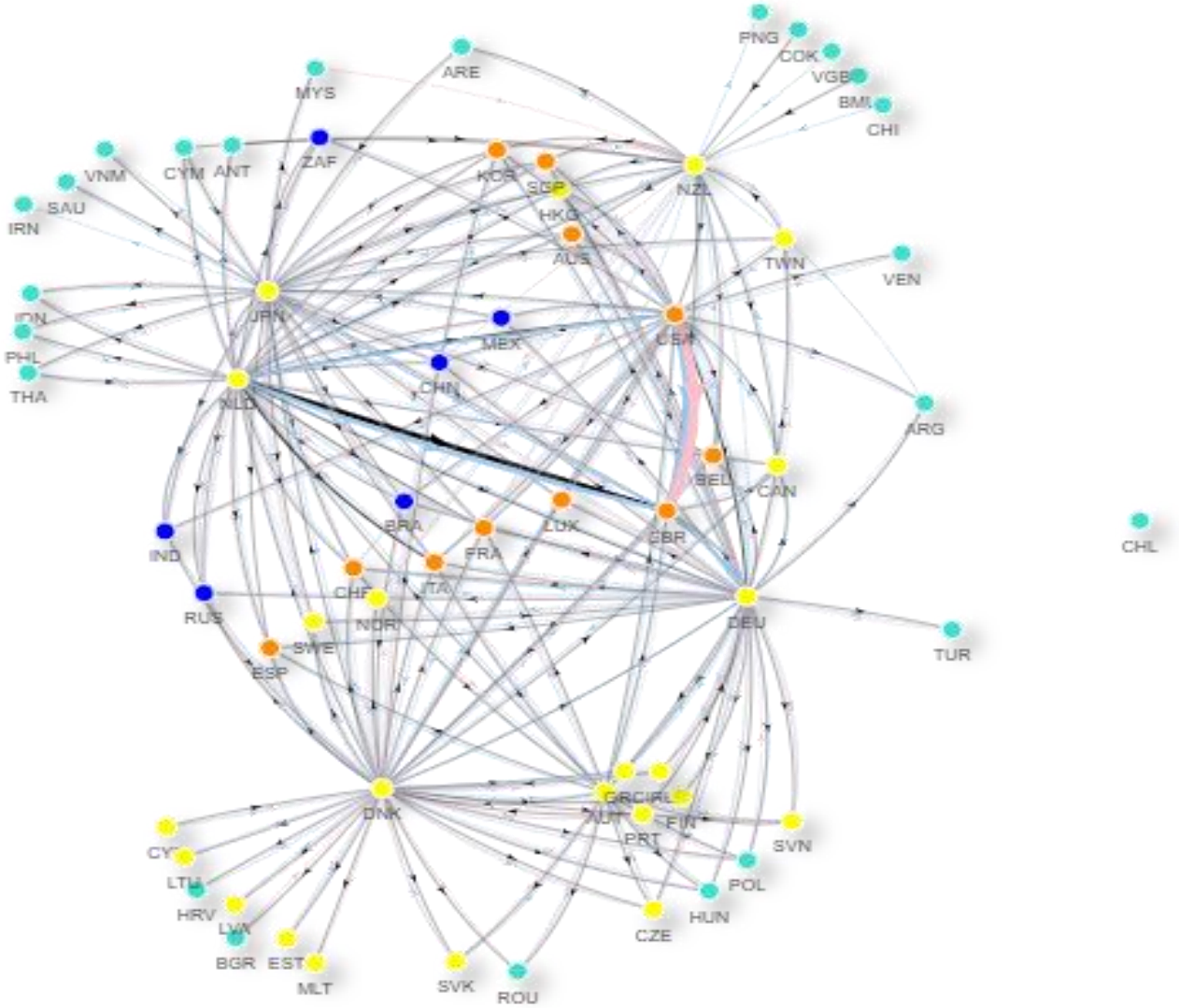
Research Applications

The geographic breakdown of capital flows will allow us to understand ***global financial flows network***.

- Mercado and Noviantie (2019) constructed financial centrality measure and found varying significance of network systemic and idiosyncratic factors in explaining financial centrality across different types of investments and residency of investors.

Future research can consider ***policy and risk spillovers***.

Figure 1: Financial Asset Network Before Crisis



Source: Mercado and Noviantie (2019).

Bilateral Capital Flows: Gravity, Push and Pull

- Mercado (2018) found bilateral capital flows are responsive to gravity factors. But capital flows literature point to the importance of global and domestic factors.

- This raises the question: ***are capital flows driven by gravity factors, alongside push and pull factors?*** If so, policy makers must also consider the role of information frictions and economic ties.

- This raises another question: ***if gravity factors are significant, do information frictions exacerbate the adverse effects of global financial risks?***

- We consider the following specifications:

$$CF_{ij,t} = \alpha_i + \alpha_j + d_{ij}\theta + h_{ij,t-1}\phi + g_t\beta + r_{i,t}\delta + p_{j,t}\gamma + \varepsilon_{ij,t}$$

$$CF_{ij,t} = \alpha_i + \alpha_j + d_{ij}\theta + h_{ij,t-1}\phi + g_t\beta + \varphi VIX_t \times dist_{ij} + \varepsilon_{ij,t}$$

Bilateral Capital Flows: Gravity, Push and Pull

Table 4: Bilateral Pairs and Partner Economy Classification

Advanced Economy Partner		Emerging Economy Partner	
Australia	5	Argentina	3
Austria*	4	Brazil	5
Belgium	6	Bulgaria	1
Canada*	6	Chile	1
Czech Republic	3	China	7
Denmark*	1	Croatia	1
Estonia	1	Hungary	3
Finland	2	India	4
France	8	Indonesia	2
Germany*	7	Iran	1
Greece	2	Malaysia	2
Hong Kong, China	5	Mexico	4
Ireland	3	Papua New Guinea	1
Italy	7	Philippines	2
Japan*	7	Poland	3
Korea*	5	Romania	2
Latvia	1	Russia	4
Lithuania	1	Saudi Arabia	1
Luxembourg	5	South Africa	3
Malta	1	Thailand	2
Netherlands*	7	Turkey	1
New Zealand*	1	United Arab Emirates	2
Norway	2	Venezuela	1
Portugal	3	Vietnam	1
Singapore	5	**Bilateral Pairs**	**57**
Slovakia	2		
Slovenia	3		
Spain*	5		
Sweden	3		
Switzerland	6		
Taipei, China	4		
United States*	8		
Bilateral Pairs	**129**		

Table 5: Determinants of Bilateral Financial Asset Flows

Doubling the distance between two economies reduces financial asset flows, on the average, by about 0.03% of reporting country's GDP (approximately US$5.6 billion for the U.S.).

	(1)	(2)	(3)	(4)
$distance_{ij}$	-0.107*	-0.106*	-0.108*	-0.107*
	(0.058)	(0.058)	(0.058)	(0.058)
$legal\_origin_{ij}$	0.033	0.032	0.033	0.033
	(0.080)	(0.080)	(0.080)	(0.080)
$common\_languange_{ij}$	0.520	0.516	0.516	0.514
	(0.393)	(0.390)	(0.393)	(0.390)
$bilateral\_trade_{ij,t-1}$	0.122**	0.123**	0.121**	0.122**
	(0.048)	(0.048)	(0.048)	(0.048)
$global\_growth_t$		0.006		0.015
		(0.023)		(0.031)
$global\_interest\_rate_t$		0.083**		0.078
		(0.034)		(0.064)
$commodity\_price_t$		-0.001**		-0.001*
		(0.000)		(0.001)
VIX_t		-0.015**		-0.011**
		(0.006)		(0.006)
$reporter\_growth_{i,t-1}$			-0.009	-0.006
			(0.014)	(0.014)
$reporter\_interest\_rate_{i,t-1}$			-0.066	-0.008
			(0.053)	(0.038)
$reporter\_governance_{i,t}$			0.021	0.028*
			(0.019)	(0.016)
$reporter\_kaopen_{i,t}$			0.020**	0.016*
			(0.010)	(0.009)
$reporter\_financial\_depth_{i,t}$			0.000	-0.002
			(0.003)	(0.002)
$partner\_growth_{j,t-1}$			0.001	0.005
			(0.007)	(0.005)
$partner\_interest\_rate_{j,t-1}$			-0.005	-0.005
			(0.005)	(0.005)
$partner\_governance_{j,t}$			0.016**	0.014*
			(0.008)	(0.007)
$partner\_kaopen_{j,t}$			-0.001	-0.000
			(0.002)	(0.002)
$partner\_financial\_depth_{j,t}$			0.000	0.000
			(0.001)	(0.001)
Observations	2,713	2,713	2,713	2,713
R-squared	0.208	0.205	0.210	0.207
Marginal R-squared	0.045	0.045	0.045	0.045

Notes: Dependent variables are total bilateral financial asset flows in % of reporting economy nominal GDP. Marginal R2 is computed as 1-(RSS/RSS^c) where RSS is the residual sum of squares in a regression specification with gravity factors, while RSS^c is the residual sum of squares in a regression specification without gravity factors. All specifications include reporter and partner dummy variables. Specification (1) and (3) include year dummy variables. Clustered standard errors (bilateral pairs) are in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Bilateral Capital Flows: Gravity, Push and Pull

Gravity factors (distance and trade) are significant alongside global and domestic reporter and partner factors (VIX, global prices, governance, capital account openness).

- This holds across different types of investments, though there are differences.
- For advanced economy partner, distance is insignificant while trade is significant. For emerging economy partner, distance is negative and significant, but trade is insignificant. Common legal origins is positive and significant.
- Period and annual regressions show either distance or bilateral trade is significant; or both or neither are significant.
- Results hold when I changed the specification; winsorised the data; used different global and domestic factors; and included financial centres in the sample.

Bilateral Capital Flows: Gravity, Push and Pull

Table 6: Interaction Between Distance and VIX

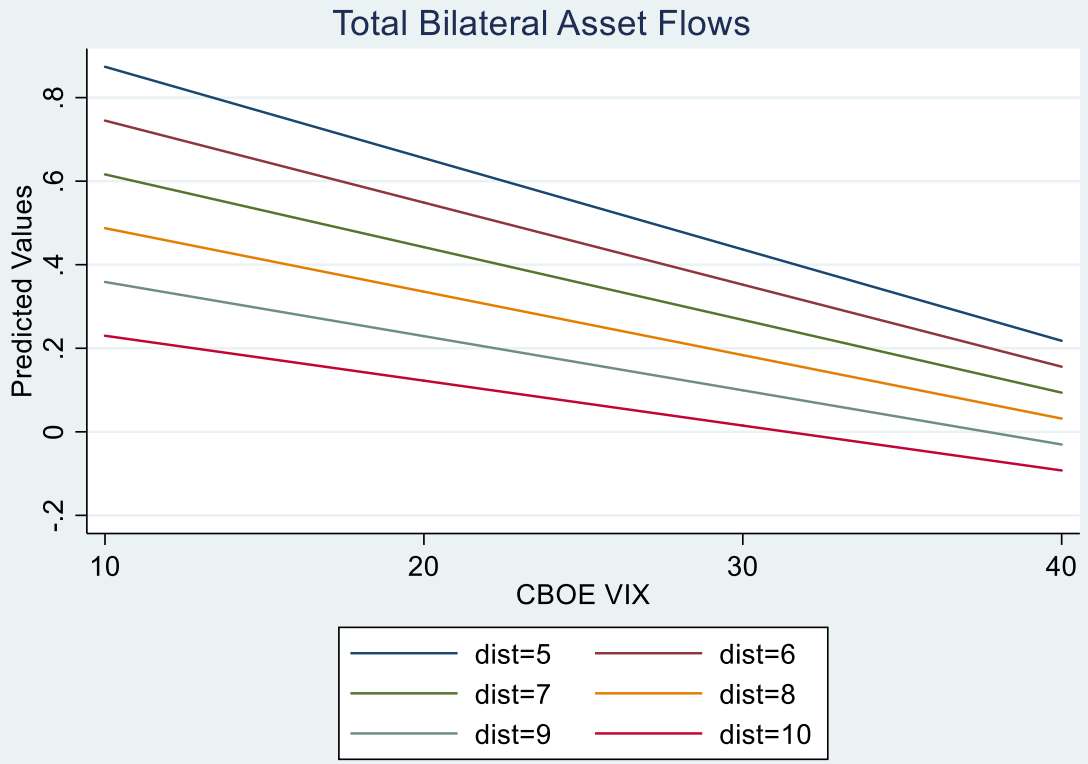
Marginal Effects	dy/dx	std. err.	t	P>|t|	[95% Conf.	Interval]
dist = 5	-0.022	0.013	-1.650	0.099	-0.048	0.004
dist = 6	-0.020	0.010	-1.950	0.051	-0.039	0.000
dist = 7	-0.017	0.007	-2.390	0.017	-0.032	-0.003
dist = 8	-0.015	0.006	-2.730	0.006	-0.026	-0.004
dist = 9	-0.013	0.006	-2.200	0.028	-0.025	-0.001
dist = 10	-0.011	0.008	-1.340	0.181	-0.026	0.005

Note: Marginal effects are partial effects of one unit increase in VIX on bilateral financial asset flows at given levels of distance (dist). Distance are in log values.

At log distance 6 (e.g. between Germany and Belgium), a unit increase in VIX decreases bilateral capital flows by around 0.02% of reporting country's nominal GDP (around US$0.7 billion); but at log distance 9 (e.g. between Germany and Korea), a unit increase in VIX decreases bilateral capital flows by around 0.01% of GDP (around US$0.3 billion).

Bilateral Capital Flows: Gravity, Push and Pull

Figure 2: Predicted Values of Bilateral Financial Asset Flows on Change in VIX at Given Levels of Distance



An increase in global risk aversion has a uniform negative impact of bilateral capital flows across different levels of distance.

However, the adverse impact of an increase in global risk aversion is greater for country pairs that are closer to each other (contagion).

The results hold when some gravity and global factors were removed; when bilateral flows data were winsorised; and when we removed crisis years of 2008-09.

Concluding Remarks

Compiling the geographic breakdown of the Balance of Payments Statistics will provide new insights to researchers and policymakers.

For instance, we have new evidence that *bilateral capital flows* are responsive to gravity factors alongside push and pull factors. We also have evidence showing that although bilateral capital flows decrease across different levels of distance when global risk aversion increases, the impact is greater for economies closer to one another. This offers support for regional cooperation.

The SEACEN Centre

Thank You

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