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ABSTRACT

This paper provides a novel perspective on the impact of U.S. unconventional monetary policy (UMP) on emerging market capital flows and asset prices. Using high-frequency Treasury futures data to identify U.S. monetary policy shocks, we find, through the lens of an affine term structure model, that these shocks represent revisions to both the expected path of short-term interest rates and required risk compensation. The risk compensation component is especially important during the UMP periods. Further, we find that these high-frequency policy shocks do exhibit sizable effects on U.S. holdings of emerging market assets and their valuations. We also document that the relative effects of U.S. monetary policy shocks are larger for emerging asset returns relative to physical capital flows, and they are largest for emerging equity markets relative to fixed income markets. Last, these effects are largest when the Federal Reserve is engaged in "tapering" its large-scale asset purchase program.

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1. Introduction

The massive surge of foreign capital to emerging markets in the aftermath of the global financial crisis (GFC) of 2008–2009 has led to a contentious debate about the international spillover effects of developed-market monetary policy with particular emphasis on the United States (Fratzscher, Lo Duca, and Straub 2013, Rey 2014). The monetary policy decisions of the U.S. Federal Reserve during the crisis had a primarily domestic focus to stimulate growth in its aftermath. However, these policy actions led to substantial spillover effects for emerging-market economies (Fratzscher, Lo Duca, and Straub 2013). As interest rates in developed economies remained low, investors were attracted to the higher rates in many emerging economies (Fratzscher 2012).

The surge in foreign capital led Brazilian President Dilma Rousseff to evocatively claim that advanced economy monetary policy had unleashed a "monetary tsunami" in the developing world.[2] The governor of Taiwan's central bank, Perng Fai-Nan echoed this sentiment, "The U.S. printed a lot of money, so there's a lot of hot money flowing around. We see hot money in Taiwan and elsewhere in Asia. . . . These short-term capital flows are disturbing emerging economies." Later, announcements by the Fed suggesting that an unwinding of quantitative easing was imminent appeared to trigger a selloff in emerging markets; "taper talk" may have signaled looming increases in borrowing costs and other market disruptions in emerging countries.

Using a relatively recently developed technique to identify U.S. monetary policy shocks, we ask examine the effects of (unconventional) U.S. monetary policy on emerging market capital flows and asset prices. We exploit the development of a budding literature on the use of high-frequency data to identify monetary policy shocks to the more precisely address the magnitude of any attendant spillover effects. With this technology in hand, we can further decompose and quantify these effects. This paper answers these questions using a dataset on global capital flows and positions from the U.S. Department of Treasury, capturing U.S. investment positions in emerging market asset markets and their valuations. While previous studies use these data in other

[2] http://articles.economictimes.indiatimes.com/2012-03-28/news/31249809_1_india-and-brazil-brazil-today-brazilian-president-dilma-rousseff

contexts,[3] we shed new light on the link between U.S. monetary policy shocks, net capital flows, and emerging market equity and bond market returns.

Our first step is to identify monetary policy shocks at the zero lower bound (ZLB) — and the task is not straightforward. For example, as Christiano, Eichenbaum, and Evans (1999) make clear; the literature has not converged on a unifying set of assumptions to identify exogenous shocks to monetary policy (even for the pre-crisis period). The primary methods of identifying monetary policy shocks in the literature fall into three general categories. They are (i) panel estimation with announcement dummies (Fratzscher, Lo Duca and Straub 2013; Ahmed and Zlate 2014;), (ii) structural VARs (Zha 1997, Dedola, Rivolta, and Stracca, 2015), and (iii) high-frequency identification (HFI) schemes (Gilchrist, Yue and Zakrajsek 2014; Neely 2010; Mishra, Moriyama, N'Diaye and Nguyen 2014). Although the particular details vary, the benefits of each methodology lie in the data used for monetary policy shock identification and usually depend on the frequency of the chosen data.

As mentioned above, we follow the rapidly growing set of papers that employ high-frequency identification of monetary policy shocks by extracting the unexpected component from Treasury futures contracts. While expectations of Fed policy actions are not directly observable, futures prices are associated with a traded derivative contract, providing a “market-based proxy” for these expectations (Kuttner 2001). Given that actual rate changes were largely absent during most of the crisis and post-crisis periods, the Fed has relied heavily on forward guidance to manage expectations about future Fed policy. During the QE period, FOMC statements, for the most part, worked to manage expectations that the policy rate would continue near the ZLB and had an explicit goal of influencing longer-term interest rates. Changes in the price of derivatives contracts such as Treasury futures can therefore reflect changes in the perceived probability of future Fed policy. In this setting, we follow Rogers, Scotti, and Wright (2014) to measure monetary surprises at the ZLB as the change in futures-implied yields bracketing FOMC announcements. With these observed policy shocks in hand, we then regress measures of net capital flows and asset returns on the extracted shocks in a panel setting to more precisely gauge the degree to which emerging markets are affected by U.S. monetary (especially, unconventional) policy.

[3] Examples include Curcuru et al (2010) and Bertaut, Griever and Tryon (2006).

Before proceeding, it is important to recognize that during ordinary times, monetary policy can generate spillovers to emerging markets through conventional channels (Kim 2001; Obstfeld and Rogoff 1995). However, additional transmission channels are possible because the period of unconventional monetary policy has involved heavier management of expectations and efforts to exert direct control further along the yield curve.[4] A unifying question is the degree to which monetary shocks represent revisions in market participants' expectations about the path of short-term interest rates and / or changes in their required risk compensation. To interpret the nature of the shocks extracted from the Treasury bond futures market, we use a common affine term structure model (see Kim and Wright 2005). We find that our monetary policy shocks, in part, represent revisions in expectations about short-term interest rates, but even more significantly, they capture changes in required risk compensation. The important role for time-varying risk compensation is particularly true during the periods of unconventional monetary policy.

Using panel data and high-frequency identification, we then turn to our main contribution. We examine the impact of measured, high-frequency U.S. monetary policy surprises around FOMC meetings on capital flows from the United States to a range of emerging markets as well as the associated emerging market valuations. The benchmark specification estimates the impact of monetary surprises for both equity and debt instruments as a percent of annual GDP for: (i) total positions, (ii) valuation changes (e.g., returns) and (iii) capital flows, as well as an examination of any attendant exchange rate effects.

Our results reveal heterogeneity along three principal lines: flows versus prices, debt versus equity, and quantitative easing versus tapering. Among these, the most robust finding is that valuation changes for both debt and equity played a key role in the change in overall positions observed between sub-periods. That is, in nearly every specification, the effect of monetary policy shocks on asset returns is larger than that for physical flows. This finding is consistent with the notion that our shocks may capture a revision in required risk compensation across financial markets. We also find that (scaled) equity positions and valuations are more sensitive to monetary policy shocks—across three sub-periods, equity valuation effects are an order of magnitude larger than debt valuation

[4] See Fratzscher et al 2014 for a comprehensive summary.

effects. During the QE period, for instance, the coefficient on equity valuations in response to a monetary policy shock is ten times higher than the coefficient on debt valuations.

While we detect some significant effects of monetary policy on flows and valuations during the QE period, the effects are not consistent over all dependent variables. However, during the period following the first mention of asset purchase tapering, we find a consistent and large effect of monetary policy shocks on nearly all variables of interest. In particular, we find that the effects of monetary policy on debt flows during the taper period are much higher and statistically significant than during the QE period. Further, the effects on debt and equity positions, flows, and valuations during the taper period are an order-of-magnitude larger compared to the pre-crisis period in nearly every specification.

The coefficient estimates on the monetary surprise measures during the taper period suggest that the market interpreted the unwinding of unconditional monetary policy as a signal that normalcy was being restored to the U.S. economy and, consistent with both the signaling and portfolio balance channels, expected monetary tightening in the U.S. both in the near-term and ongoing in the future led to a massive retrenchment from emerging markets.

A significant advantage of extracting the *magnitude* of the monetary surprises directly from futures data is that we can estimate a dollar amount in terms of the changes in U.S. investor positions and flows into emerging markets, controlling for a variety of push and pull factors. Previous studies that use period indicator variables or alternative approaches to examine U.S. monetary policy spillovers are only able to make qualitative statements about the direction of impact. In contrast, using derivatives price changes we can quantify the impact of U.S. monetary policy on emerging market capital flows depending on the magnitudes, signs, and dispersion of the extracted monetary policy shocks. A richer picture emerges from our approach, whereby we can make distributional predictions that are more in line with emerging markets' varied experience across both markets and time periods.

Our paper is related to previous studies that examine the effect of unconventional monetary policy on capital flows using panel data on emerging markets by including indicators for the dates of FOMC meetings and speeches by the Fed Chair, along with a number of fundamental control variables (Fratzscher, Lo Duca and Straub 2013; Ahmed and Zlate 2014; Aizenman, Binici and Hutchison 2014). The main findings are that quantitative easing in the U.S. was an important driver of capital flows into emerging economies (Ahmed and Zlate 2014), although the effects varied across episodes and importantly, the impact of QE on asset prices was greater than that on flows (Fratzscher, Lo Duca and Straub 2013).

Event studies that use high-frequency identification suggest that U.S. unconventional monetary policy had a significant effect on interest rates in both advanced and emerging economies. Focusing on both the QE and taper periods, Mishra, Moriyama, N'Diaye and Nguyen (2014) find that taper talk had a significant effect on bond yields, exchange rates, and equity prices, but that better country fundamentals and stronger trade ties with China mitigated the effect. Karolyi and McLaren (2016) show that the initial tapering announcement in 2013 had negative valuation impacts overall, but that emerging market stocks with larger positive cumulative abnormal returns around earlier LSAP purchase announcements were particularly hard hit in 2013. Our nearest neighbor in this literature uses factor analysis to separate market and signal factors from changes in bond yields around FOMC events, finding that unconventional monetary policy surprises had larger effects on equity prices, exchange rates, bond yields and mutual fund flows than those during conventional periods, finding additionally that "signal" shocks—those that portend the path of future interest rates—generate larger and more ubiquitous spillovers (Chen et al. 2014).

The paper proceeds as follows. Section 2 briefly describes the related literature on U.S. monetary policy and capital flows to emerging markets with an emphasis on identifying monetary policy shocks and measuring spillovers at the zero lower bound. Section 3 presents our methodology for extracting monetary policy surprise measures using high-frequency identification and explores their relationship to revisions in expectation about future short rates and term premia. Section 4 describes the data and methodology for measuring capital flows and presents summary statistics. Section 5 presents the benchmark specification and the regression results. Section 6 concludes.

2. Related Literature

The literature on the pattern of international capital flows separates determinants into push factors which are common, global factors associated with external shocks, and pull factors, which are country-specific. Push factors alter the relative attractiveness of investing in developed countries. Global volatility (the VIX an often employed proxy), global liquidity, global interest rates and global growth are considered push factors—their variation is thought to drive phenomena such as search for yield or flight to safety which may affect developed market flows to or from emerging economies (Calvo et al 1993). There is strong evidence in the literature for the impact of global risk aversion and developed-economy interest rates, and there is some evidence for the effect of advanced-economy output growth (Fratzscher 2012; Fratzscher et al 2014; Passari and Rey 2015; Milesi Ferretti and Tille 2011; Broner et al 2013; Forbes and Warnock 2012).

Pull factors, on the other hand, change the risk-return characteristics of emerging-market assets. These include country characteristics such as financial sector development, domestic interest rates and asset returns, integration with global financial markets, fiscal position and domestic growth shocks. While the balance of evidence suggests that push factors are a more powerful determinant of capital flows, there is some evidence that domestic output growth, domestic interest rates or asset returns and country risk indicators have an impact on capital flows, as well (Ahmed and Zlate 2013; Fratzscher 2012).[5]

A third set of factors that fall partially under each of the previous two are related to contagion, trade linkages, financial linkages and location, which may also play a role in driving portfolio and banking flows. These are addressed in a separate literature on financial contagion. Although we do not focus on contagion directly, by measuring the impact of U.S. monetary policy on flows to and from a broad set of emerging markets, we are attempting to identify the size of flows induced by a global financial shock.

2.1 U.S. Monetary Policy and Capital Flows to Emerging Markets: Spillovers at the Zero Lower Bound

The period of unconventional monetary policy has involved a heavier management of expectations and efforts to exert direct control further along the yield curve. Additional channels of monetary policy transmission in operation include the portfolio balance, signaling, confidence, and liquidity (Krishnamurthy and Vissing-Jorgensen 2011; Neely 2010; Fratzscher 2012; Fratzscher et al 2014; Lim et al 2014).

[5] Capital flows driven by pull factors may be more desirable when the intrinsic quality of these assets attracts foreign investors, as they may be more committed to these positions and less likely to unwind them quickly.

Based on the usual decomposition of yields on safe long-term government bonds, there are two potential elements of the yield curve that central bank bond purchases can affect: the average level of short-term interest rates over the maturity of the bond and the term premium. Specifically, consider the yield on an *n*-year bond as decomposed in the asset pricing literature: as the average of expected overnight rates over the life of the bond and a term premium:

$$Y_{t;t+n} = Y^{EH}_{t:t+n} + YTP_{t;n} \tag{1}$$

where $Y^{EH}_{t:t+n}$ is the average short term rate expected over the period t to $t+n$ (that is, the component of the yield that would drive yield variation if the expectations hypothesis were to hold), and $YTP_{t;n}$ is a maturity-specific term premium. We next address each potential channel' s relationship to this yield decomposition in turn.

First, the portfolio balance channel results from a confluence of forces. Quantitative easing involves the purchase of longer-duration assets, which reduces the effective supply of such assets to private investors, thereby raising their price and lowering yields. As investors rebalance their portfolios in response to quantitative easing, the prices of the assets they buy should rise as well, decreasing their respective yields.[6] Thus, we can expect that, if the portfolio balance channel dominates, a loosening of monetary policy via quantitative easing will result in increased flows to emerging markets as investors substitute toward emerging-market assets in search of higher yields. Likewise, we would expect that a contractionary monetary policy incentivizes investors to rebalance in favor of U.S. Treasuries. Thus, if the portfolio channel is in operation we expect that monetary policy shocks will be inversely correlated with emerging market flows and valuations.

Additionally, if investors demand a premium for holding longer-term bonds, then the term premium ($YTP_{t;n}$ above) will also be influenced by the relative supply of long term assets. If the Fed removes long-term securities from the market, i.e. duration risk, investors should require a smaller premium to hold the reduced quantity of long-term securities. Overall yields can fall once again prompting a rebalancing toward higher yield emerging market assets.

[6] http://www.federalreserve.gov/newsevents/speech/bernanke20120831a.htm

Although quantitative easing does not directly affect short-term interest rates, it may serve as a signal to markets regarding the future path of interest rate policy. This signaling channel operates as follows. If taken as a commitment by the Fed to keep future policy rates lower than previously expected, the signaling channel would suggest lower yields associated with a lower the average expected short-rate, $Y_{t:t+n}^{EH}$ in equation (1) (Fratzscher et al 2014; Neely 2010; Lim et al 2014).

In the context of emerging market capital flows, the ongoing large scale asset purchases (LSAPs) can signal that large interest rate differentials between advanced economy yields with respect to emerging markets are expected to persist. In the literature on capital flows, the interest rate differential may trigger a carry trade, resulting in sizeable capital flows into emerging markets (Galati, Heath and McGuire 2007). As in the case of the portfolio balance channel, we would expect the coefficient on a monetary policy shock dominated by the signaling channel to be negative.

The confidence channel of unconventional monetary policy, which is closely related to the signaling channel, can influence portfolio decisions and asset prices by altering the risk appetite of investors; for example, an announcement of tapering might serve as a signal that the FOMC is feeling sanguine about global economic prospects, lowering relative risk aversion and, consistent with predictions from the literature on capital flow determinants, increasing capital flows to emerging markets. Reduced confidence, in contrast, can lead to capital outflows from emerging markets or a flight to safety. We would thus expect a loosening monetary policy shock dominated by the confidence channel to drive capital outflows from emerging markets.

Quantitative easing can also affect portfolio decisions and asset prices by altering the liquidity premium (Krishnamurthy and Vissing-Jorgensen 2011; Neely 2010), and thus the efficiency of markets. In practice, LSAPs are credited in the form of increased reserves on private bank balance sheets (Krishnamurthy and Vissing-Jorgensen 2011). Since such reserves are more easily traded in secondary markets than are long-term securities, the liquidity premium decreases. Thus, liquidity-constrained banks can extend credit to borrowers, resulting in decreased borrowing costs and elevated lending levels. However, before we can identify the various channels through which unconventional monetary policy operates, we must first identify it.

3. Extracting Monetary Policy Surprise Measures Using High-Frequency Identification

Using high frequency identification allows us to make several unique contributions to the literature on the spillover effects of U.S. monetary policy on emerging market capital flows. For example, panel estimation using dummies only for event dates thought to contain a surprise Treasury rate change may fail to include dates that are not widely-recognized as surprises or may miss dates that contain a surprise insofar as rates did not change. Similarly, studies that use simple changes in the Treasury yields may lead to an attenuated estimated monetary policy effect if the lack of any change is itself a surprise. Finally, using dummies to identify a monetary policy shock obscures the magnitude of the shock. Using high-frequency identification and conditioning on the magnitudes of the monetary surprises we are able to quantify the impact on capital flows to emerging markets.

The abundance of short-term interest rates that potentially measure federal funds rate expectations has led to a proliferation of asset price-based monetary policy expectation measures emanating from Kuttner (2001). Among the short-term variables found in use in this literature are the current-month federal funds futures contract price, the month-ahead federal funds futures contract price, the one-month Eurodollar deposit rate, the three-month Treasury bill rate, and the three-month Eurodollar futures rate.

Gürkaynak, Sack and Swanson (2005, 2007) and Gürkaynak (2005) propose alternative shock measures that capture changes in market *expectations* of the policy rate over slightly longer horizons. Since December 2008, however, there have been almost no changes in the target federal funds rate, and, until recently, FOMC statements for the most part worked to maintain the perception that the policy rate would continue near zero. In this setting, and in light of QE`s explicit goal of influencing longer-term interest rates, we use a measure of monetary policy shocks at the ZLB as in Rogers, Scotti and Wright (2014). Following their methodology, we measure U.S. monetary policy surprises as the change in futures-implied yields bracketing FOMC announcements. Specifically, the surprise is the daily change in five-year Treasury futures on the date of FOMC announcements.

To construct our baseline monetary policy shocks, we used the daily difference in the implied yield of the five-year Treasury bond futures contract on potential dates for monetary policy surprises. The majority of our dates are FOMC meetings and conference calls from the Federal Reserve Board website, https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm. The remaining events are taken from Gagnon et al (2011). Finally, we include the "Taper Tantrum" episode of May 22, 2013. Table 1 displays summary statistics for our main monetary policy shock measure and for three additional robustness measures, including correlations among the various measures. The data underlying our monetary policy shock measures are expressed in percentage points. Thus, for example, the average daily change in the implied yield on five-year Treasury Futures during the QE (Taper) period is a decrease (increase) of 2.0 (1.6) basis points, in contrast to a -0.6 basis point average daily change in the contract over the full sample and a -0.5 basis point change in the pre-GFC period.[7] Table 1 also includes the significance levels from a simple test of means between periods; hence, the differences in period averages between our dates of interest are statistically significant. Figure 1 shows the five-year Treasury Futures yield changes on FOMC event dates.

3.1 Understanding the Monetary Surprise Measures

In order to understand the manner in which our monetary policy shocks affect global flows and valuations, we first need to better understand the nature of the revisions in expectations housed in our variable. As mentioned, monetary policy potentially influences both the expected path of short-term interest rates and the term premium. However, from mid-2008 until as recently as mid-2015, the Fed was not expected to deviate from zero short-term interest rates; it is not unreasonable, therefore, to suspect that monetary policy is qualitatively different in the periods of QE and of LSAP tapering in the sense that the relationship between monetary policy and the term structure of interest rates is altered. In this section of the paper, we explore the relationship between our monetary policy surprise measure and the decomposition of the yield curve into a component associated with the expected path of the short interest rate and that associated with the term premium. This disaggregation permits an evaluation of the role for monetary policy surprises across the conventional and unconventional periods.

[7] The robustness section examines a variety of monetary policy shocks extracted from different futures instruments such as the one- and two-month Fed Funds futures contracts as well as the changes in the two-year Treasury bond yields.

We appeal to a well-established affine term structure methodology from Kim and Wright (2005) that permits the decomposition of various government bond yields into information about future short rates and term premia. Kim and Wright estimate a standard latent three-factor Gaussian term structure model using zero-coupon Treasury yields from the Gurkaynak, Sack, and Wright (GSW, 2007) database. To facilitate empirical implementation, forecast data on the three-month T-bill yield from Blue Chip Financial Forecasts are incorporated into the model estimation. Their model yields a point-in-time daily estimate of the expected short rate over the life of any longer dated bond as well as the risk compensation market participants require for holding that bond.[8]

With these various components in hand, we separately regress changes (1) in bond yields, (2) in the expected path of the short rate, and (3) in the term premium onto our monetary policy shock to assess its importance on each. We conduct these separate regressions for one, five and ten year maturity bonds, separating the MP shock effects of interest (those arising on relevant FOMC or policy announcement days) across three periods (pre-crisis, March 1994 – August 2008, QE, December 2008 – April 2013, and tapering, May 2013 – June 2016) [9]:

$$\Delta Y_{(n),t} = \alpha_0 + \beta_1 dummy_{pre} MP_t + \beta_2 dummy_{QE} MP_t + \beta_3 dummy_{taper} MP_t + \varepsilon_t \qquad (5)$$

Where the left-hand side variable $Y_{(n),t}$ is either the zero coupon bond yield on an *n* year bond, the expectations hypothesis-implied average short rate component of an *n* year bond, or the term premium on an *n* year bond. We consider two event windows for the changes in the dependent variables – a daily change for event days perfectly coinciding with the day of the MP shock, and a two-day change that includes the event day plus the

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[8] The Kim and Wright yield curve decomposition data are made available at http://www.federalreserve.gov/pubs/feds/2005/200533/200533abs.html

[9] The pre-crisis dummy is equal to one in the period March 1994 to July 2008 and zero otherwise. The QE dummy is equal to one from the period December 2008 (when the U.S. interest rate reached the ZLB) to April 2013. The Taper dummy is equal to one for the period after May 2013 (wherein Ben Bernanke first mentioned the possibility of tapering LSAP purchases). We elect December 2008 as the beginning of the QE period precisely because it is at this point that the Fed can no longer undertake conventional simulative monetary policy by lowering the interest rate (except to offer a negative interest rate in the vein of Bank of Japan and the European Central Bank). The period between the collapse of Lehman Brothers and the beginning of QE was marked by global "flight to safety" and its inclusion in either neighboring sub-period muddles the analysis in the sense both that it is a period of extraordinary uncertainty and that it truly belongs to neither classification.

following to capture any relevant slow moving market effects.[10] We provide White standard errors to correct for heteroskedasticity (in parentheses). Finally, we allow the monetary policy shock coefficients to vary across the three periods.

Table 2 (Panel A) shows the daily regressions for the overall yield change, the change in the path of the expected short rate, and the change in the term premium, and Panel B shows two-day yield change regressions for the same event dates. First, focusing on the coefficients associated with the conventional, pre-crisis period, we find that a positive FF5 shock is significantly associated with bond yield changes across maturities both for the one-day event (Panel A) and the two-day event window (Panel B), though this effect appears to diminish with the 10-year bond across both event windows. To provide a sense of the economic magnitude, a one-standard deviation FF5 shock would be associated, on average, with a 4.73 (4.81) basis point increase in the ten-year bond yield across the one-day (two-day) event window over the conventional policy period. For comparison, a one-standard deviation daily (two-day) ten-year bond yield change is 5.76 (8.31) basis points over this period. Finally, we decompose the overall yield changes into changes in the expected path of the short rate and in the relevant term premia. The regression results suggest that over the conventional monetary policy period, FF5 shocks plays a role in altering the expected path of the short rate. As one might anticipate, this effect diminishes sharply with maturity across both measurement widows. We also uncover an important role for FF5 shocks in altering term premia, where the risk compensation effects are relatively stable across different maturities. In sum, during the period of conventional monetary policy, our measured FF5 shock has implications for both revisions in expectations about the path of future short rates as well as risk premia.

Next, we turn to the coefficients associated with FF5 shocks during the period of unconventional monetary policy (both QE and eventual policy tapering). First, overall yield changes appear to be significantly affected by FF5 shocks across both the QE and tapering periods for both the one and two-day event windows. As an example, a one-standard deviation FF5 shock during the QE period would be associated, on average, with a 12.2 (13.6) basis point increase in the ten-year bond yield across the one-day (two-day) event window. For comparison, a one-standard deviation daily (two-day) ten-year bond

[10] We also considered regressions based on a three-day event window. While there still appears to be an important role for shocks housed in the Treasury futures contracts, the effects on bond yield and their yield components do start to diminish by day three.

yield change is 7.10 (9.99) basis points over the QE period. Similarly, sizeable effects are present during the tapering period. One interesting point to note is the fact that, unlike the conventional period, the FF5 shock effects on bond yields during the unconventional periods monotonically increase over time. Since the effect of a shock on the expected path of future short rates is likely to be *relatively* short-lived over the life of a long-term maturity bond, we can speculate on the manner in which the FF5 shocks map into revisions in the compensation for interest rate risk. Indeed, despite a role for the FF5 shocks during the unconventional QE and tapering periods altering the expected path of future short rates, the largest effects are associated with sizeable and statistically significant revisions in term premia. Further, these risk premia effects monotonically increase with maturity.

Taken together, during the period of unconventional monetary policy, it may be the case that our measured FF5 shock has more to do with variation in required risk compensation relative to variation in the expected path of the short rate. This result is true despite the fact that high frequency variation in futures contracts are employed in the construction of the FF5 shocks in the first place. The important role for FF5 shocks in describing variation in risk compensation during the period of post-crisis unconventional policy may help us better interpret the manner in which our measured monetary policy shocks affect global flows and valuations in the sections to follow.

4. The Data

We use data from the U.S. Department of Treasury International Capital (TIC) System. TIC provides data on U.S. transactions with foreigners in domestic and foreign securities by type and country on a monthly basis. The data are collected from issuers of U.S. securities issued directly in foreign markets and from large U.S.-resident end investors who do not use U.S. custodians for holdings of foreign securities (for example, pension funds, foundations, and endowments), as well as large U.S. custodian banks and U.S. broker–dealers. Net debt and equity flows are gross sales to U.S. residents by foreigners less gross purchases from U.S. residents by foreigners.

Specifically, Bertaut and Tryon (2007) and Bertaut and Judson (2014) generate monthly estimates of U.S. cross-border investment by combining information from detailed annual Treasury International Capital (TIC) surveys with data from the TIC forms SLT and TIC S.[11] We use this measure of capital flows because it yields a consistent, high frequency time series that can be decomposed into flows, estimated valuation changes, and a residual "gap" (the last component arising from the challenge of reconciling year-end holdings data with within-year cumulative valuation and flow data). These decompositions can provide a richer and timelier view of developments in both foreign portfolio investment in the U.S. and U.S. portfolio investment abroad than available from transactions data or survey data alone.

To obtain a measure of positions in securities by type and country, it is necessary to interpolate the annual holdings data using the growth rate of country-level fixed-income and equity indices, along with flow data from the monthly transactions data. The methodology differs slightly over the sample based on the available data. From the start of the sample through December 2011, the data is compiled using the methodology developed by Bertaut and Tryon (2007). Starting in January 2012, the data are compiled using the methodology developed by Bertaut and Judson (2014), which makes use of the TIC SLT form introduced in 2011 in response to the financial crisis.

4.1.1 Bertaut and Tryon (2007)

Bertaut and Tryon (2007) interpolate annual holdings into a monthly series by cumulating monthly net transactions reporting on the TIC S form and adjusting for changes in asset valuation on a monthly basis.

To illustrate, denote as $H_{i,j,t}$ U.S. holdings of asset-type j from country i at time t. Then,

$$H_{i,j,t} = H_{i,j,t-1}(1 + V_{i,j,t}) + F_{i,j,t} + A_{i,j,t} \tag{3}$$

where $V_{i,j,t}$ is the total return on country *i*'s return index for asset type j and $F_{i,j,t}$ is the net flow in U.S. dollars. $A_{i,j,t}$ accounts for the repayment of principal on asset-backed securities, acquisitions of equity through stock swaps, and flows consisting of non-marketable Treasury bonds. As emerging market debt is increasingly denominated in local currency, the return used is the average of USD EMBI+ and the local currency bond index weighted by the currency composition of U.S. resident positions. Holdings

[11] Their data management efforts are made available at http://www.federalreserve.gov/Pubs/ifdp/2007/910/default.htm

observations in the first month of every year are the values from the annual survey; that is, annual observations are the interpolation end-points.

Making the above adjustments, however, leaves a substantial gap between the cumulation-implied holdings at the time of the next survey and the value of reporting holdings in that month. One complication that arises in constructing estimated positions for individual country holds is the geographic distortion caused by financial center transaction bias. By construction, the transaction data are recorded by country of first cross-border counterparty, rather than actual end buyer or seller of the security. Thus, estimates calculated in the above fashion will tend to overestimate holdings by residents of financial center locations and underestimate holdings by residents other countries.

If the gap for the year is negative, then the cumulation-implied holdings for the year overstates the year-end position in comparison with the survey. If the gap for the year is positive, the cumulation-implied holdings understate the year-end position. If the distributed gap in a given month differs in sign from the overall gap accumulated during the year, the cause can be a very large drop in value, a very large drop in volume, or both because the valuation and volume enter the weighting formula multiplicatively.

In addition, the gap may be due to approximation and measurement errors in the construction of prices used to calculate the valuation adjustments, and transaction costs due which are included in reported transactions, but not in annual holdings surveys. The basic challenge is to distribute the observed error across the months between annual survey dates to arrive at a more accurate estimate of monthly positions.

Beginning with an initial survey position, an estimate of the current position of a given asset type for a given country at an inter-survey date t is constructed as follows:

$$\hat{S}_t = S_0(1+\hat{\pi}_{0,t}) + \sum_{k=1}^{t} \hat{N}_k(1+\hat{\pi}_{kt}) \tag{4}$$

Where S_0 is the latest survey observation for a given country, security, and holder, $\hat{S}_t$ is the estimated position at time t, { $\hat{N}_i$ } is the sequence of flows from time 1 to time t, and $\hat{\pi}_{i,t}$ is the rate of increase of the price of security S over the period, with $\hat{\pi}_{0,0} = 0$. So, we assume that flows and prices are observed with error, and between-survey holdings represent estimated values. When t = T, S_T is known. The gap is thus: $G_T = S_T - \hat{S}_T$.

In short, Bertaut and Tryon extrapolate the time 0 survey position forward using the observed flow data and compute the residual *vis-à-vis* the reported survey at time T. The residual is then distributed across time periods according to each period's share of net transactions, discounted by the appropriate inflation rate. The cumulative flows will then match the annual surveys by construction, consistent with both endpoints.

$$H_{i,j,t} = H_{i,j,t-1}\,(1 + V_{i,j,t}) + F_{i,j,t} + A_{i,j,t} + Gap_{i,j,t} \tag{5}$$

and

$$\Delta H_{i,j,t} = H_{i,j,t-1}\,V_{i,j,t} + F_{i,j,t} + A_{i,j,t} + Gap_{i,j,t} \tag{6}$$

4.1.2 Bertaut and Judson (2014)

The financial crisis in 2008 highlighted the need for more timely collection of information on cross-border security positions, and the Survey-S estimates perform best when the TIC S data is book-ended by annual survey data meaning the lag on the most reliable estimates can be up to a year. TIC SLT provides market-value reports of actual holdings rather than flows, meaning that valuation adjustments are reported directly and the approach to distributing the gap between flows, valuations and positions over the year requires fewer assumptions. Annual surveys still provide the most detailed information available about the distribution of investment flows between valuation effects ("passive" changes) and purchases or sales ("active" changes). Thus, the monthly holdings positions are still updated by annual holdings and anchored to them in the intervening months.

Let $H_{i,j,t}$ be the holdings of security type *j* issued in country *i* at time *t* and let P^{SLT} be the position for that security, country and time as recorded in the SLT form.

$$H_{i,j,t} = H_{i,j,t-1} + \left[\frac{12-m}{12}R_{i,j,y-1} + \frac{m}{12}R_{i,j,y}\right](P^{SLT}_{i,j,t} - P^{SLT}_{i,j,t-1}) \tag{7}$$

Where $R_{i,j,y}$ and $R_{i,j,y-1}$ are the ratio of the SLT-recorded position at time t to the annual survey position at current and previous year's end, respectively. The gap is calculated as:

$$Gap_{i,j,t} = \Delta H_{i,j,t} - F_{i,j,t} - A_{i,j,t} - ValAdj_{i,j,t} \tag{8}$$

In our final dataset, we define positions as outlined above decomposed into (i) valuations changes and a flow measure that combines the reported flow measures with the gap. We do so on the assumption that the error attributable to flow mis-measurement is like to be higher than that attributable to prices. Due to the difference in data collection, our approach differs by subsample. In the Survey-S data, we simply add the adjusted flows to the gap. In the Survey-S-SLT data, we back out the valuation adjustment and take flows to be the difference between the change in positions and the proportion of position changes attributable to valuation changes.[12] When fully constructed, these data are monthly from 1994 until 2014. The countries in the panel include Argentina, Brazil, Chile, Colombia, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Russia, South Africa, Thailand and Turkey.

4.2 Control Variables

Our control variables include both "push" and "pull" variables suggested by the literature on capital flows. Controls for financial conditions include a measure of liquidity (the Ted spread), market risk (VIX), the U.S. GDP growth rate, the return on the S&P 500 Index, the average of policy rates for the US, France, Germany and Japan, as well as a lag of the left-hand-side variable to account for autocorrelation. Country-specific controls include GDP growth rates, changes in local policy rates, the real effective exchange rate (REER), emerging equity market returns (measured as the annual growth of the MSCI total return index), government debt as a percent of GDP, the current account balance as a percent of GDP, the fiscal balance as a percent of GDP, the real effective exchange rate, and ICRG political risk. Country-specific controls are included with a lag to rule out simultaneity.

4.3 Summary Statistics

Table 3 presents detailed summary statistics about country-level portfolio flow data and the pull and push control variables. Total holdings (across both equity and bond markets) increase, on average across countries, by 165% between the pre-crisis and the QE period and increase by a further 27% between the QE and Taper period. The

[12] We thank Frank Warnock for suggesting this adjustment.

difference in means between the two periods is statistically significant. Summing bond and equity measures, average monthly flows in the data increase, on average across countries, by 421% over the QE relative to the pre-crisis period and decline, on average, by 49% over the Taper relative to the QE period, respectively, although the decline is not statistically significant. Disaggregating total positions into equity and bond positions shows that both increase significantly, on average across countries, over the QE and Taper periods relative to the pre-crisis period; however, both exhibit a slower rate of increase between the QE and Taper periods. Note that monthly changes in both bond and equity valuations exhibit significant declines, on average across countries, between the QE and the Taper periods. Given that we employ scaled versions (by GDP) of these figures later in our main specifications, we also include these ratios towards the bottom of the table (the directions are largely similar).[13]

Turning to push factors, while the VIX measuring global volatility increases during the QE period relative to the pre-crisis period, it actually declines significantly between the QE and the Taper periods to a value below that which prevailed during the pre-crisis average. The Ted spread declines over every consecutive sub-period (QE-pre-crisis and Taper-QE), which implies that lenders believe the risk of default on interbank loans is decreasing, and therefore liquidity increases. Finally, the S&P's average annual return in the Taper period is very high relative to the QE and pre-crisis periods. On average, advanced economy interest rates decline steadily over the consecutive sub-periods while US GDP growth falls between the pre-crisis and the QE periods and rises over the Taper period.

The policy rate in the destination emerging market, a pull factor, reveals an interesting pattern. On average, there is a statistically significant decline between pre-crisis and QE period, but not between the QE and taper periods, indicating a significant drop in the emerging market policy rate since the global unconventional monetary policy regime commenced. Table 3 shows that on average, the level of the policy rate in the sample is unchanged between the QE and Taper periods. However, on average emerging markets decreased interest rates during the QE period, and tightened during the taper

[13] The magnitudes of the flow and valuation change ratios (divided by GDP) are naturally rather small. The numerator is a monthly USD flow or monthly USD valuation change, whereas the denominator is the GDP level for the previous year. While the magnitudes are small in percentage terms, the economic implications remain sizeable for the relevant local markets.

period. Consistent with the valuation declines observed in the capital flows data, both the EMBI bond indices and the MSCI emerging-market equity indices show a significant decline, on average across countries, in the Taper period, -80% and -76% respectively. With regard to variables capturing slow-moving macroeconomic conditions, we find that on average real GDP growth, the fiscal balance, and the public debt ratio deteriorated between the pre-crisis and QE periods, and deteriorate further between the QE and tapering periods. Inflation declines over the sub-periods while the real exchange rate appreciates between the pre-crisis and QE periods and depreciates between the QE and Taper periods. Finally, the variable "political risk" (as measured by ICRG), on average, shows a statistically significant improvement between each subsequent period.

5. Benchmark Specification and Regression Results

To examine the impact of monetary policy surprises around FOMC meetings on capital flows from the United States to a range of emerging markets we estimate the following benchmark specification using panel data:

$$\begin{aligned} y_{i,t} &= \alpha y_{i,t-1} + \beta dummy_{pre} MP_t + \gamma dummy_{QE} MP_t + \delta dummy_{taper} MP_t \\ &+ \eta' PUSH_t^{AE} + \theta_i' PULL_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{9}$$

where $y_{i,t}$ is the capital flow or position measure of interest. We estimate the impact of monetary surprises on the following variables for both country-level equity and debt markets: (i) positions, (ii) the monthly net flows into each market, and (iii) the monthly valuation changes across each market. As mentioned above, the latter two quantities represent a monthly change, divided by the GDP to facilitate cross-country comparison. While the ratios are invariant to currency since both the numerators and denominators are expressed in the same currency, we do nevertheless include (iv) the monthly change in the bilateral USD exchange rate. To examine the degree to which U.S. policy shocks affect the FX market, the bilateral exchange rate is expressed as USD/Local currency, so that an increase is associated with an appreciation of the local currency, and vice versa. Our specifications include a lagged measure of the dependent variable to account for the strong autocorrelation we observe in the flows and holdings time-series.

β, γ and δ are the coefficients on the high-frequency monetary surprise measures in the pre-crisis, QE and taper/unwinding periods, respectively. η' is a transposed vector of coefficients on the set of push variables mentioned above. Finally, θ' is a transposed vector of coefficients on the set of pull variables also mentioned above. Robust standard errors are White' s corrected and clustered at the country level. We use the random effects model instead of fixed effects under the assumption that our sample is sufficiently long that country-level unobserved heterogeneity cannot be considered immutable. A Hausman test corroborates our choice, rejecting fixed effects.

5.1 Monetary Surprises and Capital Flows

Table 4 examines the impact of the monetary surprise measures on the various holdings and flow measures across the three sub-periods: the pre-crisis period, the QE period and the unwinding period. Columns 1-3 present results for debt positions, flows, and valuations, respectively. Columns 4-6 present the analogous measures for equity. Finally, column 7 shows the results for the bilateral USD exchange rate change. Consistent with the previous literature, both holding and flows display significant autocorrelation as shown by the positive coefficients on the lagged dependent variables (displayed near the bottom of the table for each specification).

In the pre-crisis period, changes in the five-year Treasury futures rates (FF5) corresponding to FOMC announcement dates are generally inversely correlated to bond and equity positions, monthly flow and monthly valuation changes across emerging markets (see the first row of each regression specification – where the effect on bond flows is the only exception). Such a pattern is consistent with a role for both the signaling and portfolio balance channels. That is, a tightening U.S. monetary policy shock may be associated with emerging market portfolio outflows as foreign investors substitute into long-term U.S. bonds. Alternatively, a signal that today's 'tight' monetary policy portends future tightening, worsening credit conditions in the U.S. can drive a negative association between monetary policy shocks and portfolio flows and valuations. Conversely, easing surprises, on average, lead to increased inflows to emerging markets.

In the QE period, while five-year Treasury Futures (FF5) surprises are inversely and significantly correlated with debt valuation changes (Column 3), we do not see evidence of statistically significant changes in debt positions or flows. Equity positions and valuations, on the other hand, are inversely correlated with the FF5 monetary surprise measure (Columns 4 and 6). Given that interest rates fell dramatically during this period and the U.S. quickly entered the ZLB regime, this pattern suggests that U.S. investors significantly increased their emerging market equity holdings during the QE period. While it may seem a little puzzling that the flow measures do not exhibit statistical significance for either debt or equity, one explanation may be that there is more noise in the measured flows data during periods of higher volatility. On the other hand, it is plausible that there was indeed no detectable increase in flows because the positions inflated due to improved expectations for the valuation of emerging market firms. Many large emerging markets appeared to weather the crisis well. Optimism about emerging markets would contribute to increased valuations for emerging market firms. Given that our flow variables of interest are specific to the United States, the valuation changes could be attributed to increased domestic investment or increased investment from other locales. Overall, during the QE period there appears to be a significant and consistent relationship between FF5 surprises and for both emerging market debt and equity valuations, rather than flows.

A point to also note is that for equity flows in the QE period, while valuation changes translate to a statistically significant effect on positions, this is not the case for debt since positions are not statistically significantly affected by monetary policy shocks. Moreover, the effect on valuation changes in equity is ten times larger than that for debt.

The unwinding, or taper, period presents a significant shift in the pattern of results. Across alternative measures of debt and equity flows and valuation changes, we observe inverse and statistically significant coefficients suggesting that the period of taper talk and the actual unwinding was associated with significant outflows from emerging markets. It is also noteworthy that across the board the coefficients associated with the unwinding period are higher than both the pre-crisis and the QE periods and for some specifications an order of magnitude higher for debt positions, debt valuations, and equity flows. Moreover, the levels of statistical significance across all specifications in the taper period are consistently at the 1% level. The coefficient estimates on the FF5 surprises during the taper period suggest that the market interpreted the unwinding of unconditional monetary policy as a signal that normalcy was being restored to the U.S. economy and, consistent with both the signaling and portfolio balance channels, expected monetary tightening in the U.S. both in the near term and ongoing in the future led to a massive retrenchment from emerging markets.

Additionally, note that in the tapering period, the effect of monetary policy shocks on equity measures is double or even triple the magnitude of the effect for debt. It is striking that in both the QE and tapering periods, valuation effects contribute more heavily to position changes than do active reallocations (flows). Further, in the unwinding period, the flows become a statically significant contributor to position changes. Recall that in the QE period, changes in positions are attributable entirely to valuation changes.

Finally, we turn to the effects of U.S. monetary policy shocks on emerging markets exchange rates. During the pre-crisis period, an unexpected policy shock is, on average, associated with a move in emerging market currencies in the same direction (relative to the USD). For example, a positive (tightening) monetary policy shock in the U.S. is associated, on average, with an appreciation in emerging market currencies. While one might expect interest rate differentials to play a textbook role in currency determination going forward, we nevertheless observe the opposite, possibly suggesting a role for a confidence channel whereby U.S. policy tightening is, for instance, correlated with expectations of global economic expansion.

In sharp contrast, we observe that a U.S. policy shock is associated with emerging market currency fluctuations in the opposite direction during UMP periods. This is particularly true during the later tapering period. For example, during the QE period, the average monetary policy shock was negative (or a loosening shock), and is associated with emerging market currency appreciation. In contrast, during the taper period positive (tightening) U.S. policy shocks are associated with large and significant emerging market currency depreciations. Taken together, it appears that the role for US monetary policy shocks extends beyond capital flows and local markets valuations to also include the exchange rate.

5.1.1 Push Factors and Capital Flows

In addition to the monetary surprise measures across sub-periods, Table 4 includes controls for a range of push and pull factors that can drive capital flows. In particular, liquidity and volatility in advanced financial markets can affect flows to emerging markets. Table 4 includes an indicator of global risk aversion, the VIX, and a transformed TED spread, our measure of global liquidity. The TED spread measure is orthogonalized to the VIX in order to capture the component of the spread that is not due to changes in volatility or risk aversion.

Turning to the push variables, we see that in all but one specification the TED spread, our measure of global liquidity, is inversely correlated with capital flows. ; thus, a decrease in global liquidity (measured by increasing spreads) leads U.S. investors to decrease their holdings and flows to emerging markets. This result is unsurprising in the sense that a liquidity squeeze can make it difficult for institutions to obtain capital, especially in times of heightened overall risk aversion (Fratzscher 2012). Debt positions, flows and valuations in emerging markets are inversely correlated with TED spreads, consistent with the hypothesis that increased spreads represent reduced financial market liquidity and are therefore correlated with a decline in capital flows to emerging markets (Columns 1 - 3). A similar inverse correlation is seen with equity positions and valuations (Columns 4 and 6). We would expect that an increase in the market volatility or risk aversion would cause capital flows to emerging economies to slow or reverse as investors reallocate their portfolios toward safer assets (Ahmed and Zlate 2014; Milesi-Ferretti and Tille 2011; Broner et al 2013). An increase in the VIX, or volatility, is positively correlated with debt positions and valuations but not with debt flows. This finding could arise due to an increase in the risk premium on emerging-market debt. Also, the VIX is inversely correlated with changes in equity positions at the 15% level of significance but our specifications do not pick up a significant impact of changes in the VIX on either equity flows or valuations.

Next, we control for the S&P 500 Index return and U.S. real GDP growth rates as push factors. Results in the literature on capital flows suggest that the return on advanced economy equities should evince a negative relationship with emerging market equity flows, as an increase in the U.S. equity return increases the relative attractiveness of returns in the U.S. (Ghosh et al 2012; Lo Duca 2012). However, we find that the S&P return is positively and significantly related to a range of debt equity valuations and equity positions (Columns 3, 4 and 6). We could be observing here a wealth effect of the U.S. return on capital flows—an increase in the return to investment in the U.S. increases the total wealth available for investment activity. This result, however, is not without precedent, as Forbes and Warnock (2012) find a similar pattern.

There are two countervailing forces readily apparent regarding the expected sign on the real GDP growth coefficient,. We might expect real GDP growth in the U.S. to be negatively correlated with emerging market capital for the same reasoning outlined for the S&P return—the return differential shrinks, incentivizing investors toward advanced economies (Ahmed and Zlate 2014). However, there is some evidence that mature economy growth has a positive effect on emerging market flows via a wealth effect (Forbes and Warnock 2012). We find that U.S. real GDP growth is positively related to bond and equity positions and mildly inversely related to equity valuations in emerging markets (Columns 1,4 and 6).

We include in our push variables the average of advanced economy interest rates as an indicator of the world interest rate—numerous studies have concluded that an increase in the external interest rate environment exerts a negative effect on emerging market portfolio flows (Dalhaus and Vasishtha 2014; Montiel and Reinhart 1999; Sarno and Taylor 1997) or that an increase in the spread between emerging market interest rates and that of advanced economies tends to exercise a positive effect on emerging market portfolio flows (Ahmed and Zlate 2014). We find that the average advanced economy interest rates are inversely related with emerging market debt positions and flows but positively related to debt and equity valuations (Columns 1-3 and 6). This result suggests that when, for example, advanced economy interest rates fall debt positions and debt flows to emerging markets rise and debt and equity valuations rise.

5.1.2 Pull Factors and Capital Flows

Regarding country-specific pull factors, we find that a lagged increase in the emerging-market policy rate is on average directly related to equity positions (Column 4). A lagged increase in the MSCI emerging market equity return is inversely correlated with debt and equity positions and equity flows (Columns 1, 4 and 5) and debt and equity valuations (Columns 3 and 6). Although we might expect to see a positive relationship between such measures of domestic returns and capital flows the literature on emerging market capital flows also produces some contrasting evidence in domestic returns (Ahmed and Zlate 2014; Forbes and Warnock 2012).

Turning to macro-fundamental pull factors, there is some evidence in the literature that real GDP growth in the destination country plays a role in determining emerging market flows, although it is less robust (Fratzscher 2012; Forbes and Warnock 2012). We find that a lagged increased real GDP growth in the recipient country is associated with increased bond positions as well as bond flows and equity flows (Columns 1, 2 and 5). Inflation in emerging markets is, in contrast, inversely correlated with equity positions (Column 4).

Turning next to slow-moving macroeconomic variables, there is some evidence that country vulnerability indicators such as the current account, fiscal balance and government debt impact portfolio flows because of their effect on the confidence of investors regarding growth potential and perceived risk (Eichengreen and Gupta 2014; Moore et al 2013; Chen et al 2014). However, these vulnerability measures also indicate increased financing needs, generating a mechanical relationship with debt flows in particular. In this vein, we find that lagged current account balances are inversely correlated with debt positions and flows (Columns 1-2). We also find, however, that lagged current account balances are positively correlated with equity valuations (Column 6). Similarly, the lagged fiscal balance in the destination country is inversely correlated with debt positions and flows (Columns 1-2), but positively correlated with equity flows and valuations (Columns 5-6). This division is consistent with the forces described above—a positive fiscal balance indicates lower financing needs, but a negative fiscal balance might also disincentivize investment. For debt flows, the effect of financing needs appears dominant. The positive relationship between the lagged fiscal balance and equity flows and valuations is consistent with changes in perception of risk in the face of a public deficit—a strong fiscal position spurs equity flows and prices and vice-versa. A similar logic may apply to government debt ratios. We find that the lagged gross government debt ratio is inversely correlated with debt positions and flows (Columns 1-2) and positively correlated with equity positions and equity valuations (Columns 4 and 6).

We also include in the regressions the ICRG political risk index, which is increasing in perceived institutional quality. The positive and significant coefficient on this factor for debt positions and debt flows is consistent with the prediction that capital flows to a country increase as political risk declines (Fratzscher et al 2013; Eichengreen and Gupta 2013). Finally, real exchange rate appreciation is positively correlated with equity flows. This result is not unexpected, since real exchange rate appreciation is often itself used as a measure of increased capital flows (Calvo et al., 1993).

5.2 Economic Significance: Quantifying the Impact of US Monetary Policy Shocks

The advantage of extracting the magnitude of the monetary surprises directly from the futures data is that we can directly estimate a dollar amount in terms of U.S. investor position and flow changes to emerging markets controlling for a variety of push and pull factors. To get a sense of the economic magnitudes in question, Table 5 presents the response of monthly capital flows and valuation changes to the monetary policy shocks evaluated at the mean as well as for a one standard deviation shock from the mean.

We consider two examples of emerging-market capital flow measures with significant coefficients for the FF5 surprise in the QE and taper sub-periods. First, let's examine the equity positions measure. In the baseline regression (Table 4, Column 4) the coefficients on the FF5 surprise measure during the QE period is -0.99 percent of annual GDP. From Table 1 Panel A, the mean value for FF5 changes during the QE period is -0.02. Country-level GDP in the QE and Taper periods averaged $791.29B and $911.88B across the markets we consider, respectively. Combined with the coefficient estimates, this suggests that the average monetary policy shocks (loosening shocks during the QE period) appear to be accompanied by, on average, a monthly increase of $153.5M in emerging-market equity positions.

During the taper period, the coefficient on the FF5 change measure is -0.97 percent of annual GDP (Table 4, Column 4). From Table 1 Panel A, the mean values for the FF change, during the taper period is 0.016. Together, these coefficient estimates for reversals in the unwinding period, the mean- magnitude shocks are correlated on average with monthly outflows of $144.1M.

One standard deviation on either side of the mean for the FF5 monetary surprise measures distribution during the QE period, is correlated with monthly changes in equity positions that range from [-$672.26M, +$979.26M]. Similarly, one standard deviation from the mean for the FF5 monetary surprise measures during the tapering period, is correlated with equity position changes that range from [-$970.45M +$682.35M]. Given that these are simple one-standard deviation shocks in either direction and that these local markets tend to be relatively small and illiquid, position changes of these magnitudes are quite sizeable. Table 5 presents detailed capital flow changes predicted by the quantification exercise for all the debt and equity capital flow measures with significant coefficients on the FF Treasury futures; the one-standard deviation effects are economically large across all variables of interest.

An average monetary policy shock (at its mean) during the QE period leads to a 1% monthly appreciation, on average, in emerging market currencies. In contrast, during the taper period, an average policy shock leads to a 0.11% monthly depreciation in emerging market currencies. In the QE period, the changes in currency values range for a 0.16% depreciation for a mean plus one-standard deviation shock to a 0.24% appreciation for a mean minus one-standard deviation shock. In the taper period these changes range from a 0.52% appreciation for a mean minus one-standard deviation shock to a 0.75% depreciation for a mean plus one-standard deviation shock. While the impact on bilateral exchange rates is statistically significant, the magnitudes are not large from an economic perspective. Note that the unconditional standard deviation of the monthly change in bilateral exchange rates is 3.57%.

Extracting the magnitude of the monetary surprises allows us to quantify the distributional impact of U.S. monetary policy on our emerging-market capital flow measures. Previous studies that use dummy variables or alternative approaches to examine U.S. monetary policy spillovers are only able to make qualitative statements about the direction of impact.

5.3 Alternative Specifications and Robustness

To ensure the robustness of the patterns we document, we conducted a number of alternative exercises.

First, a concern with the five-year Treasury futures contract is that these contracts may not be as liquid as contracts of shorter maturity such as the one-month ahead and two month ahead contracts that are the most heavily traded contracts. The abundance of short-term interest rates that potentially measure federal funds rate expectations has led to a proliferation of asset price-based monetary policy expectation measures emanating from Kuttner (2001). Gürkaynak (2005) proposes alternative shock measures that capture changes in market *expectations* of policy over slightly longer horizons. We measure monetary policy shocks proposed by Gürkaynak (2005) and by Kuttner (2001). These are described below.

Note that Federal funds futures have a payout that is based on the average effective federal funds rate that prevails over the calendar month specified in the contract. Thus, immediately before an FOMC meeting, at time $t - \Delta t$, the implied rate from the current-month federal funds future contract, ff^1, is largely a weighted average of the federal funds rate that has prevailed so far in the month, r_0, and the rate that is expected to prevail for the reminder of the month, r_1:

$$\mathrm{ff}^1_{t-\Delta t} = \frac{\mathrm{d1}}{\mathrm{M1}}\, r_0 + \frac{\mathrm{M1 - d1}}{\mathrm{M1}} E_{t-\Delta t}(r_1) + \rho^1_{t-\Delta t} \qquad (10)$$

where d1 denotes the day of the FOMC meeting, M1 is the number of days in the month, and $\rho^1_{t-\Delta t}$ denotes any term or risk premium that may be present in the contract. By leading this equation to time *t* and differencing, the surprise component of the change in the federal funds rate target, which Gürkaynak (2005) calls MP1, is given by:

$$\mathrm{MP}^1_t = (\mathrm{ff}^1_t - \mathrm{ff}^1_{t-\Delta t})\frac{\mathrm{M1}}{\mathrm{M1 - d1}} \qquad (11)$$

The scale factor M1/(M1 – d1) is necessary because the surprise is only relevant for the remaining part of the month, although it adds a complication. Note that to interpret the above as the surprise change in monetary policy expectations, we need to assume that the change in the risk premium ρ in this narrow window of time is small in comparison to the change in expectations itself. For example, for a policy action on the last day of a month, the change in the term premium is multiplied by thirty amplifying the noise in the measurement of the surprise. To surmount this problem, Kuttner (2001) suggests using the next month's contract (i.e., the month ahead contract in place of the current month contract) when a policy action takes place in the last week of the month.

Gürkaynak (2005) goes a step further, constructing a measure to capture the change in the federal funds rate expected to prevail after the next FOMC meeting. Given the unexpected change in the federal funds rate following the current meeting, $\mathrm{MP1}_t$, the change in the rate expected after the subsequent meeting, $\mathrm{MP2}_t$, can be calculated as follows:

$$MP2_t = \frac{\mathrm{M2}}{\mathrm{M2 - d2}}\left(\Delta \mathrm{ff}^2_t - \frac{\mathrm{d2}}{\mathrm{M2}} MP^1_t\right) \qquad (12)$$

where $\Delta \mathrm{ff}^2_t$ is the change in the federal funds futures contract for the month of the next FOMC meeting. This is contained in the two-month-ahead contract, as FOMC meetings are scheduled to take place once every six weeks.

To see whether the pattern of results is different for shocks extracted from short maturity contracts we repeat the estimations using the one-month (MP1) and two-month (MP2) Fed Funds futures contracts (Table 6). The pattern of results is interesting.

The two monetary policy surprise measures (MP1 and MP2) are included together in the regression under the assumption that they capture distinct elements of monetary policy. Interacting our monetary surprise measures with time dummies allows us to capture the differential effect of monetary policy over three distinct regimes while allowing our controls to have a regime-invariant effect. Table 6 presents an interesting pattern of results using these more liquid contracts.

In the pre-crisis period, there appears to be no effect of MP1 on any of our bond flow measures. In contrast, the coefficient on the MP2 monetary surprise measure is positive and statistically significant for debt positions and flows (Columns 1 and 2). The MP2 measure based on the two-month Fed Funds Futures contract which captures, in part, revisions in the expected 'path' of monetary policy in the conventional policy period. A positive and statistically significant coefficient therefore suggests that markets interpret a tightening as a signal that the Fed is feeling sanguine about global market conditions such that debt positions, flows and valuations in emerging markets increase.

Turning to the equity data, we see that emerging market equity valuations scaled by destination GDP are inversely related to the MP1 monetary surprise measure, i.e., a US tightening surprise is correlated with a statistically significant decline in emerging-market equity valuations (Column 6) consistent with a role for the signaling and portfolio balance channels. In the pre-crisis period, for all the other capital flow and holdings measures, monetary surprises extracted from short contracts do not appear to be significantly correlated with U.S. capital flows to our emerging-market sample countries. Recall in comparison that the coefficients on the longer five-year Treasury futures measure (FF5) measure was negative and significant in nearly every specification.

In contrast to the conventional policy period, the QE period displays a somewhat different pattern for the shocks extracted from the short-duration contracts. The MP1 surprise measure is now positively and statistically significantly correlated with total debt positions, suggesting that on impact quantitative easing led to a decline in debt flows to emerging markets (Column 1) consistent with the confidence channel (or a lack thereof). In contrast, the MP2 measure, associated in large part with revisions in market participants require risk compensation during this period, is inversely and significantly correlated with debt positions, valuations and flows (Columns 1-3). Given that interest rates fell dramatically during this period and the U.S. quickly entered the ZLB regime, monetary policy surprises extracted from Fed Funds futures contracts suggest that U.S.

investors significantly increased their emerging market debt and equity holdings during the QE period. Equity positions and valuations are inversely correlated with the MP1 monetary surprise measure (Columns 5 and 8). However, none of the equity measures are significantly correlated with the MP2 or path measure of monetary policy. While it may seem a little puzzling that the equity flow measures do not exhibit statistical significance, one explanation may be that there is more noise in the measured flows data during periods of higher volatility.

Similar to the results using five-year Treasury futures surprises, the unwinding, or taper, period presents a significant shift in the pattern of results. Across both monetary surprise measures and alternative measures of debt and equity flows and valuations, we see inverse and statistically significant coefficients suggesting that the period of taper talk and the actual unwinding was associated with significant outflows from emerging markets. It is also noteworthy that once again the coefficients associated with the unwinding period are an order of magnitude larger than both the pre-crisis and the QE periods. The coefficients on both the MP1 and MP2 measures suggest that the market interpreted the unwinding of unconditional monetary policy as a signal that normalcy was being restored to the U.S. economy and, expected monetary tightening in the U.S. both in the near term and ongoing in the future led to a massive retrenchment from emerging markets.

We also experimented with longer shorter horizons of the monetary policy shock, for example at the three one month and four two month Fed Funds futures contract horizons (MP3 and MP4). These coefficients on these variables did not enter the regressions with consistent statistical significance. We do not therefore report these results but note that the exercise established that the relevant monetary surprise measures are MP1 and MP2.

We repeated the estimations with our final monetary surprise measure the difference in the yield two-year treasury bond on the date of an FOMC meeting. The principle is the same as the five-year Treasury futures rate—over a very narrow window, it is reasonable to state that change in the price of the asset reflects a change in the expectations component of yield i.e., the sum of expected future interest rates, which is driven by a monetary surprise. Table 7 presents the results, which remain robust especially for the taper/unwinding period.

To examine whether the yield on the two-year bond is capturing expectations about the path of the short rate over the life of the bond or about changes in risk compensation we appeal to Kim and Wright's (2005) decomposition of the bond yield into expected short rates and term premia. Figure 2 depicts the contribution from expected short rate and the term premium to the overall daily changes in the two year zero coupon bond yield on FOMC event days. The changes on FOMC dates tend to result in larger part from changes in the term premium, although the decomposition is frequently close to an even contribution.

The dependent variables in the benchmark regressions are scaled by the GDP of the destination country. We repeated the estimations with the previous period's holdings as an alternative scaling variable. We also conducted a set of estimations with destination-country fixed effects. The pattern of results is robust in both cases.[14]

To ensure that the choice to scale the dependent variables is not driving the results, we conducted the estimations without scaling the raw data. Table 8 shows that while the magnitude of the coefficient estimates reflect that the dependent variables have not been scaled, the pattern of results remains robust.

6. Conclusion

This paper examines the implications of unconventional monetary policy and its continued unwinding for emerging market capital flows and asset prices with an emphasis on quantifying the magnitude of these effects. We use U.S. Treasury data on emerging market flows and asset prices alongside Treasury bond futures data to extract a surprise component of Fed announcements. High frequency identification (HFI) using Fed Funds futures data allows us to extract the unexpected element of changes in the market's expectations of Fed policy.

Using this methodology, we examine the impact of monetary policy surprises extracted around FOMC meetings on capital flows from the United States to a range of emerging markets. Panel regression estimates reveal substantial heterogeneity in the monetary policy shock implications for flows versus asset prices, across asset classes, and during across the various policy periods. The most robust finding is that the evolution in overall emerging market debt and equity positions between various policy sub-periods

[14] Not reported but available from the authors.

appear to be largely driven by U.S. monetary policy induced valuation changes. In nearly every specification, the effect of monetary policy shocks on asset values is larger than that for physical capital flows.

Further, there is an order-of-magnitude difference between the effects of monetary policy on all types of emerging-market portfolio flows between pre-crisis conventional monetary policy period, the QE period and the subsequent tapering period. We detect some significant effects of monetary policy on flows and valuations during the period of unconventional monetary policy (QE). However, the effects are not consistent over all dependent variables. In contrast, during the period following the first mentioning of policy tapering, we uncover a consistent and large effect of monetary policy shocks on nearly all variables of interest.

A key advantage of extracting the magnitude of the monetary surprises directly from the Treasury futures data is that we can directly estimate a dollar amount in terms of US investor position and flow changes to emerging markets controlling for a variety of push and pull factors. By extracting the magnitude of the monetary surprises we can quantify the distributional impact of US monetary policy on our emerging-market capital flow measures consistent with emerging markets' varied experience across debt and equity, during the periods of quantitative easing and of its unwinding.

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Appendix 1: Description of Variables

Variable	Description	Source
Bond/equity positions	Sum of bond/equity flows, valuation changes and gap	Bertaut and Tryon (2007), Bertaut and Judson (2009)
Total positions	Equity positions plus bond positions	Bertaut and Tryon (2007), Bertaut and Judson (2009)
Bond/equity flows	TICS Reported transactions plus repayment of principal on asset-backed securities and stock swaps from mergers and acquisitions	Bertaut and Tryon (2007), Bertaut and Judson (2009)
Total flows	Equity flows plus bond flows	Bertaut and Tryon (2007), Bertaut and Judson (2009)
Bond/equity valuation changes	Cumulative change in the value of time t holdings between time t and t+n as measured by a weighted average of local currency and dollar-denominated asset returns	Bertaut and Tryon (2007), Bertaut and Judson (2009)
Bond/equity flows (% of holdings)	Ratio of current flows (t) to previous period holdings (t-1)	Bertaut and Tryon (2007), Bertaut and Judson (2009) and author's calculations
Bond/equity gap	Difference between the year-end annual survey holdings data and the cumulation-implied holdings, distributed over between-survey months proportional to the size of monthly flows	Bertaut and Tryon (2007), Bertaut and Judson (2009)
VIX	Implied volatility of S&P 500 index options	FRED database
Treasury Futures Rate	Implied yield from the five-year Treasury futures price	Bloomberg
Fed Funds rate	Federal reserve target interest rate	FRED database
Change in Fed Funds rate	Monthly first difference of the Fed Funds rate	FRED database
Ted spread	3-month LIBOR minus 3-month T-bill interest rate	FRED database
S&P annual return	Annual return on the S&P index	Standard and Poor's
Policy rate	Domestic (EM) central bank target interest rate	Datastream
Change in policy rate	Monthly first difference of domestic policy rate	Datastream
EMBI annual return	Year-on-year growth of MSCI total return index	Datastream
MSCI annual return	Year-on-year growth of MSCI total return index	Datastream

Figure 1: Five-Year Treasury Futures Yield Changes on FOMC Event Dates

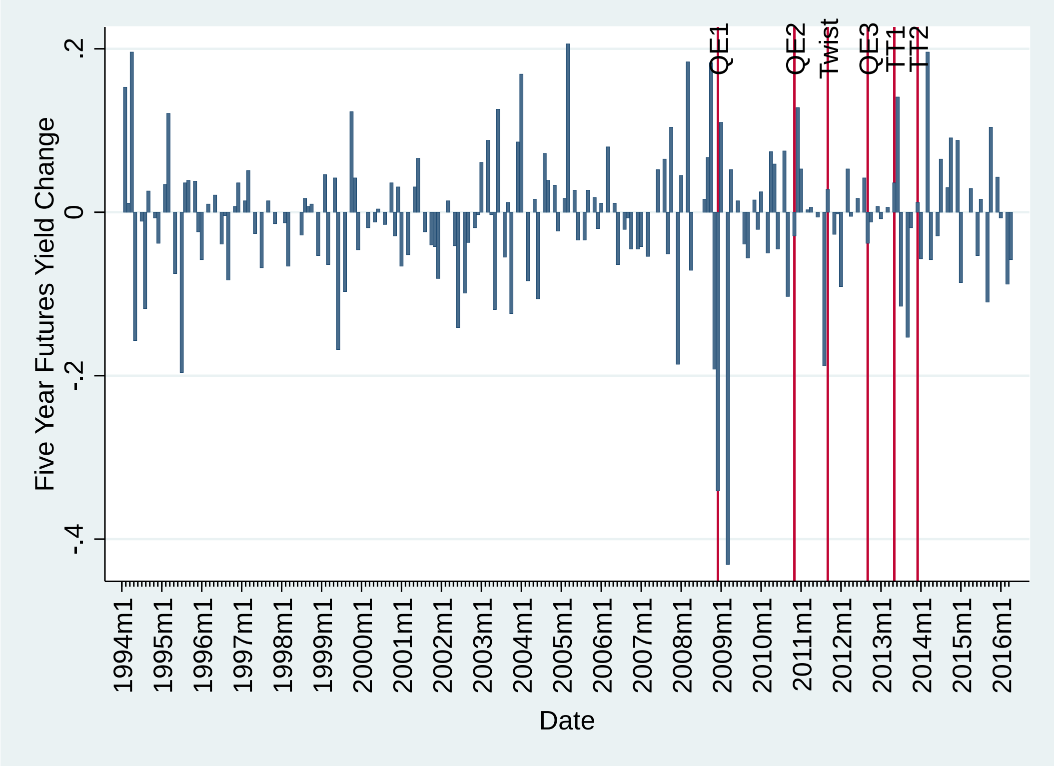
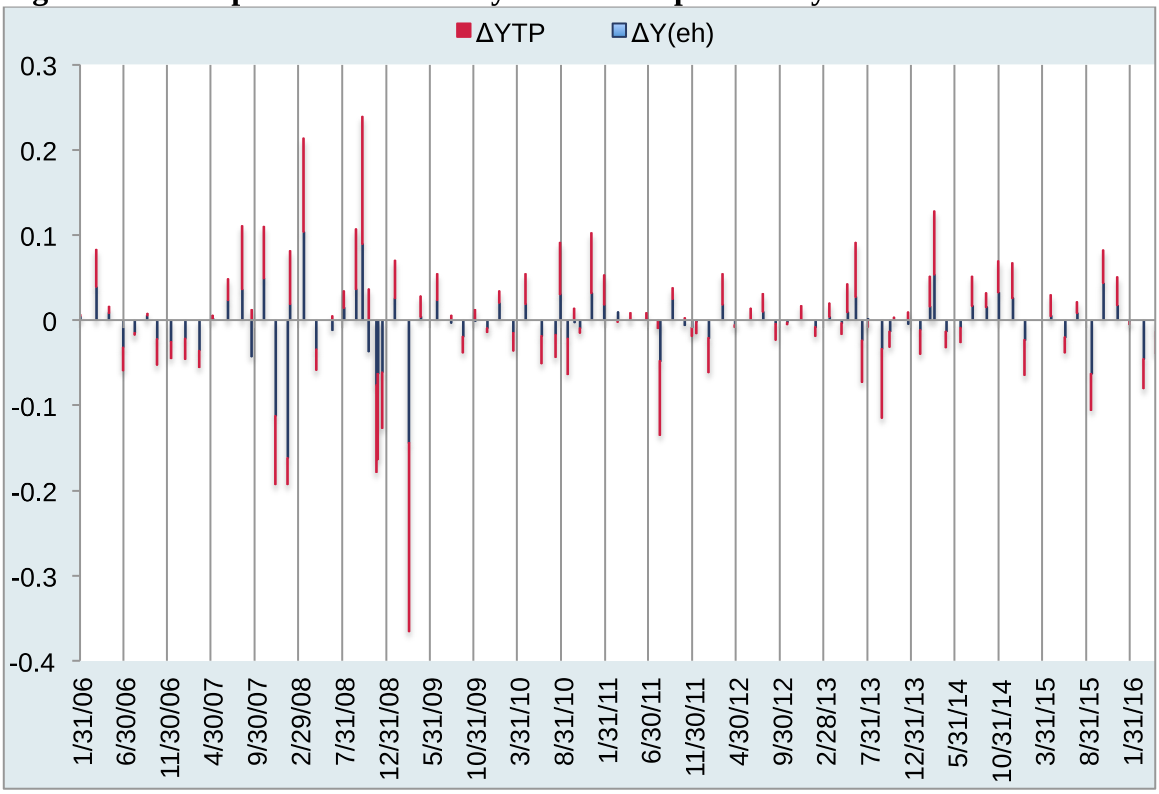


Figure 2: Decomposition of the two year zero coupon bond yield



Source: Kim and Wright (2005)

Table 1. Monetary Policy Shocks: Descriptive Statistics and Correlations

Panel A: Comparison of Means

Subsample means (standard deviations in parentheses)					**Comparison of means**		
Variables	Full sample	Pre-crisis	QE period	Taper period	Pre-crisis v. QE	Pre-crisis v. taper period	QE v. taper period
Five-year futures price changes (FF5)	-0.006	-0.005	-0.02	0.016	***	***	***
	(0.08)	(0.07)	(0.11)	(0.09)			
One-Month Fed Fund Futures (MP1)	0.001	0.005	-0.003	0.00	***	***	***
	(0.00)	(0.07)	(0.02)	(0.01)			
Two-Month Fed Fund Futures (MP2)	-0.005	-0.004	-0.008	0.005	***	--	**
	(0.00)	(0.07)	(0.04)	(0.01)			
Two-year bond yield changes (gs2)	-0.004	-0.01	0.002	0.015	***	***	***
	(0.01)	(0.08)	(0.06)	(0.05)			

*** p<0.01, ** p<0.05, *p<0.1

Panel B: Correlations Matrix for Alternative Monetary Surprise Measures

	MP1	MP2	Two-year bond yield	Five-year futures
MP1	1			
MP2	0.4621	1		
Two-year bond yield change	0.3149	0.5453	1	
Five-year Treasury futures change	0.1592	0.3757	0.783	1

Table 2: Response of Yield Changes to a One Standard Deviation Monetary Policy Shock (Five-year Treasury Futures)

Panel A: t-1 to t

VARIABLES	Difference Zero coupon bond yield (1yr)	Difference Zero coupon bond yield (5yr)	Difference Zero coupon bond yield (10 years)	Difference $Y_{eh}(1)$	Difference $Y_{eh}(5)$	Difference $Y_{eh}(10)$	Difference Term premium (1yr)	Difference Term premium (5yr)	Difference Term premium (10 years)
FF5*precrisis	0.0617***	0.0633***	0.0473***	0.0509***	0.0135***	0.00903***	0.0205***	0.0334***	0.0270***
	(0.00506)	(0.00290)	(0.00273)	(0.00407)	(0.00225)	(0.00181)	(0.00137)	(0.00212)	(0.00219)
FF5*QE	0.0259***	0.100***	0.122***	0.00504*	0.0452***	0.0356***	0.0322***	0.0729***	0.0875***
	(0.00259)	(0.00261)	(0.00389)	(0.00275)	(0.00205)	(0.00169)	(0.000732)	(0.00181)	(0.00272)
FF5*TT	0.0249***	0.0649***	0.0732***	0.0119**	0.0264***	0.0205***	0.0209***	0.0449***	0.0515***
	(0.00489)	(0.00227)	(0.00499)	(0.00534)	(0.00238)	(0.00204)	(0.000912)	(0.00261)	(0.00430)
Constant	-0.0113***	-0.0167***	-0.0185***	-0.00620***	-0.00899***	-0.00702***	-0.00351***	-0.00855***	-0.0104***
	(0.00206)	(0.00226)	(0.00283)	(0.00196)	(0.00133)	(0.00108)	(0.000889)	(0.00177)	(0.00217)
Observations	196	196	196	196	196	196	196	196	196
R-squared	0.727	0.841	0.788	0.638	0.684	0.657	0.771	0.780	0.746

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10, + p<0.15

Panel B: t-1 to t+1

VARIABLES	Difference Zero coupon bond yield (1yr)	Difference Zero coupon bond yield (5yr)	Difference Zero coupon bond yield (10 years)	Difference $Y_{eh}(1)$	Difference $Y_{eh}(5)$	Difference $Y_{eh}(10)$	Difference Term premium (1yr)	Difference Term premium (5yr)	Difference Term premium (10 years)
FF5*precrisis	0.0525***	0.0586***	0.0481***	0.0413***	0.0158***	0.0113***	0.0181***	0.0313***	0.0279***
	(0.00804)	(0.00737)	(0.00790)	(0.00621)	(0.00476)	(0.00381)	(0.00281)	(0.00491)	(0.00533)
FF5*QE	0.0177***	0.105***	0.136***	-0.00633	0.0536***	0.0427***	0.0322***	0.0779***	0.0979***
	(0.00383)	(0.0107)	(0.0161)	(0.00563)	(0.00768)	(0.00628)	(0.00291)	(0.00797)	(0.0113)
FF5*TT	0.0228***	0.0727***	0.0864***	0.00721	0.0327***	0.0257***	0.0227***	0.0511***	0.0609***
	(0.00612)	(0.00688)	(0.00969)	(0.00585)	(0.00510)	(0.00415)	(0.00145)	(0.00419)	(0.00635)
Constant	-0.0156***	-0.0209***	-0.0256***	-0.00680*	-0.0156***	-0.0124***	-0.00192	-0.00804*	-0.0121**
	(0.00430)	(0.00599)	(0.00739)	(0.00381)	(0.00340)	(0.00274)	(0.00202)	(0.00428)	(0.00527)
Observations	175	175	175	175	175	175	175	175	175
R-squared	0.332	0.474	0.459	0.288	0.384	0.375	0.420	0.449	0.444

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10, + p<0.15

Table 3. Emerging Market Capital Flows: Summary Statistics

Subsample means (standard deviations in parentheses)					**Comparison of means**		
Variables	Full sample	Pre-crisis	QE period	Taper period	Pre-crisis v. QE	Pre-crisis v. taper period	QE v. taper period
Net flow measures (in millions USD unless otherwise noted) (i.)							
Total positions	30758.35	19935.85	52905.74	67392.62	***	***	***
	(41536.26)	(27392.31)	(54662.20)	(58015.94)			
Total flows	130.75	65.87	342.91	175.12	***	**	--
	(815.15)	(555.83)	(1135.28)	(1397.44)			
Bond positions	8502.66	5956.74	12752.54	19784.44	***	***	***
	(11252.18)	(7004.18)	(13663.76)	(20623.46)			
Equity positions	22255.68	13979.11	40153.20	47608.18	***	***	***
	(33570.97)	(23420.78)	(44300.65)	(44294.58)			
Bond flows	63.43	17.46	208.98	103.40	***	***	**
	(597.77)	(390.51)	(871.17)	(1004.59)			
Equity flows	67.33	48.41	133.94	71.72	***	--	--
	(558.04)	(403.41)	(733.73)	(1001.34)			
Bond valuation changes	8.89	7.94	61.51	-93.99	***	***	***
	(450.67)	(408.35)	(392.44)	(789.55)			
Equity valuation changes	69.75	84.25	389.14	-363.57	**	***	***
	(3214.38)	(2440.73)	(4371.18)	(3957.35)			
Bond positions (% of GDP)	2.14	2.12	2.02	2.70	*	***	***
	(1.71)	(1.82)	(1.29)	(1.68)			
Equity positions (% of GDP)	3.86	3.38	4.84	5.58	***	***	***
	(3.33)	(2.93)	(3.70)	(4.36)			
Bond flows (% of GDP)	0.01	0.01	0.01	0.00	***	--	**
	(0.15)	(0.15)	(0.15)	(0.18)			
Equity flows (% of GDP)	0.01	0.01	0.01	0.01	**	*	***
	(0.06)	(0.07)	(0.05)	(0.05)			
Bond valuation changes (% of GDP)	0.00	0.00	0.01	-0.01	**	**	***
	(0.11)	(0.13)	(0.05)	(0.08)			
Equity valuation changes (% of GDP)	0.02	0.01	0.07	-0.03	***	**	***
	(0.39)	(0.38)	(0.41)	(0.36)			

Table 3. contd.

Subsample means (standard deviations in parentheses)					Comparison of means		
Variables	Full sample	Pre-crisis	QE period	Taper period	Pre-crisis v. QE	Pre-crisis v. taper period	QE v. taper period
"Push" variables							
VIX	20.42	19.51	24.54	14.63	***	***	***
	(8.07)	(6.35)	(10.36)	(2.45)			
Ted Spread	0.51	0.56	0.36	0.20	***	***	***
	(0.39)	(0.34)	(0.30)	(0.02)			
S&P annual return	10.96	11.08	8.14	22.24	***	***	***
	(18.24)	(17.00)	(21.56)	(4.71)			
Adv. Econ interest rates (Avg.)	2.46	3.27	0.60	0.25	***	***	***
	(1.44)	(0.82)	(0.18)	(0.07)			
US real GDP growth	2.50	3.11	0.84	2.14	***	***	***
	(1.86)	(1.36)	(2.25)	(0.62)			
"Pull" variables							
Domestic GDP growth	4.17	4.40	3.88	3.41	***	***	**
	(4.34)	(4.53)	(4.22)	(2.23)			
Change in REER	0.06	0.07	0.25	-0.29	*	**	--
	(3.08)	(3.39)	(1.93)	(2.25)			
Inflation	19.91	26.18	4.99	4.92	***	**	--
	(176.56)	(210.23)	(3.11)	(2.87)			
Policy rate (change)	-0.04	-0.04	-0.07	0.08	--	--	***
	(9.64)	(12.35)	(0.35)	(0.58)			
Policy rate	8.90	11.17	5.22	5.33	***	***	--
	(11.82)	(14.53)	(2.64)	(2.68)			
EMBI annual return	11.22	13.11	11.58	2.29	*	***	***
	(22.43)	(23.82)	(20.84)	(11.47)			
MSCI annual return	16.97	19.93	15.04	3.61	***	***	***
	(45.21)	(47.27)	(43.50)	(22.37)			
Fiscal balance	-0.55	-0.45	-0.74	-0.77	***	***	--
	(1.14)	(1.18)	(1.03)	(0.97)			
Public debt	11.67	11.89	11.02	11.75	***	--	**
	(6.67)	(7.26)	(5.17)	(4.91)			
Current account balance	0.12	0.27	0.12	-1.07	--	***	***
	(4.66)	(4.82)	(4.30)	(3.82)			
Political risk	65.54	65.91	65.06	63.44	***	***	***
	(8.02)	(8.49)	(6.42)	(7.33)			

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

(i.) Net debt and equity flows are gross sales to U.S. residents by foreigners less gross purchases from U.S. residents by foreigners.

(ii.) Reported new flows data as a percentage of cumulation implied monthly holdings.

Table 4. The Impact of US Monetary Policy Shocks on Emerging Market Portfolio Flows (Benchmark Specification: Five-Year Treasury Futures)

	Bond positions	Bond flows	Bond valuation changes	Equity positions	Equity flows	Equity valuation changes	Bilateral exchange rate
VARIABLES	% of GDP	% of GDP	% of GDP	% of GDP	% of GDP	% of GDP	change
Monetary Policy Shocks							
FF5*Precrisis	-0.152*	0.172**	-0.0916***	-0.867***	-0.0606**	-0.544***	1.492**
	(0.0819)	(0.0744)	(0.0252)	(0.189)	(0.0306)	(0.135)	(0.655)
FF5*QE	-0.127	-0.0529	-0.0836***	-0.986***	-0.0186	-0.849***	-1.915*
	(0.0913)	(0.0885)	(0.0257)	(0.344)	(0.0398)	(0.284)	(1.071)
FF5*Taper	-0.357***	-0.178***	-0.214***	-0.943***	-0.341***	-0.694***	-6.802***
	(0.0890)	(0.0618)	(0.0513)	(0.211)	(0.0865)	(0.212)	(2.224)
Push factors							
Ted spread (orth.)	-0.0122***	-0.00606**	-0.0107***	-0.0452***	-0.00226	-0.0570***	-0.414***
	(0.00457)	(0.00275)	(0.00283)	(0.0120)	(0.00292)	(0.0149)	(0.0875)
VIX	0.000733*	-0.000120	0.000993***	-0.00217*	-0.000256	-5.23e-05	-0.0110
	(0.000382)	(0.000359)	(0.000233)	(0.00111)	(0.000494)	(0.000740)	(0.0112)
S&P annual return	0.000108	0.000371+	0.000366**	0.00274***	0.000248+	0.00373***	0.0293***
	(0.000375)	(0.000257)	(0.000146)	(0.000861)	(0.000151)	(0.000942)	(0.00747)
US real GDP growth	0.00881*	0.00109	0.000168	0.00617	-0.00106	-0.00585	-0.120**
	(0.00520)	(0.00384)	(0.00111)	(0.00447)	(0.00234)	(0.00421)	(0.0583)
Avg. AE interest rate	-0.0101***	-0.0106***	0.00725***	0.00580	4.72e-05	0.0244**	0.165*
	(0.00336)	(0.00382)	(0.00223)	(0.00992)	(0.00363)	(0.0101)	(0.0954)
Pull factors							
Policy rate.L1	3.40e-05	0.000112	-0.000106	0.000463	0.000150	0.000110	-0.0442***
	(0.000406)	(0.000221)	(8.87e-05)	(0.000327)	(0.000149)	(0.000217)	(0.00412)
Real GDP growth.L1	0.00263*	0.00196*	0.000577	0.00102	0.00159*	-0.00154	0.00807
	(0.00154)	(0.00112)	(0.000546)	(0.00346)	(0.000854)	(0.00339)	(0.0208)
MSCI annual return.L1	-0.0454**	0.000160	-0.00961+	-0.130***	-0.0106*	-0.0337+	-0.947***
	(0.0180)	(0.0134)	(0.00634)	(0.0320)	(0.00595)	(0.0214)	(0.244)
Inflation.L1	-3.85e-05	0.000659	-0.000262	-0.00380**	-0.000354	-0.00259**	0.0366+
	(0.000486)	(0.000559)	(0.000186)	(0.00148)	(0.000344)	(0.00131)	(0.0254)
Current account (% of GDP).L1	-0.00287***	-0.00161*	0.000270	-0.000135	0.000194	0.00279	0.0648**
	(0.00105)	(0.000851)	(0.000335)	(0.00233)	(0.000687)	(0.00203)	(0.0298)
Govt. debt (% of GDP).L1	-0.00354***	-0.00252***	-8.26e-05	0.000795	-0.000381	0.00151	-0.00698
	(0.000777)	(0.000497)	(0.000350)	(0.00156)	(0.000547)	(0.00123)	(0.0172)
Fiscal balance (% of GDP).L1	-0.00846*	-0.00367*	-0.00114	0.00751	0.00335*	0.00528	-0.0299
	(0.00462)	(0.00221)	(0.00128)	(0.0103)	(0.00184)	(0.00686)	(0.0807)
ICRG Political risk.L1	0.00223***	0.00141**	0.000217	0.00211	0.000126	0.00134	0.0111
	(0.000670)	(0.000585)	(0.000331)	(0.00208)	(0.000475)	(0.00121)	(0.0112)
RER Growth.L1	-0.00120***	-0.000624**	-0.000687**	-0.00265***	-0.000255	-0.00255**	-0.0456***
	(0.000330)	(0.000283)	(0.000278)	(0.000984)	(0.000253)	(0.000999)	(0.0126)
Lagged Dependent Variables							
Bond positions.L1	0.985***						
(% of GDP)	(0.00294)						
Bond flows.L1		0.00321					
(% of GDP)		(0.0351)					
Bond valuation changes.L1			-0.0137				
(% of GDP)			(0.0479)				
Equity position.L1				0.991***			
(% of GDP)				(0.00356)			
Equity flows.L1					0.207***		
(% of GDP)					(0.0379)		
Equity valuation changes.L1						0.0660**	
(% of GDP)						(0.0283)	
Bilateral exchange rate .L1							0.163
(change)							(0.121)
Constant	0.0113	0.00537	0.0177	0.179	0.0361	0.114	3.525**
	(0.0417)	(0.0312)	(0.0244)	(0.173)	(0.0327)	(0.113)	(1.495)
Observations	1,865	1,865	1,865	1,865	1,865	1,865	1,865
Number of countrycode	15	15	15	15	15	15	15

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Economic Significance: The Quantitative Impact of US Monetary Policy on Emerging Market Capital Flows.

	QE period			Taper/Unwinding period		
	μ	μ-σ	μ+σ	μ	μ-σ	μ+σ
Bond positions				-53.02	251.13	-357.17
Debt flows				-26.43	125.21	-178.08
Debt valuations	12.96	82.69	-56.77	-31.78	150.54	-214.10
Equity positions	152.88	975.30	-669.54	-140.04	663.36	-943.44
Equity flows				-50.64	239.88	-341.16
Equity valuations	131.64	839.79	-576.51	-103.06	488.20	-694.32
Exchange rate	0.04	0.24	-0.16	-0.11	0.52	-0.75

Empty cells indicate a statistically insignificant result. All flow values in USD Million; (-) indicates outflows; (+) indicates inflows.

Table 6. The Impact of US Monetary Policy Shocks on Emerging Market Portfolio Flows (Alternative Monetary Shock Measures: One-Month & Two Month Fed Funds Futures Surprises)

VARIABLES	Bond positions % of GDP	Bond flows % of GDP	Bond valuation changes % of GDP	Equity positions % of GDP	Equity flows % of GDP	Equity valuation changes % of GDP	Bilateral exchange rate change
Monetary Policy Surprises							
MP1*Precrisis	0.0197	-0.0629	-0.0254	-0.176	0.0108	-0.391***	-6.780***
	(0.0737)	(0.0673)	(0.0368)	(0.135)	(0.0337)	(0.129)	(1.308)
MP2*Precrisis	0.0894*	0.155**	-0.0586	0.119	-0.00510	0.127+	3.554**
	(0.0476)	(0.0718)	(0.0568)	(0.140)	(0.0347)	(0.0790)	(1.770)
MP1*QE	0.664+	0.398	-0.0608	-3.609***	-0.230	-4.112***	-23.85***
	(0.410)	(0.343)	(0.109)	(1.071)	(0.238)	(1.066)	(6.914)
MP2*QE	-0.626**	-0.333+	-0.251***	0.0405	0.0987	0.172	-3.748
	(0.269)	(0.223)	(0.0797)	(0.623)	(0.185)	(0.625)	(5.295)
MP1*Taper	-5.737***	-5.436***	-0.779**	-11.93***	-2.471**	-10.04***	-126.3***
	(2.152)	(2.050)	(0.343)	(2.653)	(1.258)	(2.213)	(19.95)
MP2*Taper	-4.726***	-2.993**	-2.537***	-9.205***	-0.386	-9.987***	-82.83***
	(1.600)	(1.322)	(0.596)	(1.905)	(0.536)	(2.255)	(13.15)
Push Factors							
Ted spread (orth.)	-0.0138***	-0.00648**	-0.0102***	-0.0660***	-0.00399	-0.0739***	-0.413***
	(0.00436)	(0.00274)	(0.00233)	(0.0146)	(0.00285)	(0.0162)	(0.0625)
VIX	0.000548+	-0.000525**	0.000717***	0.000389	-0.000324	0.000815	-0.0329***
	(0.000370)	(0.000249)	(0.000195)	(0.000749)	(0.000514)	(0.000779)	(0.0101)
S&P annual return	0.000433*	0.000176	0.000318***	0.00295***	2.50e-05	0.00344***	0.00928**
	(0.000260)	(0.000225)	(8.70e-05)	(0.000918)	(0.000132)	(0.000858)	(0.00473)
US real GDP growth	0.00278	0.000993	-0.00133*	-0.0126***	-0.00227	-0.0182***	-0.102**
	(0.00336)	(0.00323)	(0.000796)	(0.00305)	(0.00226)	(0.00431)	(0.0411)
Avg. AE interest rate	-0.00667*	-0.00928***	0.00415***	0.0152+	-0.000141	0.0258***	0.176***
	(0.00387)	(0.00328)	(0.00125)	(0.00994)	(0.00352)	(0.00945)	(0.0652)
Pull Factors							
Policy rate.L1	0.000293	0.000204	-4.73e-05	0.000808***	0.000366**	0.000165	-0.0394***
	(0.000323)	(0.000212)	(8.06e-05)	(0.000245)	(0.000187)	(0.000261)	(0.00681)
Real GDP growth.L1	0.00151	0.001000	0.000710+	0.00138	0.00143**	-0.00141	0.0260
	(0.00126)	(0.000982)	(0.000432)	(0.00287)	(0.000628)	(0.00283)	(0.0232)
MSCI annual return.L1	-0.0462***	-0.00324	-0.0105**	-0.0970***	-0.00158	-0.0226	-0.626***
	(0.0157)	(0.0105)	(0.00409)	(0.0301)	(0.00608)	(0.0221)	(0.227)
Inflation.L1	-0.000469	0.000191	9.70e-06	-0.00243**	-4.35e-05	-0.00145+	0.0331
	(0.000472)	(0.000381)	(9.35e-05)	(0.00107)	(0.000386)	(0.000977)	(0.0249)
Current account (% of GDP).L1	-0.00264**	-0.00169*	0.000539**	0.00240+	0.000839+	0.00440***	0.0484**
	(0.00128)	(0.00102)	(0.000223)	(0.00163)	(0.000547)	(0.00150)	(0.0214)
Govt. debt (% of GDP).L1	-0.00202***	-0.00139***	2.44e-05	0.00138	-6.07e-05	0.00210*	0.00233
	(0.000642)	(0.000426)	(0.000197)	(0.00120)	(0.000509)	(0.00127)	(0.0127)
Fiscal balance (% of GDP).L1	-0.00357	-0.000228	0.000378	0.0165+	0.00290*	0.0162**	0.0505
	(0.00430)	(0.00220)	(0.000951)	(0.0107)	(0.00161)	(0.00792)	(0.0661)
ICRG Political risk.L1	0.00114**	0.000927**	-0.000106	-0.000442	0.000166	-0.000854	-0.00683
	(0.000476)	(0.000426)	(0.000154)	(0.00151)	(0.000391)	(0.000977)	(0.00790)
REER growth.L1	-1.22e-05	0.000123	0.000437	-0.00130	0.00101	-0.000348	-0.0529
	(0.00106)	(0.000824)	(0.000409)	(0.00229)	(0.000893)	(0.00200)	(0.106)
Lagged Dependent Variables							
Bond position.L1	0.990***						
(% of GDP)	(0.00285)						
Bond flows.L1		-0.0130					
(% of GDP)		(0.0385)					
Bond valuation changes.L1			-0.0365				
(% of GDP)			(0.0327)				
Equity position.L1				0.995***			
(% of GDP)				(0.00293)			
Equity flows.L1					0.148***		
(% of GDP)					(0.0449)		
Equity valuation changes.L1						-0.00177	
(% of GDP)						(0.0310)	
Bilateral exchange rate .L1							0.260***
(change)							(0.0294)
Constant	-0.0359	-0.0121	-0.0143*	0.0299	0.00724	0.0129	0.800
	(0.0365)	(0.0332)	(0.00851)	(0.102)	(0.0306)	(0.0615)	(0.694)
Observations	2,702	2,702	2,702	2,702	2,702	2,702	2,702
Number of countries	15	15	15	15	15	15	15

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. The Impact of US Monetary Policy Shocks on Emerging Market Portfolio Flows (Alternative Monetary Shock Measure: Two-year Treasury Bond Yields)

VARIABLES	Bond positions % of GDP	Bond flows % of GDP	Bond valuation changes % of GDP	Equity positions % of GDP	Equity flows % of GDP	Equity valuation changes % of GDP	Bilateral exchange rate change
Δgs2*Precrisis	0.0562	0.151**	-0.108***	0.155	-0.00839	0.0219	-2.079
	(0.0454)	(0.0615)	(0.0270)	(0.145)	(0.0213)	(0.0962)	(1.548)
Δgs2*QE	-0.482***	-0.148	-0.139***	-2.397***	-0.0649	-1.505***	-5.531***
	(0.170)	(0.152)	(0.0417)	(0.699)	(0.0604)	(0.480)	(1.794)
Δgs2*Taper	-0.837***	-0.574***	-0.380***	-2.371***	-0.657***	-1.895***	-18.97***
	(0.242)	(0.211)	(0.0779)	(0.539)	(0.179)	(0.490)	(4.412)
Ted spread (orth.)	-0.0146***	-0.00661**	-0.0106***	-0.0669***	-0.00291	-0.0745***	-0.396***
	(0.00431)	(0.00273)	(0.00237)	(0.0145)	(0.00275)	(0.0155)	(0.0605)
VIX	0.000478	-0.000364+	0.000798***	-0.000523	-0.000469	0.00111*	-0.0264***
	(0.000336)	(0.000249)	(0.000171)	(0.000626)	(0.000491)	(0.000656)	(0.00834)
S&P annual return	0.000472*	0.000282	0.000281***	0.00302***	-1.22e-05	0.00357***	0.0108**
	(0.000255)	(0.000218)	(8.34e-05)	(0.000899)	(0.000150)	(0.000849)	(0.00491)
US real GDP growth	0.00252	0.000526	-0.00121+	-0.0147***	-0.00259	-0.0191***	-0.112***
	(0.00313)	(0.00283)	(0.000802)	(0.00321)	(0.00228)	(0.00433)	(0.0380)
Avg. AE interest rate	-0.00512	-0.00769**	0.00416***	0.0175*	-0.00386	0.0309***	0.131**
	(0.00379)	(0.00333)	(0.00137)	(0.0100)	(0.00285)	(0.00905)	(0.0635)
Policy rate.L1	-0.000323	-0.000145	-0.000184*	-0.000720***	0.00189***	-0.00259***	-0.0261***
	(0.000305)	(0.000217)	(0.000104)	(0.000194)	(0.000302)	(0.000393)	(0.00496)
Real GDP growth.L1	0.00144	0.00111	0.000666+	0.00113	0.00172***	-0.00170	0.0334+
	(0.00125)	(0.000994)	(0.000407)	(0.00258)	(0.000630)	(0.00259)	(0.0208)
MSCI annual return.L1	-0.0457***	-0.00460	-0.00992**	-0.0928***	-9.45e-07	-0.0235	-0.665***
	(0.0154)	(0.0108)	(0.00386)	(0.0266)	(0.00489)	(0.0180)	(0.224)
Inflation.L1	8.49e-05	0.000502	0.000142*	-0.000903	-0.00126*	0.00103	0.0232
	(0.000495)	(0.000356)	(7.52e-05)	(0.00107)	(0.000676)	(0.00114)	(0.0268)
Current account (% of GDP).L	-0.00282**	-0.00176*	0.000459**	0.00203	0.00129***	0.00352**	0.0512**
	(0.00130)	(0.00102)	(0.000223)	(0.00163)	(0.000492)	(0.00145)	(0.0210)
Govt. debt (% of GDP).L1	-0.00196***	-0.00135***	3.55e-05	0.00139	-0.000341	0.00239*	-0.00109
	(0.000641)	(0.000413)	(0.000198)	(0.00120)	(0.000436)	(0.00131)	(0.0114)
Fiscal balance (% of GDP).L1	-0.00427	-0.000509	0.000233	0.0146	0.00426**	0.0137+	0.0630
	(0.00415)	(0.00209)	(0.000981)	(0.0105)	(0.00185)	(0.00833)	(0.0645)
ICRG Political risk.L1	0.00120**	0.000941**	-7.94e-05	-0.000380	0.000106	-0.000667	-0.00586
	(0.000482)	(0.000419)	(0.000152)	(0.00149)	(0.000403)	(0.000967)	(0.00766)
RER Growth.L1	-1.11e-05	5.78e-05	0.000471	-0.00132	0.00120	-0.00112	-0.0518
	(0.00108)	(0.000843)	(0.000429)	(0.00221)	(0.000850)	(0.00209)	(0.115)
Bond positions.L1	0.990***						
(% of GDP)	(0.00286)						
Bond flows.L1		-0.0135					
(% of GDP)		(0.0385)					
Bond valuation changes.L1			-0.0295				
(% of GDP)			(0.0345)				
Equity position.L1				0.995***			
(% of GDP)				(0.00293)			
Equity flows.L1					0.150***		
(% of GDP)					(0.0437)		
Equity valuation changes.L1						0.0165	
(% of GDP)						(0.0297)	
Bilateral exchange rate .L1							0.268***
(change)							(0.0292)
Constant	-0.0393	-0.0191	-0.0179**	0.0485	0.0206	-0.0102	0.657
	(0.0350)	(0.0331)	(0.00898)	(0.101)	(0.0331)	(0.0617)	(0.664)
Observations	2,711	2,711	2,711	2,711	2,711	2,711	2,711
Number of countrycode	15	15	15	15	15	15	15

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8. The Impact of US Monetary Policy Shocks on Emerging Market Portfolio Flows (Dependent Variables Scaled by Lagged Positions)

		Bond flows	Bond valuation changes	Equity flows	Equity valuation changes
	VARIABLES	% of lagged positions	% of lagged positions	% of lagged positions	% of lagged positions
Monetary policy shocks	FF5*Precrisis	12.07**	-3.887***	-2.885**	-10.90***
		(4.951)	(0.882)	(1.150)	(3.878)
	FF5*QE	-4.198	-6.602***	-1.898	-24.88***
		(5.690)	(1.654)	(2.601)	(4.421)
	FF5*Taper	-8.958***	-7.816***	-7.391***	-13.55***
		(2.615)	(1.358)	(1.578)	(3.771)
Push factors	Ted spread (orth.)	-0.456**	-0.764***	0.0472	-1.951***
		(0.211)	(0.124)	(0.139)	(0.177)
	VIX	-0.00172	0.0600***	0.00305	0.000587
		(0.0178)	(0.0115)	(0.0208)	(0.0238)
	S&P annual return	0.0499*	0.0233***	0.00386	0.0822***
		(0.0290)	(0.00467)	(0.00961)	(0.0219)
	US real GDP growth	-0.332	-0.0738+	-0.0667	-0.107
		(0.274)	(0.0476)	(0.0764)	(0.106)
	Avg. AE interest rate	-0.0381	0.528***	-0.119	0.898***
		(0.355)	(0.0875)	(0.144)	(0.205)
Pull factors	Policy rate.L1	0.0128	-0.00118	0.0646***	-0.0471***
		(0.0155)	(0.00331)	(0.0141)	(0.0143)
	Real GDP growth.L1	0.131**	0.0160	0.108**	-0.0832
		(0.0572)	(0.0339)	(0.0497)	(0.132)
	MSCI annual return.L1	0.599	-0.630*	-0.626	-1.250*
		(0.638)	(0.336)	(0.458)	(0.734)
	Inflation.L1	0.0265	0.0222	-0.0920+	0.108**
		(0.0354)	(0.0228)	(0.0576)	(0.0433)
	Current account (% of GDP).L1	-0.0833**	0.0113	0.0244	0.112*
		(0.0377)	(0.0141)	(0.0250)	(0.0650)
	Govt. debt (% of GDP).L1	-0.0564+	0.0271**	-0.0101	0.105***
		(0.0364)	(0.0124)	(0.0205)	(0.0318)
	Fiscal balance (% of GDP).L1	-0.179	0.0584	0.406*	0.296
		(0.131)	(0.0674)	(0.225)	(0.309)
	ICRG Political risk.L1	0.0345*	-0.00852	-0.0268+	-0.00332
		(0.0190)	(0.0122)	(0.0175)	(0.0216)
	RER Growth.L1	-0.0201	-1.39e-07	0.0293**	-0.161
		(0.0813)	(0.0283)	(0.0149)	(0.117)
Lagged dependent variables	Bond flows.L1	0.0477			
	(% of GDP)	(0.0560)			
	Bond valuation changes.L1		0.0118		
	(% of GDP)		(0.0456)		
	Equity flows.L1			0.115***	
	(% of GDP)			(0.0306)	
	Equity valuation changes.L1				0.0630*
	(% of GDP)				(0.0364)
	Constant	-1.615	-1.862**	2.370*	-1.911
		(1.522)	(0.931)	(1.267)	(1.469)
	Observations	1,863	1,863	1,865	1,865
	Number of countrycode	15	15	15	15

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.10, + p<0.15