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International Capital Market Frictions and Spillovers from Quantitative Easing

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Abstract

This paper analyzes the impact of large-scale, unconventional asset purchases by advanced country central banks on emerging market economies (EMEs) from 2008 to 2014. I show that there was substantial heterogeneity in the way these purchases affected EME currency, equity, and long-term sovereign bond markets. Drawing on the gravity-in-international-finance literature, I show that the degree of capital market frictions between EMEs and advanced countries is significant in explaining the observed heterogeneity in how these asset prices were affected. This result is robust to considerations of domestic monetary policy, exchange rate regime, and capital control policies in EMEs. Furthermore, I show that the size and direction of asset price movements in EMEs depended both on the type of assets purchased and on whether it was the U.S. Federal Reserve or other advanced country central banks engaging in the purchases.

Keywords: emerging markets, unconventional monetary policy, spillovers, capital market frictions

JEL Classification Numbers: F30, F42, G15,

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1 Introduction

Throughout 2008–2014 several advanced economies engaged in unconventional monetary policy in response to the global financial crisis. These policies consisted primarily of forward guidance and quantitative easing (QE) by central banks. The U.S. Federal Reserve (the Fed) implemented the first and the largest of such programs, followed by the Bank of England (BOE), the Bank of Japan (BOJ), and most recently the European Central Bank (ECB).[1] Recent research has shown that these unconventional monetary policy programs had substantial international spillovers to emerging market economies (EMEs). In particular, following the Fed's implementation of forward guidance and announcements of their large scale asset purchase (LSAP) program, many EMEs saw a rise in foreign capital inflows, a rise in equity prices, a fall in sovereign debt yields, a real appreciation of currencies, and an increase in non-financial corporate debt.[2] More recently, the Fed's retreat from unconventional policy has been associated with nominal exchange rate depreciations and equity market contractions in EMEs.[3]

In this paper I add to the existing research by identifying and explaining the heterogeneous impact, defined as the change in asset prices, of the Fed's 2008–2014 LSAPs on currency, equity, and sovereign debt prices in a large sample of EMEs. In the central finding of the paper, I show that the degree of capital market frictions (or conversely, the degree of economic integration or exposure) between EMEs and the U.S. is significant in explaining the cross-country variation in EME asset price changes following the Fed's LSAPs, even after considering domestic capital control, exchange rate, and monetary policies. Furthermore, I show that the spillovers to EMEs were driven primarily by purchases of U.S. government Treasury securities, and much less so by other types of assets purchased by the Fed. In a

[1] The BOJ also conducted QE programs during their extended period of low inflation in the 1990s and through the 2000s.

[2] See Lo Duca, Nicoletti, and Martinez (2014), Fratzscher, Duca, and Straub (2013), and speech by S. Honkapohja, Bank of Finland June 9 2014, among others.

[3] See Aizenman, Binici, and Hutchison (2014) and Eichengreen and Gupta (2014).

robustness exercise I contrast spillovers from the Fed's LSAPs with those from the BOE and BOJ's QE programs, and show that this pattern of spillovers to EME asset markets was not unique to the Fed's LSAPs.

The paper proceeds as follows. Section 2 describes the relevant literature on international spillovers of unconventional monetary policy. Section 3 discusses the data, method, and main results. Section 4 provides several robustness exercises, including studying spillovers from the BOE and BOJ's QE programs. Section 5 concludes.

2 Research Context

Much of the existing research on the international transmission of the Fed's unconventional monetary policy has studied the impact of asset purchase announcements or forward guidance statements on foreign financial markets using event studies. Neely (2010), Chen, Filardo, He, and Zhu (2012), and Bowman, Londono, and Sapriza (2015), among others, find that unconventional monetary policy announcements in the U.S. reduced long-term nominal sovereign debt yields, caused currency appreciation, raised equity prices, and compressed credit default swap (CDS) spreads in foreign countries. Eichengreen and Gupta (2014), and Dahlhaus and Vasishtha (2014) find that announcements of QE tapering caused foreign asset prices to move in the opposite direction. Fratzscher, Duca, and Straub (2013) find both announcements and operations of LSAPs triggered an increase in investment into EME equities, but that it was primarily operations that were associated with rising asset prices. Moore, Nam, Suh, and Tepper (2013) and Lim, Mohapatra, and Stocker (2014) find that LSAP operations, through changes in U.S. interest rates, were associated with an increase in foreign ownership of EME debt and a reduction in EME sovereign yields.

Unconventional monetary policy announcements and operations can affect foreign asset prices through signalling, portfolio balance, and risk channels. The signalling channel is activated as the Fed's LSAP operations provide a credible signal that future short-term interest rates will remain low, and therefore decreases the expectations component of long-term interest rates. Purchases also lead to portfolio rebalancing as the Fed reduces the supply of assets in the market and raises their price, thereby inducing investors to search for (imperfectly) substitutable assets with potentially higher returns, such as EME government debt. Finally, as the Fed makes credible commitments to continue LSAPs, the risk premium for holding long-term assets falls and global risk appetite rises, potentially propelling investors towards relatively riskier EME assets. Fratzscher *et al.* (2013) and Moore *et al.* (2013) present evidence that together these channels encourage capital flows to EMEs and raise EME asset prices, as investors purchase local equity and debt assets and convert currency to either buy these assets or to hold as hedge itself.[4] It is also possible for U.S. unconventional monetary policy to be transmitted through policy interest rates, as EME central banks lower their own policy rates in line with the Fed (or other advanced countries) in order to offset currency appreciations. This would then offset the asset price rise.

While the international transmission channels of unconventional monetary policy have been identified, there is limited consensus on what determines the size or direction of transmission. Fratzscher *et al.* (2013), Eichengreen and Gupta (2014), and Berkel (2007) find that domestic capital and exchange rate policies had a limited role in reducing the international transmission of the Fed's LSAPs during the crisis. Bowman *et al.* (2015), in contrast, find that domestic macroeconomic indicators can explain unconventional monetary policy transmission to EME sovereign yields. Rey (2015) finds that exchange rate policy alone cannot insulate countries from monetary policy in major reserve issuing countries. Ehrmann and Fratzscher (2009) have found that real, but not financial, integration with foreign countries was important in determining the transmission of conventional U.S. monetary policy in the

[4]For comparisons of which channel is more important in unconventional monetary policy, see Neely (2010), Bauer and Neely (2014), Bauer and Rudebusch (2014), and Christensen and Rudebusch (2012).

pre-crisis years.[5]

In contrast, there is evidence that the degree of bilateral capital market frictions can explain portfolio flows and business cycle transmission during the financial crisis. Galstyan and Lane (2013) show that the size of pre-crisis bilateral holdings, geographical distance, common language, the level of trade, and common institutional linkages help explain patterns of international portfolio adjustment during and immediately after the crisis. Milesi-Ferretti and Tille (2011) show that the magnitude of retrenchment in capital flows across countries is linked to the degree of international financial integration. Hausmann-Guil, van Wincoop, and Zhang (2014) show that countries more closely tied to the U.S. had business cycles and growth rates more synchronized with the U.S. during the financial crisis. Kalemli-Ozcan, Papaioannou, and Perri (2013) show that financial linkages may predict the degree of business cycle synchronization, depending on how they are defined. Rose and Spiegel (2010, 2011), however, show no link between financial integration and transmission of the 2008–2009 financial crisis from the U.S.

3 Empirical Methods and Results

My method departs from existing literature by first explicitly documenting the cross-country heterogeneity in the spillovers to EME exchange rates, equity prices, and long-term local currency sovereign yields from the Fed's LSAP operations, and then showing that bilateral capital market frictions (or conversely the degree of integration) between individual EMEs and the U.S. are significant in explaining this heterogeneity. This is very intuitive: countries that have fewer impediments to cross-border investment with the U.S. should have larger bilateral investment flows. I conjecture that because foreign monetary policy is transmitted through international capital flows, these measures of bilateral capital market frictions

[5] The authors measure real linkages as bilateral trade flows, geographic distance, volatility of exchange rates vis-à-vis the U.S., GDP correlation, plus several other similar variables. Financial linkages are measured as bilateral portfolio investment, bank flows, and FDI investment vis-à-vis the U.S.

should also explain why certain countries are more affected by foreign monetary policy than others. In fact, I will show that even after accounting for domestic controls on foreign capital and investment, exchange rate policies, and domestic monetary policy, the degree of bilateral capital market frictions between the U.S. and EMEs is still significant in explaining cross-country variation in how EME asset prices responded to LSAPs. My focus is on the effect LSAP operations, not announcements, had on EME asset prices. Existing literature has shown, through event studies, that the Fed's announcements had little impact on individual country asset prices, and on average a smaller impact than operations did (Bowman, Londono, and Sapriza (2015), Fratzscher *et al.* (2013)). An event study on the impact of the Fed's announcements on the three asset prices, using my sample, similarly shows no significant cross-country heterogeneity.[6] I further show that purchases of government debt within the larger QE programs were the primary drivers of the observed spillovers to EME asset markets. Finally, I contrast the international transmission of the Fed's LSAPs with QE programs conducted by other central banks, and show that in certain cases other central bank's QE programs were associated with similar movement in EME asset prices in terms of both direction and pattern.

I use monthly data from December 2008 to February 2014, corresponding to all rounds of QE by the Fed. Given data availability, my sample contains 21 EMEs: Bulgaria, Brazil, Chile, Colombia, Czech Republic, Hong Kong, Hungary, Indonesia, India, Korea, Mexico, Malaysia, Nigeria, Philippines, Poland, Russia, Singapore, Thailand, Turkey, and South Africa. I define the Fed's LSAP series as the sum of the Fed's holdings of U.S. Treasury securities (5 year maturity or longer), mortgage backed securities, central bank liquidity swaps, agency debt, and other loans.[7] Figure 1 plots the LSAP series by component, over the sample period. Figure 2 plots the three EME asset prices I study, where exchange rates

[6] Results available upon request. Given the lack of cross-country heterogeneity I find in the impact of announcements, there is not sufficient evidence to study the role of bilateral capital market frictions in the cross-country pattern of announcement spillovers.

[7] Results are robust to including only purchases of Treasury securities with 10–year or longer maturity.

are defined as the ratio of nominal local-currency to U.S. dollar (USD). Exchange rates are defined such that a rise in the ratio represents an EME currency depreciation. I use the Thomson Reuters Government Benchmark local-currency ten-year bid yields as the measure of sovereign yields, and I use the *Datastream* equity market index as the measure of equity prices.[8] Figure 2 suggests that while there was an average appreciation of currencies, a rise in equity prices, and a fall in yields throughout the sample period, there was substantial cross-country heterogeneity in all series. I measure bilateral capital market frictions between EMEs and the U.S. by drawing on proxy variables common to the gravity-in-international finance literature. I discuss these variables and this method in detail in section 3.3. Detailed definitions and sources of the data, beyond what is discussed below, are available in table A1 of Appendix A.

A notable aspect of my specification is that, although monetary policy is transmitted across borders via international capital flows, I look at asset prices directly. The reason is due to data limitations. There are two sources of data on bilateral capital flows: the EPFR Global and the International Monetary Fund's (IMF) *Coordinated Portfolio Investment Survey* (CPIS). The EPFR Global is a high frequency (weekly) data set of funds flows and asset allocation to EMEs, but is not a representative sample. The dataset covers only 5–20% of the market capitalization in equity and in bonds for most countries, and only tracks retail and institutional investment over $100,000.[9] It thus under-represents individual institutional investors and does not represent non-institutional investors at all. The CPIS is a very comprehensive data set of bilateral capital flows, but is only available at an annual frequency (or bi-annual, in recent years), and is thus not useful for capturing the impact of unconventional monetary policy operations that were implemented at a much higher frequency. Faced with

[8] Many studies use real exchange rates rather than nominal. Given the high correlation between nominal and real, I do not expect the results to be substantially altered by this decision. In their related study, Ehrmann and Fratzscher (2009) show explicitly that using nominal versus real exchange rates does not alter the estimated spillovers of U.S. monetary policy to foreign country currencies.

[9] Fratzscher (2012), Miyajima and Shim (2014).

the same data limitations Bowman *et al.* (2015) also look directly at the impact of unconventional monetary policy on EME asset prices. Ahmed and Zlate (2014) and Mohanty (2014) use the lower frequency Balance of Payments and CPIS data and show there was an increase in capital flows to EME during the financial crisis. Fratzscher *et al.* (2013) use the EPFR Global data, despite its limitations, and also confirm that QE (in particular, QE2) was associated with large capital inflows to EMEs.

3.1 Country-Specific Spillovers

In order to determine whether there was significant heterogeneity in EME asset price changes associated with the Fed's LSAP operation, I estimate the impact of LSAPs on individual countries by regressing each of the log difference of the exchange rate ($\Delta \ln(s_{i/\$,t})$), equity price ($\Delta \ln(p_{it})$), and long-term, local-currency sovereign bond yield ($\Delta \ln(r_{it})$) on the log difference in LSAPs ($\Delta \ln(lsap_t)$), for each country in my sample. The dependent variables are defined so that $\Delta \ln$ represents a one-month log-difference.[10] Using $\Delta \ln(y_{it}) \in \{\Delta \ln(s_{i/\$,t}), \Delta \ln(p_{it}), \Delta \ln(r_{it})\}$ to denote the one-month log-difference in EME asset prices for country i at time t, and y in the superscript to represent the coefficients corresponding to each asset price, the regression specification for each country is:

$$\Delta \ln(y_{it}) = \eta_i^y + \beta_i^y \Delta \ln(lsap_t) + \boldsymbol{x}_{it} \boldsymbol{\alpha}_i^y + e_{it}^y, \tag{1}$$

where $\boldsymbol{x}_{it} = [x_{1,it}, ... x_{J,it}]'$ is a vector of J control variables, defined in log differences. This vector includes the one-period lagged values of the CBOE VIX index, the U.S. Treasury bill rate, and the S&P 500 return which are all included to capture both the difference in returns in the U.S. relative to EME countries as well as general volatility in markets during this period. I also include the log of domestic market capitalization (in levels) to capture

[10] It is common in the literature to estimate gravity models in logs, which is based on the original theoretical gravity-in-international-trade derivation of these models. Further, augmented Dickey-Fuller tests suggest the series contain a unit root, so I use the first difference of the log series to ensure stationarity.

the ability of foreigners to invest in each EME.[11] Finally, I include a control for domestic monetary policy meant to capture the degree to which the monetary authorities in EMEs were able to offset undesired movements in their currency, equity and debt markets due to large capital inflows following the Fed's LSAPs. I use the monetary base as a proxy for domestic monetary policy, and in a robustness check I use the monetary-policy-related interest rate. In both cases I instrument the monetary policy variable by its lagged value to avoid potential endogeneity between monetary policy decisions and asset prices. Equation (1) is estimated by two-stage least squares (2SLS).[12]

I then determine whether the Fed's LSAPs had a heterogeneous impact across countries by testing the hypotheses:

$$\begin{aligned} &\mathrm{H}_0 : \beta_i^y = \beta^y \ \forall i \\ &\mathrm{H}_1 : \beta_i^y \neq \beta^y \text{ for at least one } i \end{aligned} \tag{2}$$

using the coefficient estimates from specification (1) for each country i and asset y. That is, I test whether the estimated impact of an increase in LSAPs on asset price y_{it}, denoted by coefficient $\hat{\beta}_i^y$, is homogeneous across countries.

Results are reported in table 1, with the dependent variable the log difference exchange rate, log difference equity prices, and log difference sovereign bond yields in columns (1), (2), and (3), respectively. The full set of control variables are included in all regressions, but their coefficients are not reported in table 1. All countries are estimated to have experienced a cur-

[11] Market capitalization is only available at an annual frequency, and thus I cannot measure this variable in log-differences. All results are robust to the exclusion of the log of market capitalization as a control, and are available upon request.

[12] All results (including those in sections 3.2 and 3.3) are robust to excluding the monetary policy control variable and estimating the specification by ordinary least squares (OLS). I do not include these results as part of the main analysis because controlling for domestic monetary policy is essential in the context of studying exchange rates and equity and debt prices. Results for the OLS estimates are available in tables B1–B3 of the online appendix.

rency appreciation following the Fed's LSAPs. In the majority of cases this appreciation was both economically large and statistically significant: a one percent increase in LSAPs was associated with a currency appreciation of up to 0.73 percent. Given that LSAPs increased by over 300 percent in the sample period, these predicted appreciations are substantial for many EMEs. Furthermore the magnitude of the predicted appreciation exhibits substantial variation across countries. As one would expect, countries with non-floating exchange rates (*e.g.* China and Hong Kong) observed little change in their exchange rate, but did see large changes in equity and debt prices. I formally test the statistical significance of this variation with an F-test for coefficient equality across countries. The p-values of this test are reported in the bottom panel of table 1, column (1). I strongly reject the null hypothesis that all countries experienced an equivalent appreciation of their currencies.

The Fed's LSAPs also were associated with a large and significant rise in equity prices across countries. Again, we observe substantial heterogeneity in the magnitude of these prices increases and strongly reject coefficient equality. One notices that the magnitude of the impact on equity prices tends to be larger for those countries with shallower equity markets, as one might expect *a priori*.[13] For example, countries like Bulgaria, Hungary, Turkey, and Poland, which have the lowest stock market capitalization in the sample, saw some of the largest adjustment in prices. However, countries with very large market capitalization were also affected, such as South Africa, Korea, and Singapore, suggesting that market size alone cannot explain the magnitude of QE's impact.[14]

Finally, LSAPs were associated with lower sovereign yields in most countries. While the coefficient estimates are statistically significant in fewer countries, coefficient equality across

[13] Where depth of equity markets refers to market capitalization, which is measured as market capitalization of listed companies as a % of GDP.

[14] In 2008 the market capitalization to GDP ratio for Hungary was 11.9 %, for Turkey 16.1%, for Bulgaria 16.6%, and for Poland 17.0%. Countries in the sample with the deepest capital markets are Hong Kong with a ratio of 606.0%, South Africa 179.9%, Singapore 93.6%, and South Korea 49.4%.

countries is still strongly rejected. This suggests that despite being less affected by LSAPs compared to equities and currencies, there remained substantial heterogeneity in how yields reacted across countries to LSAPs. Furthermore, as in the case of the other assets, there is no immediately obvious pattern to the differences in sign or magnitude of the coefficient estimates across countries, such as by region, market capitalization, or explicit capital controls.

3.2 Average LSAP Spillovers

To examine whether the degree of capital market frictions vis-à-vis the U.S. is able to explain the observed heterogeneity in coefficients from equation (1), I first estimate the average impact of the Fed's LSAP program on EMEs. I use this average estimate as a baseline to then gauge whether capital market frictions between EME's and the U.S. can explain cross-country variation in spillovers. I also use this specification to study whether a particular component of LSAPs drove the spillovers to EME asset prices. I estimate a panel fixed effects model by 2SLS, again instrumenting the monetary policy control variable by its first lag:

$$\Delta \ln(y_{it}) = \eta^y + \chi_i^y + \beta^y \Delta \ln(lsap_t) + \boldsymbol{x}_{it}\boldsymbol{\alpha}^y + \boldsymbol{k}_{it}\boldsymbol{\psi}^y + e_{it}^y \tag{3}$$

for $\Delta ln(y_{it}) \in \{\Delta ln(s_{i/\$,t}), \Delta ln(p_{it}), \Delta ln(r_{it})\}$, where χ_i are country-fixed effects that capture country-specific characteristics that are constant over time.[15] The $\boldsymbol{x}_{it}$-vector of control variables are defined as in the one-country model above. I include a vector $\boldsymbol{k}_{it} = [k_{1,it}, ..., k_{L,it}]'$ of $L = 3$ additional control variables that include indicators of the domestic exchange rate regime, and the intensity of capital inflow and outflow controls. Fixed exchange rate regimes and capital controls are policies that are typically implemented as a way to limit surges or sudden stops of capital flows and maintain more stable macroeconomic conditions within

[15] Note that because the independent variable $lsap_t$ is constant across countries, and especially when time-invariant gravity variables are added to the model, the inclusion of both country and time fixed effects results in a highly collinear model. Control variables for the VIX and S&P 500 are meant to control for at least some of the factors that would otherwise be accounted for in a time fixed effect.

a country. By controlling for these time-varying policies I identify the impact of the Fed's LSAPs on EMEs that were not offset by such domestic controls. Standard errors are clustered at the country level to control for heteroskedasticity within countries. Table 2 reports the estimation results. As in the individual country regressions, the Fed's LSAPs were associated with large and statistically significant currency appreciation, rise in equity prices, and fall in sovereign yields (columns (1), (3), and (5)) on average. A one percent rise in LSAPs is estimated to have appreciated EME currencies by 0.35 percent, raised equity prices by 0.59 percent, and decreased sovereign yields by 0.35 percent.

I also estimate equation (3) replacing aggregate asset purchases ($lsap_t$) with each of its three major components: purchases of long-term U.S. Treasury securities (tr_t), purchases of mortgage-backed securities (mbs_t), and purchases of other liquid assets (lq_t) (primarily currency swaps and federal agency debt). This step allows me to determine whether different types of assets purchased by the Fed impacted EMEs differently, or whether it was the aggregate LSAP program that had spillover effects. Columns (2), (4), and (6) of table 2 show that changes in currency and equity prices were associated almost entirely with purchases of U.S. government Treasuries. The decrease in long-term bond yields, on the other hand, was primarily driven by the Fed's purchases of other liquid assets, with purchases of mortgage-backed securities having an offsetting effect. In addition to showing that the type of asset purchased mattered for the degree to which EME markets were affected, these estimates also say something about timing. As figure 1 indicates, the Fed purchased a large amount of federal agency debt and currency swaps during the first few months of the sample period. After late 2008, the Fed sold almost all of these assets. Purchases of Treasury assets, on the other hand, started later and continued throughout the entire sample period. In fact, when the months of the first round of QE (QE1, December 2008 to March 2010) are dropped from the estimated sample period, the impact of aggregate LSAPs on EME bond yields is smaller and no longer statistically significant. However, in this reduced sample there continues to be a large and statistically significant effect of LSAPs on EME currencies and equity prices, which also continues to be driven by purchases of Treasury securities.[16]

Finally, note that across table 2 domestic monetary policy in EMEs does not appear to have played a role in offsetting the spillovers from the Fed's LSAPs. This is consistent with existing evidence on the pro-cyclicality of EME monetary policy.[17] The results are similar to using the monetary policy interest rate instead of the monetary base as the monetary policy variables, which are reported in table B4 of the online appendix.[18]Controls for flexible exchange rate regimes and capital inflow controls indicate that these types of domestic policies were also not useful in offsetting spillovers from foreign monetary policy. This too is consistent with recent evidence discussed in section 2. These results motivate my approach of asking whether capital market frictions can, instead of (or in addition to) domestic policies, explain the cross-country variation in the spillovers of LSAPs. I continue to control for domestic monetary policy, exchange rate regime, and capital controls in the remainder of the analysis to ensure that I do not overestimate the impact of U.S. monetary policy on EME asset prices.

3.3 Bilateral Capital Market Frictions and LSAP Spillovers

To identify the degree of bilateral capital market frictions between the U.S. and foreign countries, I draw on the gravity-in-international-finance literature. In the original empirical gravity-in-international-finance models, Portes and Rey (2005) and Portes, Rey, and Oh (2001) show that variables that proxy for the degree of bilateral information frictions between countries (in particular, physical distance) can explain bilateral financial transactions

[16]Results from this exercise are not reported, and available upon request. If the "tapering talk" period (April 2013–onwards) is excluded from the sample all estimates are larger and they continue to have similar level of statistical significance as in table 2.

[17]See McGettigan, Moriyama, Ndela Ntsama, Painchaud, Qu, and Steinberg (2013) for a review of the cyclicality of EME monetary policy over time.

[18]Table B5 reports results using the policy rate as the monetary policy control variable for the analysis discussed in section 3.3.

and portfolio holdings at least as well as they can explain bilateral trade flows. The inference is that investors are more apt to invest in foreign markets for which they hold more information. Many studies confirm the robustness of this result, characterizing bilateral frictions more broadly as *financial* or *capital market* frictions, which include information frictions.[19] Variables typically included in these models are distance, hours equity markets overlap, indicators of contiguous physical borders, common currency, common legal histories, common colonial histories, free trade agreements, and bilateral trade in goods, among many others. While many of these variables are used in the gravity-in-international trade literature, it is common to include both them and trade in goods in gravity-in-international finance models.[20] I use a similar set of variables in my analysis and refer to these frictions as *capital market frictions* throughout, as is common in the literature.

To examine whether the degree of bilateral capital market frictions between EMEs and the U.S. is able to explain the cross-country variation in asset price changes observed in the first step of my analysis, I augment the panel fixed-effects model introduced in section 3.2 to include an interaction term between LSAPs and a vector, $\boldsymbol{z}_i = [z_{1,i}, ..., z_{G,i}]'$, of G bilateral capital market friction proxy variables between each EME and the U.S. I include physical distance, average bilateral trade to GDP, and dummy variables for free-trade agreements, overlapping trading hours, common language, common hemisphere, and shared border.[21] Results are robust to including other common variables such as common colonial history

[19] See Lane and Milesi-Ferretti (2008), Fidora, Fratzscher, and Thimann (2007), Faruqee et al. (2004), and Berkel (2007), Coeurdacier and Guibaud (2011), Ahrend and Schwellnus (2012), Forbes (2010), and Chitu, Eichengreen, and Mehl (2013), among many others, for empirical models. See Okawa and Van Wincoop (2012), Martin and Rey (2004), Obstfeld and Rogoff (2001), and Coeurdacier (2009) for theoretical gravity in international finance models, and Anderson and van Wincoop (2003) for gravity in international trade.

[20] Chitu et al. (2013) note that trade is an important proxy as commercial transactions are a source of intelligence useful for informing foreign investors, and the existence of bilateral trade links may make foreign investments more secure as they deter strategic default with the threat of commercial retaliation.

[21] I have also run the analysis using the actual number of hours markets overlap with the NYSE. The results for this specification are statistically insignificant. This indicates that, for example, being open for 2 hours versus six hours with the NYSE makes no difference in the degree to which U.S. policy affects a market. However, the difference between being open at least for some time when the NYSE is open does make a difference. Hausmann-Guil *et al.* (2014) find similar threshold results.

and common legal systems, and are available upon request. Each variable in the $\boldsymbol{z}_i$-vector is defined so that a larger value indicates a *higher* degree of integration with the U.S. or *lower* capital market frictions. The variables are summarized in columns (1)–(7) of table 3. The panel fixed effects model I estimate is then:

$$\begin{aligned} \Delta \ln(y_{it}) = \eta^y + \chi_i^y + \beta^y \Delta \ln(lsap_t) + \big(\boldsymbol{z}_i \cdot \Delta \ln(lsap_t)\big)\boldsymbol{\gamma}^y \\ + \boldsymbol{x}_{it}\boldsymbol{\alpha}^y + \boldsymbol{k}_{it}\boldsymbol{\psi}^y + e_{it}^y \end{aligned} \tag{4}$$

for $\Delta \ln(y_{it}) \in \{\Delta \ln(s_{i/\$,t}), \Delta \ln(p_{it}), \Delta \ln(r_{it})\}$. I estimate this specification by 2SLS, with standard error estimates clustered at the country level. The $\boldsymbol{x}_{it}$-vector and $\boldsymbol{k}_{it}$-vector of control variables are defined as in equation (3). Notice that equation (4) is not a nested version of equation (1), because it imposes a constant β^y coefficient estimate across all countries. Section B3 of the online appendix provides validation for this assumption, showing that in a nested version of equation (1) in equation (4) — namely, equation (4) with country-specific β_i^y coefficients on the $\Delta \ln(lsap_t)$ variable — there is little remaining cross-country heterogeneity in the country-specific $\hat{\beta}_i$ estimates. The results for the constrained analysis, which are detailed below, are robust to this unconstrained-β_i analysis.

The specification (4) weights the impact of LSAPs by the degree of bilateral capital market frictions between the U.S. and each EME. Thus, if coefficient estimates of the $\hat{\boldsymbol{\gamma}}^y = [\gamma_1^y, ..., \gamma_G^y]$-vector are jointly statistically different from zero, I can conclude that capital market frictions play a significant role in explaining the cross-country variation in the impact of LSAPs on EME asset prices. The formal hypothesis test is:

$$\begin{aligned} &\text{H}_0 : \gamma_1^y = ... = \gamma_G^y = 0 \\ &\text{H}_1 : \gamma_g^y \neq 0 \text{ for at least one } g. \end{aligned} \tag{5}$$

Note also that under this interaction specification the total impact of LSAPs on each of the EME asset price variables will be equal to its total marginal effect: $\partial\Delta\ln(y_{it})/\partial\Delta\ln(lsap_t) = \beta^y + \boldsymbol{z}_i\boldsymbol{\gamma}^y$. I test whether or not the total marginal effect of LSAPs on exchange rates was equal to zero with the hypothesis test:

$$\begin{aligned} &\mathrm{H}_0 : \beta^y = \gamma_1^y = ... = \gamma_G^y = 0 \\ &\mathrm{H}_1 : \beta^y \neq 0 \text{ or } \gamma_g^y \neq 0 \text{ for at least one } g. \end{aligned} \tag{6}$$

Before discussing the results of this specification, it is important to note that my statistical model is not a traditional gravity model. Unlike the empirical counterparts of such models, which regress bilateral trade or capital flows on gravity variables in the cross-section, my dependent variable(s) is an asset price across a panel of countries and years. Furthermore, I am interested only in the impact of a single country's monetary policy on this panel of foreign asset prices. Thus, while I am careful to include the country fixed effect term, χ_i^y, that speaks to the multilateral ability of EME countries to 'import' foreign monetary policy (consistent with gravity models), there is no natural conjugate for a multilateral term that captures the ability of the all non-U.S. countries in the world to 'export' monetary policy to each EME in my panel.

It is also important to note that in equation (4), the $\boldsymbol{z}_i$-vector contains only bilateral (EME-U.S.) measures of capital market frictions. This implicitly assumes that it is primarily U.S. investors who are reacting to Fed policy changes by shifting their investments from the U.S. to EMEs. If the observed shifts in EME asset prices are caused by capital inflows from non-U.S. foreign investors, then these U.S.-based gravity variables may have little explanatory power. On the other hand, it also is possible that the true $\boldsymbol{z}_i$-vector is correlated with capital inflows from non-U.S. countries into EMEs. However, because the U.S. represents over 30 percent of the world capital markets, it is likely that a large share of funds that were taken out of advanced economies and put into EME equity or debt did originate from the U.S.[22]

Estimation results for equation (4) are reported in table 4, with columns (1)-(3) reporting results for each dependent variable, log difference in exchange rate, log difference in equity prices, and log difference in sovereign yields, respectively. I control for monetary policy using the monetary base, but results are robust to using the policy rate (reported in table B5 of the online appendix). Column (1) shows evidence that capital market frictions can explain some of the variation in the observed EME currency appreciations following the Fed's LSAPs, even after controlling for domestic monetary policy, exchange rate regimes, and capital controls. The negative coefficient estimates on the $\boldsymbol{z}_i$-LSAP interaction terms indicate that countries with *fewer* capital market frictions experienced a *larger* appreciation of their currency. Furthermore, the χ^2 statistic and p-values corresponding to the hypothesis test (5), reported in the bottom panel of table 4, indicate that the $\boldsymbol{z}_i$-vector of proxy variables are jointly significant in explaining the heterogeneity in exchange rate adjustments.

Notice, however, that not all coefficient estimates are of the same or the expected sign. In particular, the coefficient on the interaction term between average bilateral trade to GDP and LSAPs is of the opposite sign from the other interaction coefficients and from what was expected *a priori*. While appearing to be a puzzling results (it suggests a contradiction to evidence on conventional monetary policy spillovers, as in Ehrmann and Fratzscher (2009)), on closer inspection this is not inconsistent with the initial hypothesis: that it is not a single measure of bilateral frictions or connectedness that explain patterns of unconventional monetary policy spillovers but rather the overall level of bilateral frictions. As the example below shows explicitly, despite the sign of the coefficient on the trade-to-GDP interaction term, the total marginal impact of the Fed's LSAPs on exchange rates is still of the expected

[22]Source: World Bank World Development Indicators database.

sign. Furthermore, the total marginal effect of LSAPs on EME exchange rates is statistically different from zero (as tested using hypothesis (6), reported in the bottom of the table), suggesting that the total impact of the Fed's LSAPs was larger for countries more integrated with the U.S. The reader will note that this result is consistent throughout the analysis and for all EME asset prices studied.

To further interpret the sign and magnitude of these coefficient estimates, it is useful to look at an example of the predicted exchange rate change following a rise in LSAPs. Using equation (4), with the fitted values from column (1), and the value of the $\boldsymbol{z}_i$-vector in table 3, we can calculate how, all else equal, a one percent rise in LSAPs is predicted to affect the exchange rate for any country in the sample. For example, Mexico — the country with the least capital market frictions relative to the U.S. — is predicted to experience a 0.43 percent appreciation of the peso (with standard error of 0.02) following a one percent rise in LSAPs, while Indonesia — a country with relatively more capital market frictions relative to the U.S. — is predicted to experience only a 0.19 percent appreciation of the rupiah (with standard error of 0.10). These estimates correspond closely to the heterogeneity observed in table 1, where the estimated impact of a one percent rise in LSAPs on the Mexican peso was 0.61 percent, and on the Indonesian rupiah was 0.18 percent.

Column (2) reports results from regressing the change in equity prices on the Fed's LSAPs, the set of $\boldsymbol{z}_i$-LSAP interaction terms, and controls. As with impact of LSAPs on currencies, countries with lower capital market frictions saw larger increases in their equity prices. The $\boldsymbol{z}_i$-LSAP interaction variables are jointly statistically significant and the total marginal effects of the LSAPs and the interaction terms are also jointly significantly different from zero. Drawing again on the example of Mexico and Indonesia, a one percent rise in LSAPs predicts an increase in equity prices in Mexico by 0.82 precent (with a standard error of 0.03) and in Indonesia by only 0.58 percent (with a standard error of 0.13). This demonstrates that the degree of integration does appear to matter for the size of equity price adjustment.

Finally, a rise in LSAPs was associated with a fall in EME sovereign yields, and there is evidence that the degree of capital markets frictions with the U.S. is able to explain the heterogeneity in how yields were affected across EMEs, as reported in column (3). Jointly the $\boldsymbol{z}_i$-LSAP terms are statistically significant and the total marginal effect of LSAPs is also significantly different from zero. The sign and magnitude of the coefficients is however, somewhat mixed. Note that the more uncertain role of capital market frictions in explaining spillovers to sovereign yields individually appears to be offset by the greater role of capital controls, which was not observed in the regressions of equity prices on LSAPs and was much smaller in the regression of exchange rates on LSAPs. The lack of statistical significance on either the monetary base or policy rate variables suggest that monetary policy in EMEs was unable to offset spillovers from LSAPs to their asset markets. Concluding with the example above, the total role of the $\boldsymbol{z}_i$-vector variables in the impact of LSAPs on EME yields, Mexico is predicted to see a fall in yields of 0.37 percent, (with a standard errors of 0.05) and Indonesia of 0.13 percent (with a standard error of 0.35).

I also estimate whether the degree of capital market frictions relative to the U.S. affected the degree to which EME asset prices responded to each type of LSAP purchase — Treasury securities, mortgage-backed securities, and other liquid assets. These results are presented in table B9 of the online appendix. While the degree of capital market frictions relative to the U.S. appears to be significant in explaining a portion of the cross-country heterogeneity in how exchange rates and equity prices responded to Treasury and mortgage-backed security purchases, there is less evidence that it is significant in explaining variation in EME asset prices' response to purchases of other liquid assets. This follows from the results discussed in section 3.2, where it was shown that EMEs were primarily affected by purchases of Treasury securities and mortgage-backed securities.

These results indicate that after controlling for capital controls, domestic monetary policy, and exchange rate regimes, bilateral capital market frictions between EMEs and the U.S. are significant in explaining the patter of heterogeneous spillovers from the Fed's LSAPs (in particular from purchases of U.S. Treasury securities) to EME asset prices. In particular, those countries with the least capital market frictions relative to the U.S. experienced larger currency appreciations and rises in equity prices, on average.

4 Robustness

I conduct several robustness exercises to ensure the results presented thus far do not depend on the choice of variables, and to examine whether these results are unique to the U.S. QE program.

4.1 Macroeconomic Fundamentals

It is possible that the results are driven by countries that are less integrated with the U.S. also having stronger macroeconomic fundamentals (including, importantly, larger purchases of foreign exchange reserves to offset currency appreciation). In that case one might incorrectly attribute a smaller movement in asset prices following LSAPs to larger capital market frictions when in fact the true explanation is stronger domestic fundamentals. I control for this possibility by adding controls for macroeconomic fundamentals in EMEs in equation (4). I use the inflation rate, measured as the change in the consumer price index (CPI), the change in the unemployment rate, and the log-difference in official reserve assets. The data is from the IFS database, all at monthly frequency.[23] Results are reported in table 5.

[23]Not all countries have all data series available: unemployment data is unavailable for China, India, Indonesia, Mexico, Nigeria, Philippines, South Africa, Bulgaria after April 2013, and data is intermittent for Singapore. The full panel is available for CPI and reserve series.

Due to the highly collinear nature of the data, I drop the common border-LSAP dummy variable. In all cases the results are not qualitatively changed from the baseline results of table 4. That is, once controlling for macroeconomic fundamentals in EMEs, capital market frictions between the U.S. and EMEs — as proxied by the $\boldsymbol{z}_i$-vector — are still significant in explaining the variation in asset price movement following LSAPs.

4.2 Explicit Capital Controls

My empirical specification has assumed that explicit capital controls could only affect EMEs asset prices on their own. It is plausible though, that explicit capital inflow and outflow controls are able to explain cross-country variation in asset prices following LSAPs in the same way that capital market frictions studied in section 3.3 did. To determine if this is the case, I interact explicit capital inflow and capital outflow control variables with the Fed's LSAP variable in regression (4). I re-define capital inflow and outflows as one minus their actual value, making the interpretation of their coefficients consistent with the other interaction variables — a larger value of the capital control variables indicates *less* capital controls. First, I include only these two interaction terms. Results are reported in columns (1)–(3) of table 6. I cannot reject the null hypothesis that the coefficient estimates on the interaction terms are jointly equal to zero for any dependent variable. This suggests explicit capital controls alone cannot explain cross-country variation in EME asset prices following LSAPs. Second, I include the explicit capital control-LSAP interaction terms with the full $\boldsymbol{z}_i$-vector of frictions used in section 3.3. Columns (4)–(6) of table 6 report results. I now reject the null hypothesis for coefficient equality across all interaction terms, but cannot reject the null that only capital inflow and outflow controls are equal to zero. These results clearly indicate that explicit capital controls cannot explain the observed heterogeneity in asset price movement.

4.3 Bank of England and Bank of Japan QE

Like the Fed, the BOE and BOJ responded to the global financial crisis by engaging in unconventional QE programs in early 2009.[24] Whether or not EME financial markets were affected by these QE programs in the same way as they were by the Fed's LSAPs will give an indication of whether it was QE programs themselves or simply the considerable influence of the U.S. (and thus Fed operations) driving the results presented thus far. I define each of their QE programs as the sum of the central bank's unconventional asset holdings. Figures B1 and B2 show the BOE and BOJ's balance sheet composition. The BOE's balance sheet was comprised primarily of purchases of government debt (gilts), and the BOJ's by a wider variety of assets. When studying the international transmission of the BOE and BOJ's QE programs to EME asset prices, I measure all gravity variables noted above relative to the UK or Japan, and control for UK ten-year sovereign yield and the Japanese ten-year government yield, and the Financial Times Stock Exchange (FTSE) 100 Implied Volatility Index and the Nikkei Stock Average Volatility Index, respectively. Results for this analysis are all presented in the accompanying online appendix tables B10–B14.

I begin by re-estimating equation (3) with controls for the BOE and BOJ's QE programs.[25] Results indicate that non-U.S. QE programs were associated with significant adjustments in EME asset prices, and that the estimated impact of the Fed's LSAPs may have been overestimated when other QE program were not accounted for. I then re-estimate equations (1), (3), and (4), and the associated hypothesis tests, for the BOE and BOJ. In all three cases this involves defining the bilateral exchange rates relative to the UK or Japan, replacing the Fed's LSAPs regressor with the BOE or BOJ's balance sheet series, measuring

[24] Fawley and Neely (2013) provide a comprehensive review of the differences in the Fed's, the BOE's, and the BOJ's asset purchase programs, as well as a detailed breakdown of the types of assets purchased by each central bank. I do not look at the ECB's QE programs as they began in January 2015 and are thus out of my sample period.

[25] I do this only for the equity market price index and sovereign bond yields — it is not apparent why a U.S.-bilateral exchange rate would be affected BOE or BOJ purchases.

control and capital market friction variables relative to the UK or Japan, and including a control for the Fed's LSAPs (except when regressing the bilateral exchange rate on BOE or BOJ purchases).

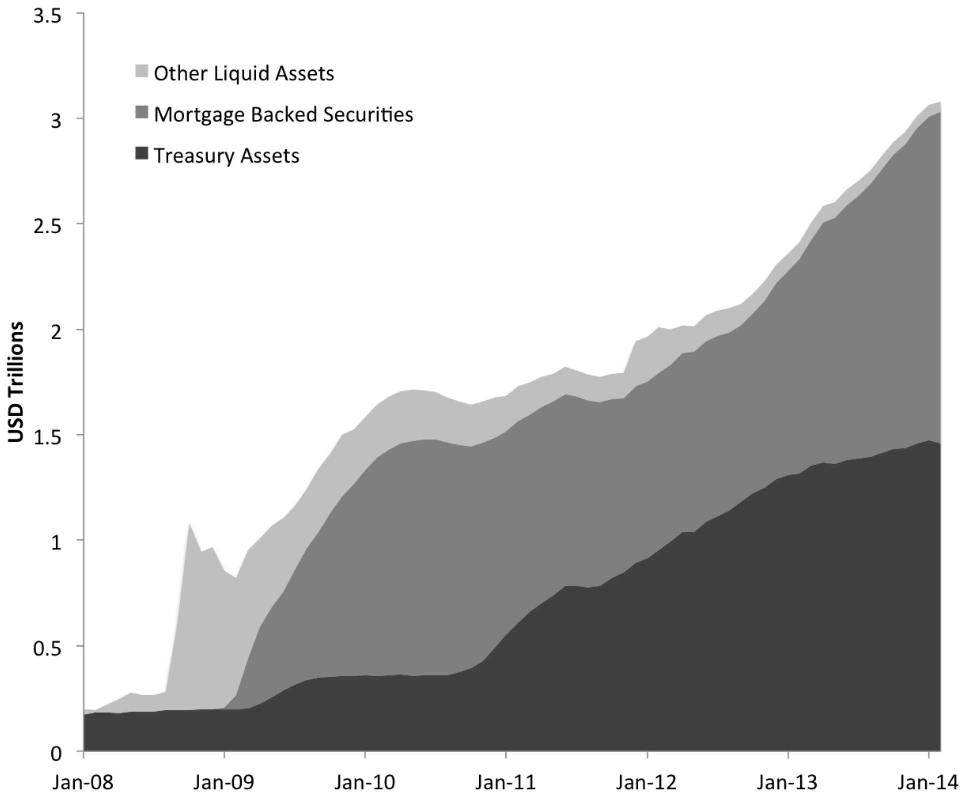
Overall the results indicate that EMEs were affected by non-U.S. QE programs, but the magnitude of spillovers was substantially less than that of the Fed's LSAPs. Consistent with spillovers from the Fed's LSAPs, countries with less capital market frictions via-á-vis the UK did experience relatively larger changes in their asset prices, indicating that EME's exposure to countries conducting unconventional monetary policy through QE is a possible predictor of the degree to which their asset prices will be affected. The BOJ's purchases were not associated with a substantive impact on EME asset prices. It is not immediately clear why this is, but it is perhaps because the composition of the BOJ's balance sheet was substantially different from those of the Fed and the BOE. Alternatively, it may be that financial markets reacted less to the BOJ's QE because it was simply seen as a continuation of previous policies from the late 1990s and early 2000s. I leave a more detailed study of this difference as a subject for further research.

5 Conclusion

This paper has shown that the Fed's LSAP program during 2008–2014 was associated with large and statistically significant currency appreciations, decreases in long-term local-currency sovereign yields, and increases in equity market prices across a large sample of EMEs. The degree to which individual EME asset prices were affected, however, displayed substantial heterogeneity. I show that bilateral capital market frictions between EMEs and the U.S. are significant in explaining the observed heterogeneity in the impact of the Fed's LSAPs on EME currency, equity, and debt prices. This is true even after controlling for exchange rate regimes, capital control policies, and domestic monetary policy in EMEs. Furthermore, explicit capital market frictions such as capital inflow and outflow controls are not significant in explaining the observed heterogeneity alone. The type of asset purchased by the Fed was an important determinant for how EME asset prices were affected, with purchases of Treasury securities having the largest spillover effects on EME asset prices. Finally, I have presented evidence that the QE program implemented by the BOE had similar international spillover effects to EMEs, with those countries facing less capital market frictions relative to the UK experiencing greater asset price adjustment.

My results here have important policy implications for EME and advanced country central banks. Recently, governments and central banks in EMEs along with international policy institutions have pressed advanced countries to consider the international implications of their unconventional monetary policy operations. My results suggest that policy makers in EMEs can better anticipate and plan for spillovers from advanced country QE if they know in advance their degree of capital market frictions or degree of integration relative to these countries, and the types of assets purchased in the QE program. Furthermore, if advanced country central banks are able to stimulate their economies with purchases of assets other than government bonds, then they may want to do so in order to limit international spillovers from their actions.

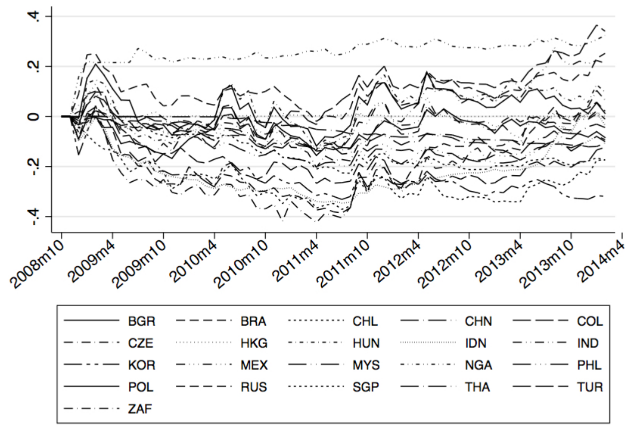
Figure 1: Federal Reserve Unconventional Asset Balance Sheet



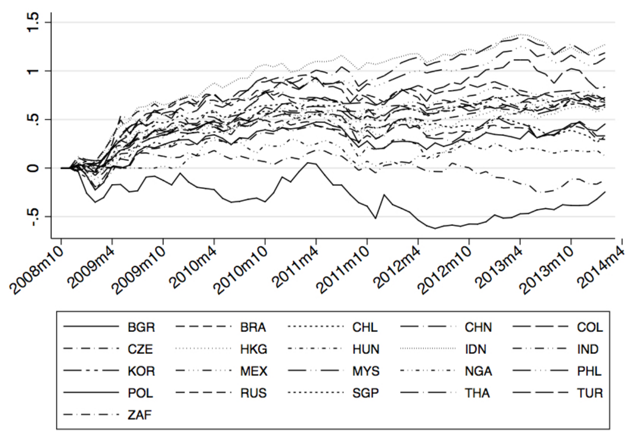
Source: Federal Reserve of St. Louis *FRED*, author's calculations.

Figure 2: Cumulative Change in Asset Prices

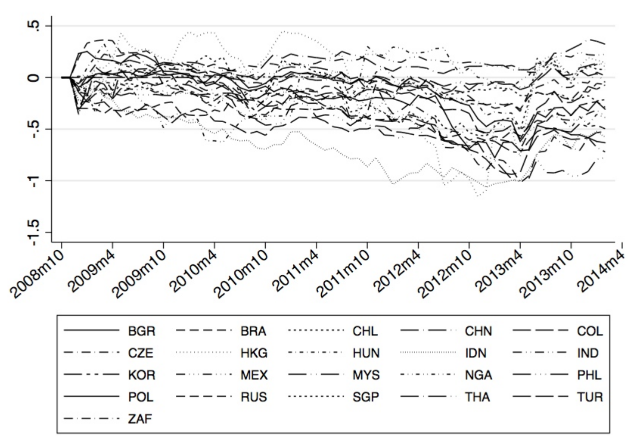
(a) Domestic currency to USD



(b) Equity market price index



(c) Yield on long-term sovereign debt



Note: Log of each series is taken and normalized to zero on November 2008. See table 3 for country code legend. Source: Datastream, author's calculations.

Table 1: Impact of LSAPs on Asset Prices, Country-Specific

Dependent Var:	$\Delta\ln(s_{it})$		$\Delta\ln(p_{it})$		$\Delta\ln(r_{it})$	
	(1)		(2)		(3)	
	$\hat{\beta}_i^s$	(se)	$\hat{\beta}_i^p$	(se)	$\hat{\beta}_i^r$	(se)
BGR	-0.815	(0.59)	1.601**	(0.77)	-0.500	(0.91)
BRA	-0.306**	(0.13)	0.480**	(0.20)	-0.108	(0.22)
CHL	-0.102	(0.10)	0.119	(0.16)	0.897***	(0.22)
CHN	-0.012	(0.02)	0.963***	(0.18)	-0.580	(0.47)
COL	-0.584**	(0.23)	-0.006	(0.15)	0.012	(0.18)
CZE	-0.407**	(0.16)	0.813***	(0.22)	-0.567	(0.41)
HKG	-0.013	(0.02)	0.498	(0.32)	-0.486	(0.93)
HUN	-0.577*	(0.31)	0.764***	(0.22)	-0.806*	(0.48)
IDN	-0.356***	(0.13)	0.464*	(0.26)	-0.869***	(0.33)
IND	-0.175	(0.21)	0.640**	(0.29)	-0.365	(0.41)
KOR	-0.672***	(0.13)	0.430***	(0.16)	-0.268	(0.27)
MEX	-0.614***	(0.23)	0.613***	(0.19)	-0.941	(0.66)
MYS	-0.324	(0.25)	0.801	(2.11)	-0.322	(1.78)
NGA	-0.047	(0.14)	0.526	(0.37)	-1.126	(0.86)
PHL	-0.086	(0.10)	0.161	(0.17)	0.106	(0.33)
POL	-0.725***	(0.21)	0.809***	(0.19)	-0.447***	(0.17)
RUS	-0.530***	(0.19)	0.588**	(0.26)	-0.400	(0.30)
SGP	-0.238**	(0.10)	0.466***	(0.17)	0.024	(0.45)
THA	-0.075	(0.16)	0.107	(0.22)	-0.494	(0.42)
TUR	-0.369**	(0.15)	0.745**	(0.29)	-11.862	(503.48)
ZAF	-0.418*	(0.23)	0.508***	(0.19)	-0.580**	(0.24)
$N^\dagger$	63		63		63	
Controls	Yes		Yes		Yes	
H$_0$: $\beta_i^y = \beta^y$						
$\chi^2(21)$:	90.49		40.37		39.45	
p-value:	0.00		0.00		0.00	

Robust standard errors in parentheses, $^*p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$. Each coefficient represents the $\hat{\beta}_i^y$ coefficient for country i from the estimation of equation (1):

$$\Delta\ln(y_{it}) = \eta_i^y + \beta_i^y \Delta\ln(lsap_t) + \boldsymbol{x}_{it}\boldsymbol{\alpha}_i^y + e_{it}^y$$

for $\Delta ln(y_{it}) \in \{\Delta ln(s_{i/\$,t}), \Delta ln(p_{it}), \Delta ln(r_{it})\}$. Countries are denoted in the first column. The vector of control variables $\boldsymbol{x}_{it}$ include: the lag of the log difference VIX index, the lag of the log difference U.S. Treasury yield, the lag of the log difference S&P 500 return, the log of market capitalization, and the log difference monetary base in the EME country (instrumented by its first lag). Regressions are estimated via two–stage least squares. $N^\dagger$ is the number of observations in each individual country regression, with the following exceptions: Thailand has 56 observations for bilateral exchange rate, Turkey has 49 observations for sovereign yields, and Nigeria has 53 observations for equity market price index. The sample period is from December 2008 – February 2014.

Table 2: Impact of LSAPs and Components on Asset Prices, Average EME

Dependent Variable:	$\Delta\ln(s_{i/\$,t})$		$\Delta\ln(p_{it})$		$\Delta\ln(r_{it})$	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\ln(lsap_t)$	-0.350***		0.592***		-0.352***	
	(0.05)		(0.06)		(0.10)	
$\Delta\ln(tr_t)$		-0.277***		0.479***		0.027
		(0.04)		(0.04)		(0.06)
$\Delta\ln(mbs_t)$		0.007***		0.007		0.020**
		(0.00)		(0.00)		(0.01)
$\Delta\ln(lq_t)$		0.001		0.002		-0.020
		(0.01)		(0.02)		(0.02)
Δln(Monetary Policy$_{it}$)	0.057	0.031	0.063	0.064	0.218	0.173
	(0.07)	(0.07)	(0.07)	(0.09)	(0.18)	(0.19)
ln(Stock Market Cap$_{it}$)	-0.004	-0.021***	0.031***	0.045***	0.012	-0.015
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δln(VIX$_{t-1}$)	0.020***	0.033***	-0.066***	-0.073***	0.050***	0.070***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Δln(U.S. Treasury Yield$_{t-1}$)	0.011	0.012	-0.079***	-0.093***	0.151***	0.126***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)
Δln(S&P 500$_{t-1}$)	0.109***	0.229***	-0.090**	-0.214***	0.177***	0.243***
	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)	(0.08)
Exchange Rate Regime$_{it}$	-0.000	-0.001	0.002	0.000	-0.002	-0.009
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Capital Inflow Controls$_{it}$	-0.006	-0.012	-0.018	-0.001	0.009	0.001
	(0.02)	(0.01)	(0.02)	(0.03)	(0.02)	(0.03)
Capital Outflow Controls$_{it}$	0.029**	0.027*	-0.015	0.000	0.107***	0.090***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1316	1276	1313	1273	1309	1269
R^2	0.11	0.14	0.17	0.16	0.06	0.06
F-Statistic (1st Stage)	17.01	18.70	21.71	23.87	14.30	15.28

Cluster robust standard errors (country-level) in parentheses $^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$. Regressions are estimated by 2SLS, with monetary policy proxied by the monetary base, which is instrumented by its first lag. F-statistic applies to the first stage of 2SLS. R^2 is from the second stage. The sample period is from December 2008 – February 2014.

Table 3: **Summary Statistics - Capital Market Frictions**

Country	**Code**	**Distance**	**FTA**	**Trading Hours**	**Language**	**North**	**Border**	$\overline{\frac{Trade}{GDP}}$(%)
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Bulgaria	BGR	7.59	1	0	0	1	0	9.12
Brazil	BRA	7.69	1	1	0	0	0	22.21
Chile	CHL	8.27	1	1	0	0	0	75.64
China	CHN	10.99	0	0	0	1	0	48.57
Colombia	COL	4.02	1	1	0	1	0	82.49
Czech Rep	CZE	6.57	1	1	0	1	0	18.07
Hong Kong	HKG	12.97	0	0	1	1	0	224.85
Hungary	HUN	7.01	1	1	0	1	0	19.75
Indonesia	IDN	16.18	1	0	0	0	0	26.95
India	IND	11.76	0	0	1	1	0	25.11
Korea	KOR	11.07	1	0	1	1	0	65.34
Mexico	MEX	3.37	1	1	0	1	1	328.33
Malaysia	MYS	15.13	1	0	0	1	0	108.65
Nigeria	NGA	8.49	0	1	0	1	0	64.89
Philippines	PHL	13.68	0	0	0	1	0	53.67
Poland	POL	6.86	1	1	0	1	0	8.75
Russia	RUS	7.52	0	1	0	1	0	11.54
Singapore	SGP	15.35	1	0	1	1	0	187.9
Thailand	THA	13.94	0	0	1	1	0	81.57
Turkey	TUR	8.07	0	1	0	1	0	20.19
South Africa	ZAF	12.58	1	1	1	0	0	33.62

Source: CEPII (Head and Mayer (2010, 2013)), IMF's Direction of Trade Statistics, Rose and Spiegel (2010), and author's calculations. "Distance" measures the physical distance between two countries, "FTA" is equal to one if there was a free trade agreement between the U.S. and each country during at least one year of the sample period or a free trade agreement in the negotiation stages,"Trading" is a dummy variable equal to one if the operating hours of the primary market in the country overlap with the New York Stock Exchange operating hours, "Language" is a dummy variable equal to one for english speaking countries, "North" is a dummy variable equal to one if country is in the Northern Hemisphere, "Border" is a dummy variable equal to one if the country shares a common border with the U.S., "$\overline{Trade}/GDP$" is calculate as the average ratio of bilateral exports plus imports with the U.S. to domestic GDP over the period November 2008–September 2014. See Data Appendix A, table A1 for details.

Table 4: Impact of LSAPs on Asset Prices, Role of Capital Market Frictions

Dependent Variable:	$\Delta ln(s_{i/\$t})$ (1)	$\Delta ln(p_{it})$ (2)	$\Delta ln(r_{it})$ (3)
$\Delta ln(lsap_t)$	-0.111	0.757*	-1.082***
	(0.13)	(0.46)	(0.37)
$\frac{1}{\ln(\text{Distance}_i)} \times \Delta ln(lsap_t)$	0.396	-0.616	2.103***
	(0.27)	(1.28)	(0.65)
$\text{FTA}_i^{Prop} \times \Delta ln(lsap_t)$	-0.278***	0.104	0.115
	(0.06)	(0.14)	(0.13)
$\text{Trading}_i \times \Delta ln(lsap_t)$	-0.216***	-0.083	-0.196
	(0.07)	(0.17)	(0.19)
$\text{Language}_i \times \Delta ln(lsap_t)$	-0.194***	0.011	-0.056
	(0.06)	(0.14)	(0.16)
$\text{North}_i \times \Delta ln(lsap_t)$	-0.256***	0.271**	-0.448
	(0.09)	(0.14)	(0.30)
$\text{Border}_i \times \Delta ln(lsap_t)$	-0.616***	1.061**	-1.435***
	(0.17)	(0.52)	(0.51)
$\left(\frac{\text{Trade}}{\text{GDP}}\right)_i \times \Delta ln(lsap_t)$	0.220***	-0.240*	0.287*
	(0.05)	(0.13)	(0.16)
$\Delta\text{ln}(\text{Monetary Base}_{it})$	0.040	0.061	0.220
	(0.06)	(0.07)	(0.19)
$\text{ln}(\text{Stock Market}_{it})$	-0.003	0.031***	0.013
	(0.01)	(0.01)	(0.01)
$\Delta\text{ln}(\text{VIX}_{U.S.,t-1})$	0.020***	-0.066***	0.050***
	(0.01)	(0.01)	(0.01)
$\Delta\text{ln}(\text{r}_{U.S.,t-1})$	0.010	-0.079***	0.151***
	(0.01)	(0.02)	(0.03)
$\Delta\text{ln}(\text{S\&P}_{U.S.,t-1})$	0.109***	-0.090**	0.176***
	(0.03)	(0.04)	(0.06)
Exchange Rate Regime_{it}	-0.001	0.002	-0.003
	(0.00)	(0.00)	(0.01)
Capital Inflow Controls_{it}	-0.007	-0.014	-0.001
	(0.02)	(0.02)	(0.02)
Capital Outflow Controls_{it}	0.029**	-0.019	0.115***
	(0.01)	(0.02)	(0.02)
Country FE	Yes	Yes	Yes
N	1316	1313	1309
R^2	0.15	0.18	0.06
$\text{H}_0 : \gamma_1^y = ... = \gamma_G^y = 0$			
$\chi^2(7)$:	111.59	85.84	28.90
p-value :	0.00	0.00	0.00
$\text{H}_0 : \beta^y = \gamma_1^y = ... = \gamma_G^y = 0$			
$\chi^2(8)$:	660.50	1676.86	155.42
p-value :	0.00	0.00	0.00
F-Statistic (1st Stage)	17.31	22.93	14.39

Cluster robust standard errors (country-level) in parentheses $^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0.01$. Regressions are estimated by 2SLS, with monetary policy proxied by the monetary base, which is instrumented by its first lag. F-statistic (1st stage) applies to the first stage of 2SLS. R^2 is from the second stage. χ^2 and p-value are from F-tests for joint significance of the coefficients on the $\boldsymbol{z}_i$-LSAP interaction terms (hypothesis test (5)) and for the coefficients on $\boldsymbol{z}_i \cdot \Delta\text{ln}(lsap_t)$ and $\Delta\text{ln}(lsap_t)$ terms (hypothesis (6)). The sample period is from December 2008–February 2014.

Table 5: Impact of LSAPs on Asset Prices, Macro Fundamentals

Dependent Variable:	$\Delta ln(s_{i/\$,t})$ (1)	$\Delta ln(p_{it})$ (2)	$\Delta ln(r_{it})$ (3)
$\Delta ln(lsap_t)$	-0.004	0.828	-0.790**
	(0.14)	(0.55)	(0.31)
$\frac{1}{\ln(\text{Distance}_i)} \times \Delta ln(lsap_t)$	0.176	-0.666	2.073***
	(0.27)	(1.39)	(0.56)
$\text{FTA}_i^{Prop} \times \Delta ln(lsap_t)$	-0.182**	0.055	0.291**
	(0.09)	(0.15)	(0.14)
$\text{Trading}_i \times \Delta ln(lsap_t)$	-0.248***	-0.118	-0.273
	(0.07)	(0.32)	(0.17)
$\text{Language}_i \times \Delta ln(lsap_t)$	-0.304***	-0.046	-0.015
	(0.08)	(0.30)	(0.12)
$\text{North}_i \times \Delta ln(lsap_t)$	-0.338***	0.342**	-0.827***
	(0.06)	(0.16)	(0.26)
$\left(\frac{\text{Trade}}{\text{GDP}}\right)_i \times \Delta ln(lsap_t)$	0.261***	-0.264	0.248**
	(0.05)	(0.16)	(0.10)
$\Delta\ln(\text{Monetary Base}_{it})$	0.048	0.003	0.053
	(0.08)	(0.10)	(0.12)
$\ln(\text{Market Cap}_{it})$	-0.010	0.045***	0.015
	(0.01)	(0.02)	(0.02)
$\Delta\ln(\text{VIX}_{t-1})$	0.026***	-0.071***	0.039**
	(0.01)	(0.01)	(0.02)
$\Delta\ln(\text{U.S. Treasury Yield}_{t-1})$	0.009	-0.104***	0.136***
	(0.01)	(0.02)	(0.04)
$\Delta\ln(\text{S\&P 500}_{t-1})$	0.130***	-0.019	0.145***
	(0.03)	(0.05)	(0.05)
$\text{Exchange Rate Regime}_{it}$	-0.006***	-0.001	-0.005
	(0.00)	(0.00)	(0.00)
$\text{Capital Inflow Controls}_{it}$	-0.005	-0.014	-0.003
	(0.02)	(0.02)	(0.02)
$\text{Capital Outflow Controls}_{it}$	0.013	-0.027	0.131***
	(0.01)	(0.02)	(0.03)
$\Delta\%(\text{CPI}_{t-1})$	-0.000	-0.001	-0.001
	(0.00)	(0.00)	(0.00)
$\Delta\%(\text{Unemployment}_{t-1})$	0.012*	0.000	0.012
	(0.01)	(0.01)	(0.01)
$\Delta\ln(\text{Reserves}_{t-1})$	0.037	-0.162***	0.035
	(0.04)	(0.05)	(0.10)
Country FE	Yes	Yes	Yes
N	857	864	850
R^2	0.17	0.20	0.09
$\text{H}_0 : \gamma_1^y = ... = \gamma_G^y = 0$			
$\chi^2(6)$:	117.21	17.89	122.76
p-value :	0.00	0.01	0.00
$\text{H}_0 : \beta^y = \gamma_1^y = ... = \gamma_G^y = 0$			
$\chi^2(7)$:	249.97	172.97	138.67
p-value :	0.00	0.00	0.00
F-Statistic (1st Stage)	14.33	14.50	11.14

Cluster robust standard errors (country-level) in parentheses $^*p < 0.1,^{**} p < 0.05,^{***} p < 0.01$. Estimating is via 2SLS, where the control for monetary policy is proxied by the monetary base, which is instrumented by its first lag. F-statistic (1st stage) applies to the first stage of 2SLS. χ^2 and p-value are from F-tests for joint significance of the coefficients on the $\boldsymbol{z}_i$-LSAP interaction terms (hypothesis test (5)) and for the coefficients on $\boldsymbol{z}_i \cdot \Delta\ln(lsap_t)$ and $\Delta\ln(lsap_t)$ terms (hypothesis (6)). Sample period is from December 2008–February 2014. The border-LSAP variable is dropped due to collinearity.

Table 6: Impact of LSAPs on Asset Prices, Explicit Capital Controls

Dependent Variable:	$\Delta ln(s_{i/\$t})$ (1)	$\Delta ln(p_{it})$ (2)	$\Delta ln(r_{it})$ (3)	$\Delta ln(s_{i/\$t})$ (4)	$\Delta ln(p_{it})$ (5)	$\Delta ln(r_{it})$ (6)
$\Delta ln(lsap_t)$	-0.258***	0.519***	-0.426***	-0.286	0.789**	-1.501***
	(0.07)	(0.13)	(0.12)	(0.18)	(0.36)	(0.39)
(1-Capital Inflow Control$_{it}$) $\times \Delta ln(lsap_t)$	-0.012	-0.009	0.429	0.263**	0.110	0.783*
	(0.20)	(0.27)	(0.48)	(0.11)	(0.24)	(0.41)
(1-Capital Outflow Control$_{it}$) $\times \Delta ln(lsap_t)$	-0.176	0.166	-0.349	-0.304**	0.235	-0.701***
	(0.21)	(0.24)	(0.36)	(0.12)	(0.22)	(0.26)
$\frac{1}{\ln(\text{Distance}_i)} \times \Delta ln(lsap_t)$				0.941**	-0.599	3.435***
				(0.45)	(1.06)	(1.22)
$\text{FTA}_i^{Prop} \times \Delta ln(lsap_t)$				-0.301***	0.012	0.018
				(0.06)	(0.13)	(0.18)
$\text{Trading}_i \times \Delta ln(lsap_t)$				-0.285***	-0.157	-0.410**
				(0.09)	(0.19)	(0.20)
$\text{Language}_i \times \Delta ln(lsap_t)$				-0.191***	-0.022	-0.088
				(0.05)	(0.12)	(0.15)
$\text{North}_i \times \Delta ln(lsap_t)$				-0.293***	0.180	-0.582*
				(0.08)	(0.16)	(0.30)
$\text{Border}_i \times \Delta ln(lsap_t)$				-0.782***	1.322***	-1.709***
				(0.17)	(0.41)	(0.46)
$\left(\frac{\text{Trade}}{\text{GDP}}\right)_i \times \Delta ln(lsap_t)$				0.228***	-0.300***	0.278**
				(0.05)	(0.10)	(0.13)
$\Delta\ln(\text{Money}_{it})$	0.049	0.073	0.203	0.031	0.075	0.193
	(0.06)	(0.07)	(0.18)	(0.06)	(0.08)	(0.19)
Exchange Rate Regime$_{it}$	-0.001	0.002	-0.003	-0.001	0.002	-0.004
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
ln(Stock Market$_{it}$)	-0.004	0.031***	0.011	-0.003	0.031***	0.014
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\Delta\ln(\text{VIX}_{U.S.,t-1})$	0.021***	-0.067***	0.053***	0.021***	-0.067***	0.053***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\Delta\ln(\text{r}_{U.S.,t-1})$	0.011	-0.079***	0.153***	0.010	-0.079***	0.152***
	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.03)
$\Delta\ln(\text{S\&P}_{U.S.,t-1})$	0.110***	-0.091**	0.182***	0.111***	-0.091**	0.182***
	(0.03)	(0.04)	(0.06)	(0.03)	(0.04)	(0.06)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1316.00	1313.00	1309.00	1316.00	1313.00	1309.00
R^2	0.12	0.17	0.05	0.15	0.18	0.06
F-Statistic (1st Stage)	17.09	21.89	14.62	17.07	22.77	14.41
$\text{H}_0 : \gamma_1^y = ... = \gamma_G^y = 0$						
$\chi^2(2)$:	1.72	0.86	0.93			
$\chi^2(9)$:				173.60	73.96	69.76
p-value :	0.42	0.65	0.63	0.00	0.00	0.00
H_0: Cap. Inflow $\times \Delta ln(lsap_t)$ =Cap. Outflow $\times \Delta ln(lsap_t) = 0$						
$\chi^2(2)$:				7.04	3.93	8.62
p-value :				0.03	0.63	0.01
$\text{H}_0 : \beta^y = \gamma_1^y = ... = \gamma_G^y = 0$						
$\chi^2(3)$:	60.56	95.21	22.49			
$\chi^2(10)$:				858.78	2252.90	209.19
p-value :	0.00	0.00	0.00	0.00	0.00	0.00

Cluster robust standard errors (country-level) in parentheses $^{*}p < 0.1, ^{**} p < 0.05, ^{***} p < 0.01$. Regressions are estimated by 2SLS, with monetary policy proxied by the monetary base, which is instrumented by its first lag. F-statistic (1st stage) reports the F-statistic for the first stage of 2SLS. χ^2 is from the second stage. χ^2 and P-value are from F-tests for joint significance of the coefficients on the $\boldsymbol{z}_i$-LSAP interaction terms (hypothesis test (5)) and for the coefficients on $\boldsymbol{z}_i \cdot \Delta$ ln $(lsap_t)$ and Δ ln $(lsap_t)$ terms (hypothesis (6)). The sample period is from December 2008–February 2014. One minus capital inflow/outflow are used so as to be consistent with the measurement of the $\boldsymbol{z}_{it}$-vector of capital market friction variables — thus a larger value indicates *lesser* capital controls.

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References

Ahmed, S. and A. Zlate (2014). Capital flows to emerging market economies: a brave new world? *Journal of International Money and Finance 48*, 221–248.

Ahrend, R. and C. Schwellnus (2012). Do investors disporportionately shed assets of distant countries during global financial crises? The role of increased uncertainty. *OECD Journal: Economic Studies 2012/1.*

Aizenman, J., M. Binici, and M. M. Hutchison (2014). The transmission of Federal Reserve tapering news to emerging financial markets. *National Bureau of Economic Research Working Paper 19980.*

Anderson, J. E. and E. van Wincoop (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review 93*(1), 170–192.

Bauer, M. D. and C. J. Neely (2014). International channels of the Fed's unconventional monetary policy. *Journal of International Money and Finance 44*, 24–46.

Bauer, M. D. and G. D. Rudebusch (2014). The signalling channel for Federal Reserve bond purchases. *International Journal of Central Banking 10*(3), 233–289.

Berkel, B. (2007). Institutional determinants of international equity portfolios - a country-level analysis. *The B.E. Journal of Macroeconomics 7*(1), 428–447.

Bowman, D., J. M. Londono, and H. Sapriza (2015). U.S. unconventional monetary policy and transmission to emerging market economies. *Journal of International Money and Finance 55*, 27–59.

Chen, Q., A. J. Filardo, D. He, and F. Zhu (2012). International spillovers of central bank balance sheet policies. *BIS Paper* (66).

Chitu, L., B. Eichengreen, and A. J. Mehl (2013). History, gravity and international finance. *National Bureau of Economic Research* (18697).

Christensen, J. H. and G. D. Rudebusch (2012). The response of interest rates to U.S. and U.K. quantitative easing. *The Economic Journal 122*(564), F385–F414.

Coeurdacier, N. (2009). Do trade costs in goods markets lead to home bias in equities? *Journal of International Economics 77*(1), 86–100.

Coeurdacier, N. and S. Guibaud (2011). International portfolio diversification is better than you think. *Journal of International Money and Finance 30*(2), 289–308.

Dahlhaus, T. and G. Vasishtha (2014). The impact of U.S. monetary policy normalization on capital flows to emerging-market economies. *Bank of Canada Working Paper* (2014-53).

Ehrmann, M. and M. Fratzscher (2009). Global financial transmission of monetary policy shocks. *Oxford Bulletin of Economics and Statistics 71*(6), 739–759.

Eichengreen, B. and P. Gupta (2014). Tapering talk: the impact of expectations of reduced Federal Reserve security purchases on emerging markets. *World Bank Policy Research Working Paper* (6754).

Faruqee, H., S. Li, and I. K. Yan (2004). The determinants of international portfolio holdings and home bias. *IMF Working Paper 2004-34*.

Fawley, B. W. and C. J. Neely (2013). Four stories of quantitative easing. *Federal Reserve Bank of St. Louis Review 95*(January/February 2013).

Fernandez, A., M. Klein, A. Rebucci, M. Schindler, and M. Uribe (2015). Capital control measures: A new dataset. *National Bureau of Economic Research* (Working Paper 20970).

Fidora, M., M. Fratzscher, and C. Thimann (2007). Home bias in global bond and equity markets: The role of real exchange rate volatility. *Journal of International Money and Finance 26*, 631–655.

Forbes, K. (2010). Why do foreigners invest in the United States? *Journal of International Economics 80*, 3–21.

Fratzscher, M. (2012). Capital flows, push versus pull factors and the global financial crisis. *Journal of International Economics 88*(2), 341–356.

Fratzscher, M., M. L. Duca, and R. Straub (2013). On the international spillovers of US quantitative easing. *ECB Working Paper 1557*.

Galstyan, V. and P. R. Lane (2013). Bilateral portfolio dynamics during the global financial crisis. *European Economic Review 57*, 63–74.

Hausmann-Guil, G., E. van Wincoop, and G. Zhang (2014, November). The great recession: Divide between integrated and less integrated countries. *IMF Economic Review (Under Review)*.

Head, K. and T. Mayer (2014). *Handbook of International Economics*, Volume 4, Chapter 3 Gravity Equations: Workhorse, Toolkit, and Cookbook, pp. 131–195. Elsevier.

Kalemli-Ozcan, S., E. Papaioannou, and F. Perri (2013). Global banks and crisis transmission. *Journal of International Economics 89*, 495–510.

Lane, P. and G. M. Milesi-Ferretti (2008). International investment patterns. *Review of Economics and Statistics 90*(3), 538–549.

Lim, J. J., S. Mohapatra, and M. Stocker (2014). Tinker, taper, QE, bye? the effect of quantitative easing on financial flows to developing countries. *World Bank Policy Research Working Paper* (6820).

Lo Duca, M., G. Nicoletti, and A. V. Martinez (2014). Global corporate bond issuance: What role for US quantitative easing? *ECB Working Paper 1649*.

Martin, P. and H. Rey (2004). Financial super-markets: size matters for asset trade. *Journal of International Economics 64*(2), 335–361.

McGettigan, D., K. Moriyama, J. N. Ndela Ntsama, F. Painchaud, H. Qu, and C. Steinberg (2013). Monetary policy in emerging markets: Taming the cycle. *IMF Working Paper 96*.

Milesi-Ferretti, G.-M. and C. Tille (2011). The great retrenchment: International capital flows during the global financial crisis. *Economic Policy 26*(66), 289–346.

Miyajima, K. and I. Shim (2014). Asset managers in emerging market economies. *BIS Quarterly Review September*.

Mohanty, M. S. (2014). The transmission of unconventional monetary policy to the emerging markets — An overview. *BIS Paper* (78a).

Moore, J., S. Nam, M. Suh, and A. Tepper (2013). Estimating the impacts of US LSAPs on emerging market economies' local currency bond markets. *Federal Reserve Bank of New York Staff Report 595*.

Neely, C. J. (2010). Unconventional monetary policy had large international effects. *Federal Reserve Bank of St. Louis Working Paper No 2010*.

Obstfeld, M. and K. Rogoff (2001). The six major puzzles in international macroeconomics: is there a common cause? In *NBER Macroeconomics Annual 2000, Volume 15*, pp. 339–412. MIT press.

Okawa, Y. and E. Van Wincoop (2012). Gravity in international finance. *Journal of International Economics 87*(2), 205–215.

Portes, R. and H. Rey (2005). The determinants of cross-border equity flows. *Journal International Economics 65*, 269–296.

Portes, R., H. Rey, and Y. Oh (2001). Information and capital flows: The determinants of transactions in financial assets. *European Economic Review 45*(4-6), 783–796.

Rey, H. (2015). Dilemma not trilemma: The global financial cycle and monetary policy independence. *National Bureau of Economic Research* (Working Paper 21162).

Rose, A. K. and M. M. Spiegel (2010). Cross-country causes and consequences of the 2008 crisis: International linkages and American exposure. *Pacific Economic Review 15*(3), 340–363.

Rose, A. K. and M. M. Spiegel (2011). Cross-country causes and consequences of the crisis: An update. *European Economic Review 55*(3), 309–324.

A Data Appendix

Table A1: Data Definition and Sources

Variable	Source	Definition
$s_{i/\$,t}$	Datastream	Nominal exchange rate, expressed as the ratio of local currency to USD. Monthly frequency, end-of-period values..
p_{it}	Datastream	Datastream equity price index, calculated on a representative list of stocks that covers a minimum of 75-80% of total market capitalization. Monthly frequency, end-of-period values..
r_{it}	Datastream	Thomson Reuters Government Benchmark ten-year bid yields, local currency, reported at end of day directly from the databases of record. Monthly frequency, end-of-period values.
$lsap_t$	Federal Reserve of St. Louis *Federal Reserve Economic Data* (FRED)	Sum of reported holdings of U.S. Treasury Securities maturing over 5 years (not seasonally adjusted), mortgage-backed securities (all maturities, not seasonally adjusted), central bank liquidity swaps of all maturities, Federal Reserve agency debt securities (all maturities), and other loans (all maturities).
Distance_i	Head and Mayer (2014) *CEPII*	Circle distance between large cities of the two countries.
Language_i	Rose and Spiegel (2010)	Dummy variable equal to one if the primary language spoken is english.
North_i	Rose and Spiegel (2010)	Dummy variable equal to one if the country is located in the northern hemisphere.
FTA_i^{Prop}	World Trade Organization (WTO)	Dummy variable equal to one if country has a free-trade agreement in place or in negotiations with the U.S.
Trading_i	WTO	Dummy variable equal to one when trading hours of the main market overlaps with the trading hours of the New York Stock Exchange (NYSE).
Border_i	Rose and Spiegel (2010)	Dummy variable equal to one if country has a shared border with the U.S.
$\frac{\text{Trade}_i}{\text{GDP}_i}$	IMF *Direction of Trade Statistics* (DOTS), author's calculations	Average ratio of bilateral trade (exports plus imports) with the U.S. to domestic annual GDP over the sample period. Monthly trade data are normalized by the corresponding annual value of GDP, due to data limitations for quarterly and monthly frequency GDP series.
Monetary Base_{it}	*International Financial Statistics* (IFS)	IFS monetary base, M2 when not available.
Policy Rate_{it}	IFS, Central Bank of Poland, Central Bank of India	Central bank policy rate, percent per annum. When not available, use the deposit rate (IFS), repurchase agreement rate (Poland), or the reverse repo rate (India). All at monthly frequency, except India whose reports are not reported at a monthly frequency. Monthly series is generated by filling in monthly rates with the last available rate.

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Table A1 – continued from previous page

Variable	Source	Definition
Stock Market$_{it}$	World Bank *World Development Indicators*	Market capitalization, annual frequency.
r$_{U.S.,t}$	FRED	U.S. Treasury bill yield, monthly frequency.
VIX$_{U.S.,t}$	Chicago Board Options Exchange	CBOE VIX index measuring market's expectation of 30-day volatility. Constructed using the implied volatilities of a range of S&P 500 index options. Monthly frequency, end-of-period values.
S&P$_{U.S.,t}$	FRED	S&P 500 index. Monthly frequency, end-of-period values.
Exchange Rate Regime$_{it}$	IMF *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER)	Dummy variable equal to one if a country has a flexible exchange rate regime. Define "flexible" to include countries with AREAER classification "Free Floating", "Floating", or "Other Managed Arrangement". Classifications "Pegged exchange rate Within Horizontal Bands", "Crawl-Like Arrangement", "Crawling Peg", "Stabilized Arrangement", "Conventional Peg", "Currency Board", and "No Separate Legal Tender", are "non-flexible".
Capital Inflow/Outflow$_{it}$	Fernandez, Klein, Rebucci, Schindler, and Uribe (2015)	Aggregate capital inflow and outflow control. Calculated as an average of the level of controls in ten asset categories for capital inflows and outflows, respectively. The indices take on a value between zero and one, one representing the highest intensity of controls. Extend the 2013 values for 2014.
BOE_t	Bank of England	Sum of the amounts outstanding of: sterling short-term market operations with BOE counter-parties, sterling long-term operations with BOE counter-parties, sterling ways and means advances to Her Majesty's (HM) government, bonds and other securities acquired via market transactions, and other assets, "other assets" category is primarily gilts.
BOJ_t	Bank of Japan	Sum of the amounts outstanding of: foreign currency assets, financing and treasury bills, Japanese government bonds, loans by funds-supplying operations against pooled collateral, receivables under resale agreement, commercial paper, corporate bonds, pecuniary trusts, asset backed securities, gold, cash, deposits with agents, loans and discounts, and other assets.
r$_{JPY,t}$	FRED	Japanese ten-year sovereign yield, monthly frequency.
r$_{UK,t}$	FRED	UK ten-year sovereign yield, monthly frequency.
VIX$_{JPN,t}$	Datastream	The Nikkei Stock Average Volatility Index. Calculated using prices of Nikkei 225 futures and Nikkei 225 options on the Osaka Exchange (OSE). Monthly frequency, end-of-period values.

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Table A1 – continued from previous page

Variable	Source	Definition
$\text{VIX}_{UK,t}$	Datastream	The FTSE 100 Implied Volatility Index. Measures the interpolated 30,60, 90, 180 and 360 day annualized implied volatility of the underlying FTSE 100 Index. Monthly frequency, end-of-period values.