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Quantitative easing and the post-crisis surge in financial flows to developing countries ☆

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This paper examines gross financial inflows to developing countries between 2000 and 2013, with a focus on the potential effects of quantitative easing (QE) policies in the United States and other high-income countries. We find evidence for potential transmission of QE along observable liquidity, portfolio balancing, and confidence channels. Moreover, we find that QE had an additional latent effect *over and above these* observable channels, one that survives an array of robustness tests, retains its significance across different types of financial flows, and which cannot be attributed to changes in expectations or elasticity. Our baseline estimates place the lower bound of a QE effect at around 5 percent of gross inflows above trend, for the average developing economy, which is a magnitude comparable to a one standard deviation change along the traditional channels. We also find evidence of heterogeneity among different types of flows; portfolio (especially bond) flows tend to be more sensitive than FDI to our measured QE effects.

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1. Introduction

In late November 2008, the United States Federal Reserve announced the first of a series of unconventional monetary interventions,[1] involving a $600 billion purchase of mortgage-backed securities in the secondary market. This policy – which has come to be known as quantitative easing (QE) – was designed with the explicit purpose of bolstering weak asset markets, as well as stimulating real activity, given the perceived constraints of the zero lower bound on short-term interest rates. Over the course of the succeeding five years, the Fed engaged in a total of three separate QE episodes, so that by the beginning of the Fed's gradual unwinding in January 2014, its balance sheet had more than doubled, to $4 trillion.

Although QE was meant to be an expansionary monetary policy for the U.S. economy, the program had profound implications for developing countries. Faced with near-zero returns in the U.S. and other high-income countries – many of which were implementing unconventional monetary policies of their own – financial capital began to seek alternative sources of yield. Emerging economies, which had enjoyed heady growth rates and stable political-economic environments over the past decade, appeared to be an ideal investment alternative.

However, cross-border financial flows respond to a host of standard "fundamental" factors – such as interest rates and growth differentials – and although inflows did recover from crisis lows during the period when QE was in place, that fact alone is insufficient for establishing whether the postcrisis recovery can be attributed to QE, since global economic and monetary conditions were also changing during that time. Moreover, since unconventional monetary policies were designed to operate along the very same fundamental variables associated with capital flows, disentangling the effects of QE from these standard drivers becomes especially tricky.

Our innovation is to identify *latent* effects that explicitly exclude these standard channels. Rather than ascribe a specific, quantitative estimate to the total effect of QE – which would require us to ascertain the impact of QE on a host of secondary variables – our strategy is to first account for potential QE spillover effects transmitted through theoretically informed liquidity, portfolio balancing, and confidence channels. The observable proxies we use for these channels – such as the short-term interest rate and yield spreads – are consistent with those typically associated with a more standard push–pull model of cross-country capital flows. Next, we seek to establish whether the QE episodes were associated with an increase in financial inflows *over and above* these observables, alongside a host of standard controls. The reasoning is that if QE did alter cross-border financial flows, the magnitude of the coefficient on the effect attributable to unobservables constitutes a lower bound of its overall effect.

Although such an estimate likely underestimates the total effects of QE (since the total effect of QE has to account for its effect via standard channels as well), our approach sidesteps the challenging problem of distinguishing between the relative contributions of QE versus other factors (such as overall economic activity) on fundamental measures, such as the interest rate. Instead, our methodology is biased, by design, toward the outcome of no QE effects. So if we do find any effect, it will support the hypothesis that QE had *some* positive influence on financial flows.

We rely on data for gross capital inflows across as many as 60 developing countries, using quarterly data for the period between 2000Q1 and 2013Q2. Our focus on gross flows is motivated, in part, by their greater volatility in developing countries; this is especially pertinent in the context of seeking to understand how financial flows move in a post-crisis environment (Broner et al., 2013; Janus and Riera-Crichton, 2013). Moreover, our reliance on aggregate gross inflows – as opposed to either inflows net of outflows (Ahmed and Zlate, 2014) or portfolio flows alone (Fratzscher et al., 2013; International Monetary Fund, 2013) – allows us to ensure that the potential effects of QE do not become washed out on net, while simultaneously representing the totality of financial flows (of which portfolio flows are only a minority part).

[1] Unconventional monetary policy encompasses not only quantitative easing, but other forms of policy implemented at the zero-lower bound of interest rates, including forward guidance and other forms of sterilized interventions designed to affect long bond yields. While our focus in this paper is primarily on quantitative easing, many central banks simultaneously engaged in a number of other forms of unconventional policy, and we use these two terms interchangeably.

We pair these gross flows data with global and country-specific variables that are selected to capture transmission along standard channels, and complement these observable measures with an indicator corresponding to the different episodes of QE. Our baseline estimation also takes into account (time-invariant) country-specific unobservables, a time trend, and the discrete fall in capital flows following the financial crisis of 2008.

Our analysis indicates that financial inflows to developing economies operate along all three potential channels of transmission for QE. More importantly, we find evidence that episodes of QE were also accompanied by increases in inflows beyond these observable channels. An average developing country experienced, during episodes of QE, increases in inflows of close to 5 percent above the post-crisis trend, a magnitude comparable to a one standard deviation change along the traditional channels – such as changes in yield curve spreads (the portfolio channel) or the short-term interest rate (the liquidity channel) – and a full order of magnitude larger than other variables often identified as key drivers of financial flows, such as countries' risk ratings. Our estimates suggest that of the 211 percent of the increase in quarterly inflows to developing countries between 2009 and 2013, at least 27 percent – and as much as 132 percent when standard channels are included – may be attributable to the effects of QE.

Our analysis suggests that this unmeasured QE effect is remarkably robust, and more so compared to other papers in the literature that are focused only on portfolio flows alone (Fratzscher et al., 2013) or using gross inflows but without our battery of measures for different transmission channels (Ahmed and Zlate, 2014). The result remains even when we consider a number of alternative variations to how we capture this latent effect. Nor can the result be ascribed to the unprecedented nature of economic conditions during and after the financial crisis: we find little evidence that the sensitivity of our observable measures for the different transmission channels changed during the QE period, or that expectational effects in financial markets were responsible. Finally, our results also point to heterogeneity in the response of different types of inflows during the period. When we decompose aggregate gross flows into their constituent components, we find that foreign direct investment (FDI) does not vary significantly along either observable transmission channels or our QE indicator, whereas portfolio (and in particular bond) flows do, especially along global "push" factors associated with economic conditions in high-income countries.

Our work speaks to several strands of literature. The general nature of the questions we pose has been examined by a vast theoretical (Betts and Devereux, 2000, 2004; Fukuda, 1993; Obstfeld and Rogoff, 1995; Turnovsky, 1986) and empirical (Ammer et al., 2010; Dedola et al., forthcoming; Ehrmann and Fratzscher, 2009; Jannsen and Klein, 2011; Kazi et al., 2013; Kim, 2001; Rogers et al., forthcoming; Xiao, 2011) literature on cross-border spillover effects of monetary policies. The vast majority of the papers in this vein are concerned with interest rates, more precisely the effect of changes in the interest rate (or monetary base) on other macroeconomic and financial market variables. However, spillovers from center economies – such as the U.S., Eurozone, and Japan – stem not just from interest rates, but financial factors more generally (Aizenman et al., forthcoming, 2015).[2] In contrast to these papers, we are concerned primarily with unconventional monetary policies in the form of quantitative easing, which is particularly relevant in the zero-lower bound environment of the past few years.

There has also been a small literature that emerged following the implementation of QE, which has sought to quantify the effects of QE on a range of macroeconomic phenomena, especially interest rates (Christensen and Rudebusch, 2012; Gagnon et al., 2011; Krishnamurthy and Vissing-Jørgensen, 2011; Pesaran and Smith, 2012) and term premia in financial markets more generally (Bauer and Rudebusch, 2014; Breedon et al., 2012; Joyce et al., 2011), but also output and inflation (Chen et al., 2012; Kapetanios et al., 2012). By and large, this family of papers finds somewhat modest but non-trivial effects, consistent with a 75–100 basis point reduction in the policy rate (although evidence

[2] Elsewhere in this issue, Aizenman et al. (forthcoming) examine the sensitivity of a host of financial variables in developing economies to center countries, and find that for most financial variables the strength of the links with the center economies has been the dominant factor. They also show that the exchange rate regime and financial openness influence the extent of this linkage, independently of the influence of global factors such as the VIX and TED spread (which has been increasing since the crisis).

on real effects is more ambiguous). However, these papers are uniformly concerned with the effects of QE on the *home* economy (in particular the United States), while we are interested more in the spillover effects as they play out in other countries, especially those in the developing world.

Of course, there is a massive literature that examines the determinants of financial inflows, including those that explore the conditions where capital flows may experience surges (Agosin and Huaita, 2012; Forbes and Warnock, 2012a, 2012b; Reinhart and Reinhart, 2008) and where developing countries may be disproportionately affected (Brana and Lahet, 2010; Broto et al., 2011; Sarno and Taylor, 1999). Our modeling approach takes after these papers, but our explicit goal is to capture the effects of QE on financial flows, rather than exploring the role of a broader set of determinants. Moreover, given the relatively brief windows in which QE operations have been in effect, we emphasize slightly higher-frequency (quarterly) movements in capital flows.

Probably the papers closest in spirit to our own are those by Ahmed and Zlate (2014), Fratzscher et al. (2013), International Monetary Fund (2013), Bauer and Neely (2014), Bowman et al. (2015), Chinn (2013), Eichengreen and Gupta (2014), and Neely (2015). While these papers all consider the international dimensions of QE, only the first three introduce *gross* financial inflows. As explained above, our attention to gross inflows is motivated by their greater responsiveness to monetary phenomena, which we regard as especially important in understanding potential cross-border spillover effects, and especially important for developing economies. Moreover, none of the first three papers consider the transmission of QE along theoretically informed channels, nor do they break down heterogeneous effects among the distinct constituents of gross flows. Furthermore, none of these papers adopt our specific strategy of identifying the latent effects of QE over each episode, as we do; as discussed earlier, we view this approach as crucial for establishing a plausible lower bound for the effect of QE.[3]

Our specific choice of data and alternative methodological approach yields distinct (and novel) results. For example, we find – in contrast to Ahmed and Zlate (2014) – that the effects of QE on financial flows are much more robust than originally presupposed, and while we verify that portfolio flows – especially bond capital – are undoubtedly the most sensitive element among flows (Fratzscher et al., 2013), we also establish that loan flows reacted to QE as well, underscoring the importance of examining the totality of financial flows. As a final example, we are able to rule out the possibility that the confidence channel operates essentially via altering the expectations of financial market (as opposed to private sector) participants.

The rest of this paper is organized as follows. In the following section, we provide some background on the unconventional monetary policies pursued by the Federal Reserve (and other major high-income central banks) following the financial crisis of 2008. Section 3 reviews the theoretical literature on transmission channels for monetary policy in general, and quantitative easing in particular. We describe our empirical methodology, data sources, and key variable definitions in Section 4. Sections 5 and 6 report our baseline results and an array of robustness tests, including the addition of explanatory variables, alternative measures of our main variables, and alternative estimation techniques. The latter section also considers, in detail, differences between the behavior of different types of financial flows. The final section concludes with some policy reflections from our analysis.

2. Unconventional monetary policies in the aftermath of the 2008 financial crisis

In the months leading up to and following the Lehman crisis in the United States in August 2008, the US Federal Reserve – along with central banks in a number of other high-income economies (the Bank of England, BoE, the European Central Bank, ECB, and the Bank of Japan, BoJ) – sharply cut policy interest rates, in an effort to support demand in the face of weakening output and employment. However, with interest rates already fairly low, the perceived constraints from a zero lower bound on nominal

[3] It should be noted that while a few of these papers do introduce dummy variables to capture discrete shifts in the data, they are either focused on very short-term announcement effects (Bauer and Neely, 2014; Fratzscher et al., 2013) or treat all QE episodes homogeneously (Ahmed and Zlate, 2014), as opposed to our interest in the effects of the various QE episodes, along with their interactions with other transmission variables.

interest rates prompted the US Federal Reserve and other central banks to subsequently implement unconventional monetary policies in the form of quantitative easing.

QE involved large-scale purchases of financial assets (LSAPs), such as long-dated government bonds and mortgage-backed securities. These unorthodox measures – which were eventually realized over three episodes between 2008 and 2013 (see Table A.1 in Appendix S1) – were initially undertaken to repair financial market functioning and intermediation during the crisis, but subsequently evolved to support weak post-crisis recovery in growth and employment.

This extended period of highly accommodative monetary policies in high-income countries has been a source of significant concern among many developing countries, who fear potential policy spillovers, primarily through an uncontrolled increase in cross-border financial flows.[4]

These fears were not unfounded. Over the four-year period between mid-2009 and the first quarter of 2013, cumulative quarterly gross financial inflows into the developing world rose from $192 billion to $598 billion (a 211 percent increase), more than twice the pace compared to the far more modest increase of $185 billion between mid-2002 and the first quarter of 2006 (Fig. 1(a)).[5] When expressed as a share of developing country GDP, they more than doubled (Fig. 1(b)). Developing world equity markets also experienced substantial gains, and the many emerging economies that received substantial volumes of inflows relative to their GDP also saw significant appreciation of their real effective exchange rates.

The initial concerns of developing countries over unmanageable financial inflows have since been compounded by the possibility of disorderly capital flow reversals. In the middle of 2013, the Fed's anticipated exit from QE sparked substantial outflows from a number of emerging market economies. The specter of further tapering of asset market purchases by advanced-economy central banks could mean increases in borrowing costs, as well as other financial market disruptions due to the unwinding of speculative positions.[6]

In January 2014, the Fed began the long-awaited taper of asset market purchases, and in the following month the BoE issued forward guidance that signaled a maintenance (without expansion) of its current stock of purchased assets (the Bank had already concluded its last major asset purchase in mid-2012). In contrast, the BoJ and the ECB remained committed to unconventional monetary policies, with announcements of expanded asset purchase programs in October 2014 and January 2015, respectively.

3. Channels of transmission for unconventional monetary policy

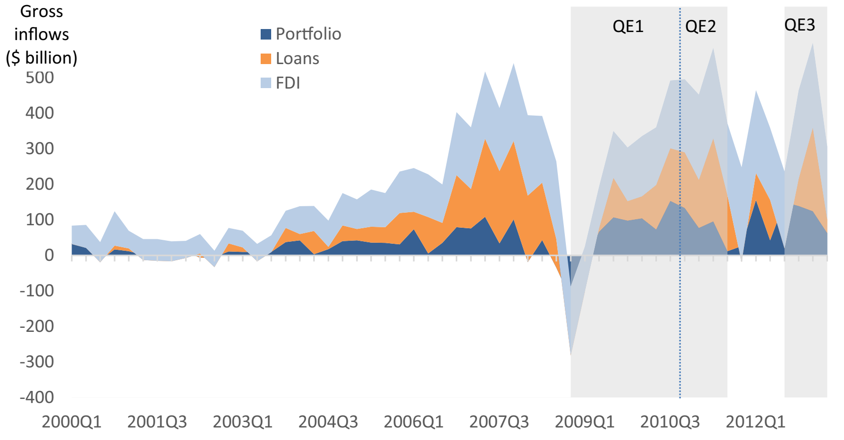
Traditional monetary policy operates along the interest rate and other asset price channels – including exchange rates and equity prices – as well as the credit channel, which includes bank lending and balance sheet mechanisms (Mishkin, 1996). In contrast, the premise for unconventional monetary policies is that these traditional channels are either ineffective, unavailable, or weak, which justifies large-scale asset market interventions by the central bank.

A central transmission channel by which such asset purchases affect cross-border capital flows is via the *portfolio balance* channel (Gagnon et al., 2011; Hamilton and Wu, 2012). QE involves the purchases of longer-duration assets – typically mortgage-backed and long-dated government bonds – which in turn reduce the available stock of privately held risk assets. Unmet risk appetite will thus be met by increasing demand for other risky investments. Thus, we would expect the portfolio balance channel

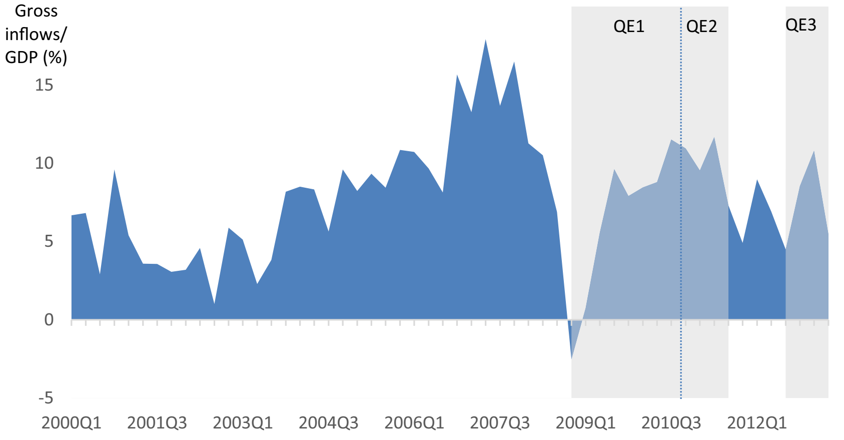
[4] Emerging markets have, since the beginning, voiced their concern over unmitigated financial flows due to QE. Foreign exchange intervention by developing countries to arrest exchange rate appreciation due to capital inflows sparked talk of "currency wars" (Mackintosh, 2010) and what many regarded as a forced buildup of foreign exchange reserves (Beckner, 2013).

[5] This comparison deliberately excludes the pre-crisis boom in inflows between 2006 and 2008. An alternative way to express the same sentiment is that cumulative inflows since the beginning of QE have paralleled the increases in the immediate pre-crisis "bubble" period.

[6] This anticipated tapering of QE in mid-2013 resulted in depreciations in a large number of developing-country currencies (Eichengreen and Gupta, 2014), and developing economies have also expressed concern over additional spillover effects due to the QE exit (Wigglesworth, 2013).



(a) Gross inflows to developing countries, cumulative value



(b) Gross inflows to developing countries, as share of GDP

Fig. 1. Gross financial inflows to developing countries, by different constituent flows, in cumulative U.S. dollars (a) and as share of developing country GDP (b). The three quantitative easing episodes are shaded. The sharp contraction in flows following the financial crisis in 2008 is evident. Increases in portfolio and loan flows over the period appear to be equiproportional, but faster than the increase in FDI (lower panel). The variations in gross flows as a share of GDP mimic those in absolute terms, although the post-crisis recovery in flows remains below pre-crisis peaks when measured in this manner (right panel).

to be expressed both in terms of heightened demand for *temporal* (longer duration) and *spatial* (developing country) assets, which comes about as investors rebalance their portfolios.

Another key transmission channel for QE is the *liquidity* channel (Gagnon et al., 2011; Joyce et al., 2011; Krishnamurthy and Vissing-Jørgensen, 2011). The long-term assets purchased through QE operations are credited as increased reserves on the balance sheets of private banks. Since such reserves are more easily traded in secondary markets than long-term securities, there is a decline in the liquidity premium, which in turn enables previously liquidity-constrained banks to extend credit to investors. This results in a decline in borrowing costs and increases overall bank lending, including direct lending to developing countries, and perhaps more importantly, indirect lending via the carry trade.

Finally, QE can also play a signaling role. Large-scale asset purchases serve as as a credible commitment to keep interest rates low even after the recovery of the economy, since a premature increase in interest rates would imply a loss on assets held by the central bank (Bauer and Rudebusch, 2014; Clouse et al., 2003). Moreover, such signaling can also improve household and business sentiment by diminishing concerns about deflation risk (Hendrickson and Beckworth, 2013); steady central bank asset market interventions can also reduce volatility and hence economic uncertainty. The sum total of these *confidence* channel effects is to bolster investment activity, and is the final channel of QE transmission to developing country financial flows that we consider.[7]

4. Measuring and estimating the effects of QE on financial flows

4.1. Econometric model and estimation methodology

Our baseline regression specification is a lagged-dependent model[8] of the form

$$\begin{aligned} GFI_{it} = & GFI_{i,t-1} + \lambda L_{it} + \pi PB_{it} + \chi C_{it} + \theta QE_t + \beta' \mathbf{X}_{it} \\ & + CRISIS_t + POSTCRISIS_t + \alpha_i + \tau_t + \epsilon_{it}, \end{aligned} \tag{1}$$

where the effects of unconventional monetary policy on gross financial inflows to country i at time t, GFI_{it} , may be transmitted via (observable) liquidity (L_{it}), portfolio balance (PB_{it}), and confidence (C_{it}) channels, but may also encompass additional effects due to unobservable latent factors, which we proxy with the (country-invariant) indicator variable QE_t. We further include dummies to account for the sharp drop in crisis ($CRISIS_t$) flows and the possibility of a post-crisis ($POSTCRISIS_t$) "secular stagnation" (Fig. 1).[9] We also include a vector $\mathbf{X}_{it}$ of additional time-varying idiosyncratic controls (such as the countrys GDP, growth rate, and its risk rating), country-specific fixed effects (α_i), and a time trend (τ_t).[10] $\epsilon \sim NID(0, \sigma_\varepsilon^2)$ is the residual. Our coefficients of interest correspond to the vector $[\lambda\ \pi\ \chi\ \theta]$ of estimated coefficients that correspond to the different observable and unobservable transmission channels.

Since (1) is a dynamic model with fixed effects, these estimates may be biased for finite T (Nickell, 1981). Since the time coverage of the dataset is relatively long (54 quarters), we suspect that the inconsistency of estimates should not pose a major problem (since the bias is of $O(\frac{1}{T})$). Nevertheless, our coefficients are estimated using bias-corrected Least Squares Dummy Variables (LSDV) (Bruno, 2005), under the strictest condition for bias approximation (up to $O\left(\frac{1}{NT^2}\right)$), with bootstrapped standard errors.[11]

7 While we recognize that these channels that we describe do not constitute an exhaustive list, our decision to focus on the liquidity, portfolio balance, and confidence channels is due to three reasons. First, there is a substantial degree of overlap between some of the more esoteric channels that have been explored in the literature, and what we identify here. For instance, Vayanos and Vila (2009) identify a duration risk channel where central bank asset purchases are able to alter investors' preferred duration risk, and hence compress the yield curve. But when interpreted more broadly as a mechanism that alters term premia and hence the shape of the yield curve, this channel – along with others, such as the safety channel (Krishnamurthy and Vissing-Jørgensen, 2012) – arguably falls within the broader rubric of portfolio rebalancing. Second (and relatedly), we have chosen to subsume channels that may be distinct but are likely to be measured in a similar fashion. For example, given the difficulty of identifying proxies for sentiment, we have chosen to fold expectational and signaling effects into a single channel, confidence. Third, while it is clear to us what the cross-border spillover effects are of the channels that we identify, other possible channels may have more ambiguous cross-border implications, which justifies our exclusion.

8 We introduce a dynamic model because high-frequency financial flows are widely understood to exhibit autocorrelative properties (Becker and Noone, 2008).

9 These variables take on the value of unity for all quarters between 2008Q3 and 2009Q2 (inclusive), and 2009Q3 and 2013Q2 (inclusive), respectively.

10 Note that this refers not to year-specific time fixed effects—which would be collinear with our QE indicator variable—but to a standard drift variable that increments by year.

11 The correction is initialized by the Anderson and Hsiao (1982) consistent estimator for β_{i0}, and the bootstrapped asymptotic variance–covariance matrix is constructed with 100 replications.

4.2. Data sources and definitions of key variables

Our analysis relies on data quarterly data, starting in 2000Q1 and spanning through 2013Q2 (inclusive). We end the study in 2013, since central banks began to pursue divergent monetary policies the following year (see Section 2), which muddies the picture insofar as the effects of QE are concerned.[12] Due to data limitations, the panel is unbalanced, but includes up to 60 developing countries.[13]

Our dataset draws primarily on balance of payments data from the International Monetary Fund's International Financial Statistics (IFS) for gross portfolio and FDI inflows.[14] We supplement these two flows with bank lending data from the Bank of International Settlements' Locational Banking Statistics (LBS).[15] We define our main dependent variable of interest, aggregate *gross financial inflows*, as the sum of changes in foreign holdings of these three categories of assets (portfolio, FDI, and loans) in the developing economy, net of their own disinvestment in each of these three flows. In our robustness checks, we also draw on EPFR Global's Global Fund Flows and Allocations Data – which compiles secondary market transactions of bond and equity purchases in emerging market mutual funds – to obtain a complementary gross inflow measure; we define this alternative measure as *gross fund inflows*.[16] Other additional control variables were obtained from the IFS and the World Bank's World Development Indicators, supplemented by data from Haver Analytics and Datastream where gaps exist.

Our main independent variables of interest is a suite of variables designed to capture the effects that occurred during QE episodes accruing to unobservable latent factors. We consider three alternative primary measures, all of which are global in nature: an indicator variable that corresponds to any of the three distinct periods for which a QE program was implemented, separate indicator variables for each of the three episodes, and a continuous measure of QE interventions based on expansions in the size of the central bank's balance sheet.[17] For the indicator variables, our coding scheme for the start/end quarters defines a quarter as belonging to the implementation window if the total number of implementation days exceeded half the days in any given quarter (e.g. QE1 operations, which began on December 16, 2008, are coded as starting 2009Q1, while QE2, which came into effect on November 3, 2010, is coded as beginning 2010Q4) (precise details of this coding scheme are provided in Appendix S1). In our baseline, we consider only QE operations by the U.S. Federal Reserve (which we subsequently expand in robustness checks to allow for QE operations in other major advanced-economy central banks).

We use a number of distinct measures to capture each of the potential transmission channels for QE. For each channel, we include a primary indicator (or set of indicators), which we use in our more

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[12] Furthermore, crude oil prices began their downward slide off peaks in mid-2013, which introduces another distinct global shock into the subsequent data.

[13] To maximize coverage, we impute quarterly observations using a cubic spline for a small number of low-volatility control variables which were only available at an annual frequency.

[14] Although the study of either net inflows or gross outflows is important to understand portfolio reallocation effects, for the question that we pose – whether QE had an effect on financial flows to developing countries, and whether this is adequately captured by observable transmission channels – we regard our focus on gross inflows alone as more appropriate. Relying on variation in only the net effect may mask important transmission effects operating primarily on gross flows, while using gross outflows instead would call for a potentially whole new set of channel transmission variables and controls. This latter exercise would go far beyond the scope of our research question, and we accordingly leave the issue for future research.

[15] The IFS data do include a residual category, "other investments," that includes loans as a subcomponent. However, this category also includes other forms of cross-border finance (such as trade credit and cash) that are of a fundamentally different nature from bank loans, which make it harder to draw inferences when we disaggregate by flow type. The main advantage of using the "other investments" data is that they aggregate consistently with outflows to yield the balance of payments. Since ensuring this consistency is not important for our application, we use the more clearly delineated LBS data instead.

[16] Since only relatively few countries report this breakdown to the IMF, the IFS data provide relatively scant country coverage for bond-equity disaggregations. While our alternative measure of gross inflows represents only a relatively small segment of the total market for financial assets, it tends to closely track actual balance of payment flows remarkably well (Miao and Pant, 2012) and serves as a useful robustness check for our main dependent variable.

[17] It is conceivable that these indicators are capturing unobservable effects that are nevertheless directly attributable to the observable channels, and merely reflect a change in the structural relationship along these channels during the QE period. We explore this possibility by examining interaction effects of the QE episode indicator with our other channel measures in Section 5.2.

parsimonious specification, followed by additional secondary indicators, which are distinct but related alternative. We call this our extended specification.

For the *liquidity* channel, our primary indicator is the 3-month Treasury bill rate, which measures the effect of changes in short-term rates resulting from QE operations.[18] Our secondary liquidity measure is the (lagged) money supply (M2), which serves as a quantity-based measure of available liquidity.[19] While analogous, these two variables capture slightly different notions of liquidity: the former is a price signal that may or may not translate into actual changes to the stock of outstanding money. Note, as well, that our use of M2 as the measure of the money supply ensures that it overlaps only minimally with changes in the monetary base that directly result from QE operations.[20]

Our primary measures for the *portfolio balance* channel are the yield curve (the difference between the long-term interest rate and short-term policy rates) and the interest rate differential between the developing country vis-à-vis the United States. The first is a global variable and captures the effect that QE can have on long-term yields, and hence temporal rebalancing toward higher-risk asset classes, of which developing-country investments are one. The second is a country-specific variable, and captures the more traditional spatial rebalancing that arbitrages cross-country differences in yields that result from QE. Since these are sufficiently distinct aspects of portfolio rebalancing due to QE, we include them both as primary indicators. The secondary measures that we consider supplement our primary return differentials with their growth analogues: the country-specific lagged growth differential (relative to the United States) and the global composite purchasing managers' index (PMI). These proxy spatial rebalancing toward asset classes that are more sensitive to short-term growth expectations and longer-term expectations of overall global growth, respectively.

Finally, our primary *confidence* channel indicator is a global variable, the VIX index. This measure is designed to capture market sentiment for investing in risk assets, in particular, although it has been used in other applications as a measure for broader financial market uncertainty.

The other controls that we include – such as GDP – are standard. Here we highlight the inclusion of the institutional investor risk rating in our baseline specification; although not a channel for QE transmission, this country-specific measure captures the important aspect of the attractiveness of a given developing country as an investment destination. Additional definitional details and source information are relegated to Appendix S1, which also includes further sample-related information, such as our country coverage, summary statistics, and cross-correlations.

4.3. Identifying the potential effect of QE

It is important to understand how the potential effects of QE are measured in the context of the model described in Section 4.1. The first point to note is that while the variables we select are meant to proxy for the observable transmission channels of QE, these measures may well be relevant for capital flows even in the *absence* of unconventional monetary policy. For instance, while the flattening of the yield curve is one of the primary goals of QE, changes in the long-term cost of capital will also alter the shape of the yield curve, which can in turn affect financial flows even in periods of unexceptional monetary policy.

In addition, it is also possible that these variables may also vary for reasons *unrelated* to QE. For example, exogenous improvements in productivity can alter the growth differential between economies, even without monetary stimulus in one country versus another. Indeed, the growth differential

[18] Note that reductions in the liquidity premium that result from QE will tend to lower the price of short-term Treasuries, which is reflected in *higher* yields. Increased Treasury yields raise the opportunity cost of alternative investments – including that of developing world assets – such that, *ceteris paribus*, inflows can be expected to fall (implying a negative coefficient).

[19] This variable is lagged since quantity signals are generally regarded as slower to disseminate than price signals. Although its interpretation is more indirect, *a priori*, we expect this coefficient to be negative: an increase in M2 indicates an increase in available financing, which lowers the liquidity premium (raises yields on liquid assets) and substitutes away from financial investments in developing countries.

[20] This is to avoid confounding the effect of the money supply measure with QE indicator(s). Pairwise correlations are relatively low: more precisely, $\rho(r_{US,t}, ms_{US,t}) = -0.49$ and $\rho(\Delta ms_{US,t}, \Delta mb_{US,t}) = 0.19$.

is a fairly standard feature of most models of cross-border financial flows, as is the interest rate differential.

Consequently, we do not make claims that point estimates corresponding to these variables necessarily represent the full effects of QE spillovers on financial inflows (although it is likely that at least *some* of the effects of QE are embedded in changes in these variables). Nor do we seek to pin down the marginal contribution of QE via the standard channels, which would require us to first determine the precise impact of QE on these fundamentals. Rather, as discussed in the introduction, our goal is to establish whether there are any additional, latent effects during the QE period, after taking into account changes in the observable channels. This allows us to sidestep the issue of identifying a direct causal influence of QE on the fundamentals, as long as we treat any estimated effect from the unobserved latent component as representing a *lower bound* to the potential effects of QE.

Of course, one could always argue that this latent QE effect is actually attributable to other, unobserved components that affect financial flows. We seek to rule these possibilities out in two ways. First, we include in our baseline estimates separate indicators corresponding to each distinct QE episode, as well as a continuous measure of QE. These are designed to allay concerns that a crude binary variable may be insufficient to capture variations due to QE. Second, we also introduce a number of placebo tests, by either artificially expanding the coverage of the QE indicator or shifting the indicator to alternative windows prior to the first instance of QE.[21] In general, these changes result in the latent QE effect either disappearing or operating in the opposite direction. These experiments allow us to be more confident that the latent effect, which we take as our lower bound, is not due to an arbitrary blip in the data that occurred during the QE period.

Our decision to frame the question as essentially about QE transmission channels, rather than about generic push/pull or global/country-specific factors, also allows us to ask (and answer) questions that are not immediately obvious when not posed in that way. For instance, we are able to probe whether the elasticity of flows along these channels was altered during the QE period, and also to what extent market-based expectational measures alone are responsible for the confidence effect.

Finally, it is useful to note that since the global variables represent changes in financial and economic conditions in high-income (in particular the U.S.) countries, changes in these variables are plausibly exogenous from the point of view of our dependent variable (gross inflows). Of course, one could argue that endogeneity may still arise from unobserved, common factors that affect both high-income and developing countries equally. We recognize this possibility – indeed, our empirical strategy embodied in (1) is to account for the effects of as many distinct common unobservables as possible – but in our robustness checks we also consider using only a single global factor, which aims to fully account for global unobservables in a systematic fashion.

5. Baseline results

5.1. Regression results and main findings

As alluded to in the previous section, our baseline estimates of (1) include two alternative specifications: a parsimonious model that includes only our primary indicators for each channel and an extended specification that includes our secondary indicators. These are reported in Table 1, where the first three columns (*B1*)–(*B3*) correspond to the parsimonious specification for each of the three alternative channels, and the next three columns (*B4*)–(*B6*) to the extended specification, again for each of the three channels.

The lagged dependent variable is highly significant across all the specifications, suggesting a certain degree of partial adjustment, which is not unexpected for quarterly data. While this might suggest the need to incorporate a deeper lag structure, model selection criteria point to retaining just a single

[21] These are reported in Appendix S1. More specifically, we extend the QE period to either include all of 2008, or all of 2008 and the lapse period between QE2 and QE3, and we shift the entire QE episode indicator forward to either exactly before the first QE begins or to the beginning of the sample.

Table 1
Baseline regressions for gross financial inflows, unbalanced quarterly panel, 2000Q1–2013Q2.[a]

	B1	B2	B3	B4	B5	B6
Lagged inflows	0.469 (0.02)***	0.477 (0.02)***	0.476 (0.02)***	0.466 (0.02)***	0.473 (0.02)***	0.473 (0.02)***
All QE episodes	0.027 (0.01)***	–	–	0.026 (0.01)***	–	–
QE1 episode	–	0.047 (0.01)***	–	–	0.049 (0.01)***	–
QE2 episode	–	0.033 (0.01)***	–	–	0.035 (0.01)***	–
QE3 episode	–	0.008 (0.01)	–	–	0.006 (0.01)	–
QE-related expansion	–	–	0.003 (0.00)***	–	–	0.002 (0.00)***
	Liquidity channel					
3M T-bill rate	–0.013 (0.00)***	–0.020 (0.00)***	–0.003 (0.00)	–0.016 (0.01)*	–0.017 (0.01)**	–0.006 (0.01)
Money supply (M2)	–	–	–	–0.106 (0.22)	0.144 (0.26)	–0.098 (0.22)
	Portfolio balance channel					
Yield curve	–0.018 (0.00)***	–0.027 (0.01)***	–0.007 (0.00)	–0.018 (0.01)**	–0.024 (0.01)***	–0.007 (0.01)
Interest rate differential	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)
Global PMI	–	–	–	–0.001 (0.00)	–0.001 (0.00)	–0.002 (0.00)
Growth differential	–	–	–	0.001 (0.00)*	0.001 (0.00)*	0.001 (0.00)
	Confidence channel					
VIX	–0.001 (0.00)***	–0.002 (0.00)***	–0.001 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***
	Basic controls					
GDP	0.139 (0.03)***	0.134 (0.03)***	0.137 (0.03)***	0.129 (0.03)***	0.125 (0.03)***	0.128 (0.03)***
Developing GDP growth	0.003 (0.00)*	0.000 (0.00)	0.002 (0.00)	0.004 (0.00)**	–0.000 (0.00)	0.004 (0.00)**
High-income GDP growth	–0.001 (0.00)	–0.000 (0.00)	–0.001 (0.00)	–0.000 (0.00)	0.001 (0.00)	0.000 (0.00)
Country rating	0.002 (0.00)***	0.002 (0.00)***	0.002 (0.00)***	0.002 (0.00)***	0.002 (0.00)***	0.002 (0.00)***
Crisis period	–0.019 (0.01)	–0.028 (0.01)**	–0.023 (0.01)*	–0.021 (0.01)	–0.026 (0.01)*	–0.026 (0.01)*
Post-crisis period	0.002 (0.01)	–0.011 (0.01)	–0.028 (0.02)*	0.002 (0.01)	–0.010 (0.01)	–0.026 (0.02)
Adj. R^2	0.368	0.371	0.366	0.368	0.371	0.367
R^2 (within)	0.372	0.376	0.370	0.374	0.377	0.372
R^2 (between)	0.522	0.525	0.525	0.526	0.529	0.528
N (countries)	1938 (60)	1938 (60)	1938 (60)	1925 (60)	1925 (60)	1925 (60)

[a]All level variables are in logarithmic form, but rates, indices, and indicator variables are untransformed. Bootstrapped standard errors (with 100 replications) are reported in parentheses. A time trend, country fixed effects, and constant term were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

lag.[22] Summary statistics suggest that much of the variation from the sample is, as to be expected, between economies, although within variation (on which our estimates depend) is reasonably high (explaining slightly more than a third of variation in the data).

There are several broad conclusions to be drawn from this set of baseline results.

First, the QE episode indicators enter with statistically and economically significant coefficients: the combined QE episode indicator, for instance, suggests that the QE period saw an increase in gross financial inflows to developing countries of $0.03/(1–0.47) \approx 5$ percent, *over and above* the effects that QE may have had on observable channels, such as a reduction in the VIX due to improved confidence or the flattening of the yield curve as investors rebalanced their portfolios.[23] This is nontrivial and comparable to a one standard-deviation change in these other traditional channels (such as changes in yield curve spreads or the short-term interest rate); indeed, this latent effect is two times in magnitude compared to our observable proxies, and an order of magnitude larger than other determinants often identified as important in the literature, such as risk ratings. If we concentrate on the period between 2009H1 and 2013H1, about 13 percent of the total change in inflows is directly attributable to this latent effect of QE, compared to around 50 percent of the change accruing to observable monetary conditions (this decomposition is graphically depicted in Figure A.1 in Appendix S1).

It is also notable that when we break down the measure into the three separate variables, these measures of QE display a diminishing effect for each episode: the magnitude of the coefficient decreases from the first and second QE interventions, and is actually insignificant for QE3 in the extended specification (*B4*). This possibility – that LSAPs were more efficacious in the earlier QE episodes than the most recent one – is in fact consistent with what the literature has found for the U.S. economy (Cúrdia and Ferrero, 2013; Krishnamurthy and Vissing-Jørgensen, 2013).[24]

Second, to the extent that QE affected the fundamentals, there is evidence that its transmission occurred along all three channels.[25] The rate on 3-month Treasury bills is generally negative and significant; this is consistent with how reductions in the liquidity premium due to QE increased yields on short-term bills, which in turn served as a substitute for developing country asset, hence reducing financial inflows[26] (the money supply, in contrast, tends to be indistinguishable from zero). The coefficient on the U.S. yield curve also typically enters with a significant, negative coefficient, consistent with temporal portfolio rebalancing. The evidence on spatial rebalancing, however, is more mixed; while the coefficient on the (lagged) growth differential is statistically significant, it is small in magnitude, and the coefficient on the interest rate differential is indistinguishable from zero across all specifications.[27] There is also evidence that confidence effects are relevant: the coefficient on the VIX is highly significant, and is in fact the most robust covariate among the different transmission channel proxies.

Finally, we note that a number of the controls, in particular GDP and country risk, consistently enter with significant coefficients that are in accordance with theory. For example, the coefficient on GDP is generally positive (an increase in GDP is associated with more financial inflows), although the small

[22] We considered lag depths of up to 2 years (8 lags). Both the Akaike and Bayesian information criteria select the model with only one lag. Results for these additional regressions are available on request.

[23] We also consider, but do not report, regressing our indicator variable with the lagged dependent variable and other controls, but excluding the channel proxies. This effectively allows the QE measure to absorb all possible variation in the data arising during the period, but may overestimate the full effects of QE. The coefficient in this case is 0.037 (and significant at the 1 percent level), which falls within our range of estimates for the effect in our baseline specifications.

[24] In contrast, Fratzscher et al. (2013) find only a marginal effect of QE on equity inflows to developing economies and a *negative* effect when considering bond inflows. Our results instead reinforce the bulk of the existing literature (albeit from an international context) and point to the importance of examining the totality of financial flows.

[25] It should be pointed out that a number of covariates display nontrivial correlations with each other. While this may be a problem for multicollinearity, the relatively low $R2$s suggest that this is not an issue in practice.

[26] To the extent that the T-bill rate was *falling* during the early part of QE, this would suggest that inflows into developing countries would have increased as short-term Treasuries became less attractive.

[27] The insensitivity of financial flows to interest rate differentials, while disappointing, has been fairly widely replicated in the literature on gross flows; see, for example, Bruno and Shin (2015) and Forbes and Warnock (2012a). One reason for this may be the *counter*cyclical relationship of capital flows to the real interest rate (Contessi et al., 2013), which would obviate any portfolio rebalancing effect due to changes in interest rate differentials.

size of the coefficient (significantly less than one) suggests a diminishing effect.[28] The crisis dummy is also negative and significant, a result consistent with the substantial reduction in global capital flows following the crisis (recall Fig. 1).

What would be the total effect of QE in this case? Given our estimates in Table 1, the lower bound of QE effects would likely be, for the average country, around 5 percent of gross financial inflows. Thus, even if one assumes no transmission via the observable channels, this latent component of the effect of QE still accounts for an increase in inflows in the order of several percent. If one is willing to make the additional assumption that changes in the observable fundamentals are entirely attributable to QE, the effects would be even greater. For example, including the portfolio balance effect from a 129 basis point decrease in yield curve spreads (one standard deviation in our data) would yield an increase in gross inflows of between 3 and 5 percent. If changes along all the three channels were assumed to be fully due to QE, the total effects could be as large as 15 to 22 percent. Put another way, of the 211 percent increase in developing country inflows between 2009 and 2013, as much as three-fifths of the total may have been due to QE.[29]

5.2. *Understanding latent QE effects*

It is tempting to assign a specific interpretation to latent unobservables during the QE period. In this subsection, we consider two possible candidate explanations that may potentially explain the significance of the QE episode variable.

The first explanation we probe is whether the unmeasured effects are implicit measures of expectations. Although difficult to precisely measure, *market* expectations are, in principle, recoverable from data on futures and forwards. We draw on two market-based measures in this regard: the yield implied by the 3-year futures contract for the 3-month T-bill, and an "implied" yield curve, calculated as the difference between the 3-year implied forward rate for the 10-year Treasury note and 3-year futures of the 3-month bill.[30] Since the VIX already embodies an expectations component, we do not introduce any additional controls for expectations via the confidence channel.

The most straightforward way to incorporate such market expectations into our model is to take the difference between a future/forward-implied rate and the prevailing rate; for example, the difference between the *current* 3-month T-bill futures rate and the 3-month T-bill rate. This captures the manner by which differences between market expectations of future short rates and contemporaneous short rates can affect financial flows; in other words, these are *anticipated* rate changes. We introduce additional "expectation" measures along these lines for the 3-month rate only, the yield curve only, and both, in columns (*E1*)–(*E3*) of Table 2, respectively.

Another way to think about expectations is to consider how expectational *errors* may come into play. Computation of such errors amounts to taking the difference between current realizations of a yield and the *3-year lagged* implied yield from futures/forwards; a positive value of the deviation between the T-bill rate and lagged 3-year forecasts of the same rate would suggest that market participants systematically underpredicted yields. We include these "error" measures – which we can treat as *unanticipated* rate changes – in columns (*E4*)–(*E6*).

[28] The total effect of this coefficient is (for a lagged dependent coefficient of 0.47) equal to $0.13/(1-0.47) \approx 0.25$. Since the model includes country fixed effects, this amounts to a *within* estimate of a concave relationship between inflows and GDP. However, this estimate likely underestimates the total effect (i.e. when *between* differentials are taken into account). For example, the standardized coefficient – which implicitly captures between-country variation in GDP since it draws on the pooled sample to compute standard deviations – is significantly larger (in excess of one), which strongly suggests that the inflow/GDP ratio is not diminishing when examined at the cross-country level (estimates with standardized coefficients for the baseline are reported in Appendix S1).

[29] These are computed from the minima and maxima among the significant coefficients across all specifications in Table 1, assuming a one standard deviation change for all measures with the exception of the QE episode indicator, which is assumed to hold at unity.

[30] We use a 3-year time frame to approximate the medium run. Since equivalent price data for futures on the 10-year note are not generally available (and even if they were would likely embed a nontrivial liquidity premium), we instead rely on computed implied forwards to capture expectations of yields for the 10-year note.

Table 2
Regressions for gross financial inflows with expectational measures, unbalanced quarterly panel, 2000Q1–2013Q2.[a]

	E1	E2	E3	E4	E5	E6
Lagged inflows	0.462 (0.02)***	0.462 (0.02)***	0.462 (0.02)***	0.461 (0.02)***	0.463 (0.02)***	0.463 (0.02)***
All QE episodes	0.031 (0.01)***	0.031 (0.01)***	0.031 (0.01)***	0.028 (0.01)***	0.029 (0.01)***	0.030 (0.01)***
3M T-bill (expectation)	–0.001 (0.02)	–	0.019 (0.06)	–	–	–
Yield curve (expectation)	–	0.002 (0.01)	0.012 (0.03)	–	–	–
3M T-bill (error)	–	–	–	–0.005 (0.01)	–	0.003 (0.01)
Yield curve (error)	–	–	–	–	0.013 (0.01)	0.017 (0.01)
Channel variables	Yes	Yes	Yes	Yes	Yes	Yes
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.367	0.367	0.366	0.367	0.368	0.367
R^2 (within)	0.372	0.372	0.372	0.373	0.373	0.373
R^2 (between)	0.527	0.527	0.527	0.527	0.527	0.527
N (countries)	1938 (60)	1938 (60)	1938 (60)	1925 (60)	1925 (60)	1925 (60)

[a] All level variables are in logarithmic form, but rates, indices, and indicator variables are untransformed. Bootstrapped standard errors (with 100 replications) are reported in parentheses. A time trend, country fixed effects, and constant term were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

On the basis of these results, we see no basis for attributing the QE episode effect to unmeasured expectations by financial market participants. Both classes of expectational measures enter with small, and statistically insignificant, signs. In some ways, this should not be entirely surprising; market-implied forecasts of interest rates generally perform rather poorly, especially at longer horizons (Campbell and Shiller, 1991; Lange et al., 2003). We are thus inclined to discount the possibility that the QE effect due to latent factors is due to either anticipated or unanticipated expectations of future interest rates changes. Just as important, if the latent QE effect indeed operates along the confidence channel, it likely affects the expectations of the nonfinancial private sector, as opposed to financial market participants.

The second explanation that we explore is whether the QE episode indicator is indirectly capturing structural shifts in the observable factors, due to the unprecedented nature of QE. Framed another way, the magnitude of monetary policy intervention in asset markets may have led to a change in the elasticity of response of gross inflows to the conventional, observable channels.

We operationalize this hypothesis by interacting our measures of the liquidity, portfolio balance, and confidence channels with the QE episode indicator. For each channel, we consider both the parsimonious (first four columns) and the extended specifications (latter four columns). In the initial three columns of each set – (*I1*)–(*I3*) and (*I5*)–(*I7*) of Table 3, respectively – we interact the measures separately by channel, while in the final ones – (*I4*) and (*I8*), respectively – we consider them all in tandem.

The main message one receives from this set of results is that there is little evidence that supports the argument that the sensitivity of transmission channels for unconventional monetary policy changed as a result of QE (with the exception of the interaction with the money supply). By and large, the coefficients on most of the uninteracted variables in Table 3 remain significant (if they were before in Table 1), whereas the coefficients on the interaction terms are generally statistically indistinguishable from zero.[31]

The significant coefficient on the interacted QE and money supply deserves some brief comment. While the significance is consistent with the liquidity channel being operative, it is of an unexpected sign. That said, the negative effect from this term appears to be more than offset by a much larger QE episode coefficient. There are also conceptual, econometric, and measurement reasons that would lead us to discount this particular result.[32]

6. Robustness of the baseline

6.1. Additional and alternative controls and estimators

We test the sensitivity of our baseline by several ways. Our first set of tests incrementally introduces additional controls that correspond to (*R1*) the global level of saving (to account for the quantity of investable funds); (*R2*) the (lagged) ratio of trade to output (to account for economic openness);[33] (*R3*) the (lagged) ratio of private credit to output (to account for variations in the level of financial development); (*R4*) the (lagged) ratio of debt to GDP (to control for the existing debt burden); (*R5*) the inflation differential (to allow for possibility excess inflation may reduce the value of investment

[31] Note also that the insignificant coefficient on the uninteracted QE episode variable in most of the specifications need not be a real cause for concern. For proper inference, the total effect of any given channel has to be inferred from the sum of both the uninteracted and interaction terms, and a weighted standard error computed from the variance–covariance matrix. For example, the marginal effect of the QE episode in specification (I1), computed at the means, is 0.167, with a standard error of 0.02 ($p = 0.00$).

[32] First, we do not observe a similar significance in the interaction effect for the 3-month T-bill rate, which would corroborate the potential importance of elasticity changes along this channel. Second, this coefficient is significant in specifications where the coefficients on the 3-month T-bill rate (interacted and uninteracted) fall out of significance, which raises the concern that the significance of the coefficient could be an artifact of possible multicollinearity, rather than a genuine interaction effect. Finally, although the magnitude of the effect appears fairly large (and would therefore argue for taking this effect into account), this is because of scaling differences; the standardized coefficient for M2 (reported in Table A.7 in Appendix S1) reveals that it exerts an effect of a similar magnitude as the short-term interest rate, which *is* taken into account in the uninteracted model.

[33] Alternatively, one may argue that it is *financial* openness, in particular, that is more relevant for understanding capital flows. Appendix S1 documents this set of results, using the Chinn and Ito (2008) measure of capital account openness. They are qualitatively similar to our baseline.

Table 3
Regressions for gross financial inflows with interacted channels, unbalanced quarterly panel, 2000Q1–2013Q2.[a]

	I1	I2	I3	I4	I5	I6	I7	I8
Lagged inflows	0.474 (0.02)***	0.471 (0.02)***	0.474 (0.02)***	0.474 (0.02)***	0.474 (0.02)***	0.470 (0.02)***	0.471 (0.02)***	0.473 (0.02)***
All QE episodes	0.002 (0.01)	–0.004 (0.02)	–0.005 (0.01)	–0.031 (0.02)	5.086 (2.37)**	0.102 (0.07)	–0.003 (0.02)	10.201 (5.07)**
Liquidity channel								
3M T-bill rate	–0.009 (0.00)**	–0.022 (0.01)***	–0.011 (0.00)***	–0.018 (0.01)***	–0.012 (0.01)	–0.018 (0.01)*	–0.011 (0.01)	–0.008 (0.01)
3M T-bill× QE	0.065 (0.03)**	–	–	0.072 (0.09)	0.003 (0.04)	–	–	0.059 (0.09)
Money supply	–	–	–	–	0.268 (0.27)	0.012 (0.23)	–0.006 (0.23)	0.403 (0.29)
Money supply × QE	–	–	–	–	–0.316 (0.15)**	–	–	–0.630 (0.31)**
Portfolio balance channel								
Yield curve	–0.014 (0.00)***	–0.029 (0.01)***	–0.016 (0.00)***	–0.026 (0.01)***	–0.021 (0.01)**	–0.025 (0.01)**	–0.015 (0.01)	–0.019 (0.01)
Yield curve × QE	–	0.015 (0.01)	–	0.017 (0.01)	–	0.017 (0.01)*	–	–0.011 (0.02)
Interest rate differential	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)
Interest rate diff. × QE	–	–0.001 (0.00)	–	–0.000 (0.00)	–	–0.000 (0.00)	–	–0.000 (0.00)
Global PMI	–	–	–	–	–0.001 (0.00)	–0.000 (0.00)	–0.001 (0.00)	–0.000 (0.00)
Global PMI × QE	–	–	–	–	–	–0.003 (0.01)**	–	–0.000 (0.00)
Growth differential	–	–	–	–	0.001 (0.00)*	0.001 (0.00)	0.001 (0.00)*	0.001 (0.00)
Growth diff. × QE	–	–	–	–	–	0.001 (0.00)	–	0.001 (0.00)
Confidence channel								
VIX	–0.001 (0.00)***	–0.001 (0.00)***	–0.001 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***	–0.001 (0.00)***	–0.002 (0.00)***	–0.001 (0.00)***
VIX × QE	–	–	0.001 (0.00)**	–0.000 (0.00)	–	–	0.001 (0.00)*	–0.003 (0.00)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.369	0.369	0.369	0.370	0.371	0.370	0.369	0.371
R^2 (within)	0.374	0.374	0.374	0.375	0.377	0.376	0.375	0.379
R^2 (between)	0.524	0.522	0.524	0.524	0.530	0.532	0.528	0.534
N (countries)	1938 (60)	1938 (60)	1938 (60)	1938 (60)	1925 (60)	1925 (60)	1925 (60)	1925 (60)

[a] All level variables are in logarithmic form, but rates, indices, and indicator variables are untransformed. Bootstrapped standard errors (with 100 replications) are reported in parentheses. A time trend, country fixed effects, constant term, and basic controls from the extended specification were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

in any given economy);[34] (*R6*) the (lagged) real exchange rate (which allows for exchange rate differentials to affect inflows).

The left panel of Table 4 presents the results from these tests, using the extended specification with a single QE episode indicator (specification (*B4*) of Table 1).

Note that the inclusion of additional variables does not alter the qualitative message from our baseline results. Moreover, the additional controls do not generally improve the fit of the model substantially nor do the coefficients for these controls generally enter with significant coefficients.[35] They do, however, erode the size of the sample (dramatically so in the case where the real exchange rate is included).

The second suite of tests allows for alternative measures for a number of our variables of interest, which comprise the middle panel of Table 4. As in the first set of checks, we apply the alternative measures to our original extended specification (*B4*).

The first alternative, reported in column (*R7*), considers a measure of the third QE episode that includes not just a single indicator that corresponds to the three quarters from 2012Q4 through 2013Q2, but also includes an additional indicator for the period where there were anticipations of a tapering of QE (due to interpretations of forward guidance issued by the Federal Reserve).[36] Interestingly, expectations of tapering were associated with a significant *reduction* in inflows. This reduction was not just statistically but economically important: indeed, the coefficient on the variable is almost twice as large as average effects over all prior QE episodes.

One reservation with regard to the interest rate differential we rely on in our baseline is that our reliance on interest rate *differentials* may not reflect true fluctuations in cross-country costs of capital, since the country-specific nominal interest rate we rely on to compute our interest rate differential is only one possible measure of the average cost of capital. To establish whether such measurement issues may explain the insignificance of the interest rate differential in the baseline, column (*R8*) substitutes the baseline interest rate differential with the interest rate spread computed from a richer array of fixed income instruments. The coefficient on this measure is still negligibly small and statistically insignificant, which suggests that mismeasurement is not at the heart of the insignificant coefficient for the interest rate differential in our baseline.

A third alternative set of measures that we explore allows for the fact that unconventional monetary policies were not the sole domain of the Federal Reserve, but were more or less simultaneously pursued by the Bank of England (via the Asset Purchase Facility), the Bank of Japan (via its Asset Purchase Program), and the European Central Bank (through its Securities Market Program and Outright Monetary Transactions[37]). Consequently, we substitute all our U.S.-centric controls with their weighted-average equivalents from these countries (which we collectively refer to as the G4).[38] As is clear from the results in column (*R9*), our main qualitative conclusions are unaffected by this change.

A final alternative measure we consider collapses all global variables into a single global factor, and substitutes this for all the global variables in (1).[39] This approach has some precedence in the international macroeconomics literature (Albuquerque et al., 2005; Köse et al., 2003). The principle is that global variables are driven by some underlying, unobservable common factor, and that controlling only for observables may still omit some time-varying global component. The tradeoff – and the reason

[34] Note that since the variables in our baseline are measured in real terms, this only captures the residual effect that large inflation differentials may exert on inflows, rather than a standard adjustment for variables expressed in nominal terms.

[35] The domestic credit/GDP ratio does enter with a marginally significant coefficient in the final specification, but the sample size is substantially smaller. For this reason, we play down these results, but note that the sign of the coefficient does comport with *a priori* expectations (higher levels of financial development are associated with larger inflows).

[36] Given our quarterly frequency, this effectively amounts to including an additional fixed effect for the period 2013Q2.

[37] There is some dispute as to whether the ECB's Long-Term Refinancing Operations constitute a form of quantitative easing; we stay with the convention here and exclude this program as a form of QE. Note as well that while the SMP has resulted in a substantial expansion of the ECB balance sheet, the OMT has in fact never been used, despite widespread acknowledgment that the program engendered confidence effects.

[38] For the episode indicator, we drew on qualitative information in Neely (2015) concerning G4 central bank unconventional monetary policy actions, and coded additional quarters as QE periods if at least two additional central banks engaged in QE.

[39] We construct this factor from the varimax orthogonal rotation of the first principal component of the vector of global variables. We also considered an alternative, the proportion-weighted sum of the first three principal components (all possessed eigenvalues greater than unity). Both methods produced qualitatively similar results, which are available on request.

Table 4

Robustness regressions for gross financial inflows, unbalanced quarterly panel, 2000Q1–2013Q2.[a]

	R1	R2	R3	R4	R5	R6
	Additional controls					
Lagged inflows	0.466 (0.02)***	0.462 (0.02)***	0.446 (0.03)***	0.465 (0.03)***	0.464 (0.03)***	0.344 (0.03)***
All QE episodes	0.029 (0.01)***	0.030 (0.01)***	0.028 (0.01)***	0.032 (0.01)***	0.033 (0.01)***	0.044 (0.02)***
QE tapering	–	–	–	–	–	–
	Liquidity channel					
Short-term rate	–0.017 (0.01)**	–0.016 (0.01)*	–0.016 (0.01)**	–0.018 (0.01)*	–0.018 (0.01)*	–0.023 (0.02)
Money supply	–0.009 (0.24)	0.077 (0.24)	–0.056 (0.20)	0.080 (0.29)	0.067 (0.29)	0.090 (0.45)
	Portfolio balance channel					
Yield curve	–0.021 (0.01)**	–0.021 (0.01)**	–0.018 (0.01)**	–0.021 (0.01)*	–0.022 (0.01)*	–0.027 (0.02)
Interest rate differential	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	0.000 (0.00)	–0.000 (0.00)
Interest rate spread	–	–	–	–	–	–
Global PMI	–0.001 (0.00)	–0.001 (0.00)	–0.001 (0.00)	–0.001 (0.00)	–0.001 (0.00)	–0.001 (0.00)
Growth differential	0.001 (0.00)*	0.001 (0.00)*	0.001 (0.00)**	0.002 (0.00)**	0.002 (0.00)**	0.002 (0.00)
	Confidence channel					
VIX	–0.002 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)***	–0.002 (0.00)**
	Additional controls					
Global saving	0.055 (0.06)	0.064 (0.06)	–	0.081 (0.08)	0.085 (0.08)	0.116 (0.10)
Trade/GDP	–	0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)
Credit/GDP	–	–	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.002 (0.00)*
Debt/GDP	–	–	–	0.011 (0.02)	0.010 (0.02)	–0.056 (0.07)
Inflation differential	–	–	–	–	0.000 (0.00)	0.002 (0.00)
Real exchange rate	–	–	–	–	–	0.000 (0.00)
Global factor	–	–	–	–	–	–
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	LSDV	LSDV	LSDV	LSDV	LSDV	LSDV
Adj. R^2	0.369	0.374	0.373	0.379	0.379	0.423
R^2 (within)	0.374	0.381	0.380	0.388	0.388	0.437
R^2 (between)	0.526	0.529	0.549	0.550	0.551	0.559
N (countries)	1925 (60)	1838 (57)	1665 (53)	1435 (47)	1435 (47)	947 (27)

(*continued on next page*)

Table 4
(Continued)

	R7	R8	R9	R10	R11	R12
	Alternative measures				*Alternative estimators*	
Lagged inflows	0.472 (0.02)***	0.461 (0.02)***	0.479 (0.02)***	0.464 (0.02)***	0.421 (0.05)***	0.421 (0.06)***
All QE episodes	0.031 (0.01)***	0.026 (0.01)***	0.038 (0.01)***	0.021 (0.01)***	0.027 (0.01)**	0.027 (0.01)***
QE tapering	–0.063 (0.02)***	–	–	–	–	–
	Liquidity channel					
Short-term rate	–0.007 (0.01)	–0.013 (0.01)*	–0.008 (0.01)	–	–0.016 (0.00)***	–0.016 (0.01)*
Money supply	0.226 (0.22)	0.007 (0.25)	0.078 (0.06)	–	–0.099 (0.10)	–0.099 (0.26)
	Portfolio balance channel					
Yield curve	–0.012 (0.01)	–0.015 (0.01)*	–0.013 (0.01)	–	–0.018 (0.01)***	–0.018 (0.01)**
Interest rate differential	–0.000 (0.00)	–	–0.001 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)
Interest rate spread	–	–0.000 (0.00)	–	–	–	–
Global PMI	–0.002 (0.00)	–0.002 (0.00)	–0.002 (0.00)	–	–0.001 (0.00)	–0.001 (0.00)
Growth differential	0.001 (0.00)**	0.001 (0.00)**	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)*	0.001 (0.00)*
	Confidence channel					
VIX	–0.002 (0.00)***	–0.001 (0.00)**	–0.002 (0.00)***	– –	–0.002 (0.00)***	–0.002 (0.00)***
	Additional controls					
Global saving	–	–	–	–	–	–
Trade/GDP	–	–	–	–	–	–
Credit/GDP	–	–	–	–	–	–
Debt/GDP	–	–	–	–	–	–
Inflation differential	–	–	–	–	–	–
Real exchange rate	–	–	–	–	–	–
Global factor	–	–	–	0.009 (0.00)***	–	–
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Estimator	LSDV	LSDV	LSDV	LSDV	FE	SCC-FE
Adj. R^2	0.374	0.347	0.373	0.362	0.368	–
R^2 (within)	0.380	0.351	0.378	0.365	0.374	0.374
R^2 (between)	0.530	0.523	0.530	0.526	0.526	–
N (countries)	1925 (60)	2286 (61)	1926 (60)	1925 (60)	1925 (60)	1925 (60)

[a] All level variables are in logarithmic form, but rates, indices, and indicator variables are untransformed. Bootstrapped standard errors (with 100 replications) are reported in parentheses, with the exception of the final two specifications, where heteroskedasticity and autocorrelation-robust and Driscoll–Kraay standard errors are reported, respectively. A time trend, country fixed effects, constant term, and basic controls from the extended specification were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

why we choose not to employ this method for our baseline – is that, given our interest in transmission channels, it is difficult to establish the precise contribution of each global variable using a single global factor. Moreover, the Kaiser-Meyer-Olkin test of sampling adequacy indicates that the underlying variables are sufficiently distinct that partial correlations between them are low, and hence are not particularly well suited for factor analysis. Keeping these caveats in mind, introducing a global measure nevertheless serves as a useful counter-check for the importance of the sum total of global effects.

This is reported in column (*R10*). The global factor is statistically significant and fairly large – a one standard deviation increase in the measure is associated with an increase in inflows of approximately 0.01 percent – but relying on the global factor alone is likely to underestimate the total effect of QE on inflows. To see this, note that a one standard deviation increase in each of the three significant channels in the simplest parsimonious specification (*B1*) in Table 1 yields an increase of inflows of 0.07 percent, an estimate seven times larger. Crucially, even after accounting for latent global effects using a time-varying factor constructed from global observables, it is *still* the case that a latent QE effect remains. This lends us tremendous confidence that any effect captured with our QE indicator is real.

The rightmost panel of Table 4 offers two alternative estimation methods for (1). Column (*R11*) provides estimates using naïve OLS with fixed effects and heteroskedasticity- and autocorrelation-robust clustered errors to determine the importance of our correction for Nickell (1981) bias. As is clear, our quantitative results are substantially unchanged even when the bias remains uncorrected; most coefficient estimates obtained using OLS differ only from the third decimal place onward.[40] Finally, one may be concerned about the possibility that cross-sectional dependency may contaminate our estimates; this is especially pertinent given how the response of portfolio capital to QE may be subject to herding behavior. Column (*R12*) corrects for this possibility by estimating spatial correlation-consistent standard errors using the methodology suggested by Driscoll and Kraay (1998). As before, our qualitative findings are substantially unaffected.[41]

6.2. *Decomposition of aggregate flows*

Not all flows are created equal, and different forms of financial flows can be expected to respond differently to the effects of QE. The theoretical literature has long recognized that the determinants of portfolio flows are fundamentally distinct from those of FDI (Kraay et al., 2005; Smith and Valderrama, 2009), and empirical work has corroborated the importance of accounting for global drivers for the former (Fratzscher, 2012) and country-specific factors for the latter (Alfaro et al., 2008; Bénassy-Quéré et al., 2007; Busse and Hefeker, 2007; Dailami et al., 2012).

Here we break down our dependent variable – aggregate gross inflows – to obtain greater insight into whether specific channels may be more operative than others, depending on the financial flow. Inflows are decomposed into portfolio, loans, and FDI. By relying on an alternative measure – gross fund inflows – we are further able to separate portfolio flows into equity and bond purchases.

Our estimates are reported in Table 5, again relying on the extended specification with a single QE episode indicator – specification (*B4*) – for each constituent flow: (*D1*) portfolio, (*D2*) loans, and (*D3*) FDI. In column (*D4*), we first report – for comparison purposes – total gross fund inflows, before this is separated into portfolio bond and equity flows, in columns (*D5*) and (*D6*), respectively.[42]

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[40] Estimates for all specifications in the baseline are provided in Appendix S1.

[41] Another, suggested by an anonymous referee, is that imposing common coefficients assumes the same rate of convergence of regressors in the long run (especially, but not limited to, for the lagged dependent variable). We therefore report estimates using a pooled mean group estimator – which turns out to be qualitatively similar to our baseline – in Appendix S1. We also examined, but do not report, robustness regressions of the extended specification that incrementally reduce the sample by the largest country, in lieu of subsample analysis. As may be expected, the largest economies, which account for the bulk of financial flows, also appear to be key in driving our results. Nevertheless, the coefficient on our QE episode variable only becomes insignificant after a full third of the stratified sample is dropped. These results are available on request.

[42] Since the decomposed series are generally less persistent than the aggregate flows data (with comparable average time periods), the magnitude of bias between the different approximations is virtually identical (Bruno, 2005). Accordingly, we relax the bias correction to just $O(\frac{1}{T})$ for the estimates in Table 5. Since the panels in the decomposed series also include smaller samples and can be more unbalanced, we also increase the number of bootstrap replications to 200.

Table 5
Regressions for financial inflows, by type, unbalanced quarterly panel, 2000Q1–2013Q2.[a]

	D1	D2	D3	D4	D5	D6
	Portfolio	*Loans*	*FDI*	*Gross fund*	*Bonds*	*Equity*
Lagged inflows	0.261 (0.02)***	0.307 (0.02)***	0.597 (0.02)***	–0.088 (0.04)**	0.294 (0.03)***	–0.011 (0.03)
All QE episodes	0.018 (0.01)***	0.021 (0.01)***	–0.003 (0.01)	0.061 (0.02)***	0.015 (0.02)	0.044 (0.03)*
	Liquidity channel					
3M T-bill rate	–0.015 (0.01)**	–0.008 (0.01)*	0.004 (0.01)	–0.080 (0.02)***	–0.089 (0.02)***	–0.053 (0.03)**
Money supply	0.015 (0.19)	–0.071 (0.16)	0.056 (0.26)	–1.110 (0.65)*	–2.120 (0.45)***	–0.589 (0.66)
	Portfolio balance channel					
Yield curve	–0.020 (0.01)***	–0.002 (0.01)	0.005 (0.01)	–0.090 (0.03)***	–0.065 (0.02)***	–0.064 (0.03)**
Interest rate differential	–0.000 (0.00)	–0.000 (0.00)	–0.000 (0.00)	–0.001 (0.00)	–0.002 (0.00)*	–0.000 (0.00)
Global PMI	–0.001 (0.00)	–0.001 (0.00)	–0.001 (0.00)	0.008 (0.01)	0.003 (0.00)	0.004 (0.01)
Growth differential	0.001 (0.00)*	0.001 (0.00)	0.000 (0.00)	0.001 (0.00)	–0.000 (0.00)	–0.001 (0.00)
	Confidence channel					
VIX	–0.002 (0.00)***	–0.000 (0.00)	–0.000 (0.00)	–0.002 (0.00)	–0.006 (0.00)***	–0.000 (0.00)
	Basic controls					
GDP	0.009 (0.03)	0.110 (0.02)***	0.070 (0.04)*	–0.060 (0.09)	0.020 (0.07)	0.039 (0.08)
Developing GDP growth	0.004 (0.00)***	0.000 (0.00)	–0.001 (0.00)	0.014 (0.01)***	0.023 (0.00)***	0.007 (0.01)
High-income GDP growth	–0.001 (0.00)	0.002 (0.00)	0.004 (0.00)	–0.011 (0.01)	–0.017 (0.01)***	–0.007 (0.01)
Country rating	0.001 (0.00)***	0.001 (0.00)***	0.002 (0.00)**	0.002 (0.00)	0.001 (0.00)	0.000 (0.00)
Crisis period	–0.002 (0.01)	–0.043 (0.01)***	–0.005 (0.02)	0.024 (0.04)	–0.043 (0.03)	0.032 (0.05)
Post-crisis period	0.024 (0.01)*	–0.025 (0.01)**	–0.010 (0.02)	0.038 (0.05)	–0.061 (0.04)	0.050 (0.05)
Adj. R^2	0.157	0.032	0.399	0.054	0.193	0.005
R^2 (within)	0.164	0.037	0.403	0.070	0.203	0.018
R^2 (between)	0.572	0.209	0.854	0.450	0.562	0.042
N (countries)	1925 (60)	3460 (85)	2419 (63)	974 (31)	1220 (39)	1185 (37)

[a] All level variab7les are in logarithmic form, but rates, indices, and indicator variables are untransformed. Bootstrapped standard errors (with 100 replications) are reported in parentheses. A time trend, country fixed effects, and constant term were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

We draw several conclusions from this exercise.

First, and most remarkable, is the distinction between FDI and both portfolio and loan flows. For FDI inflows, exempting the lagged dependent variable, only the institutional investor variable and GDP enter with a (marginally) significant coefficient.[43] This result underscores the importance of political and institutional risk as determinants of FDI, which has ample support in the literature (Alfaro et al., 2008; Bénassy-Quéré et al., 2007; Busse and Hefeker, 2007; Dailami et al., 2012). This result also corroborates with evidence from gravity-type models of FDI (which finds larger FDI flows between bilateral pairs with larger pairwise GDP) and the more general stylized fact that gross FDI inflows tend to be countercyclical and the least volatile among different financial flows (Contessi et al., 2013). It is nevertheless useful for us to recognize that the insensitivity of FDI inflows to global variables applies even when considering gross (rather than net) flows, and that QE has had little impact on this large and stable source of developing country cross-border finance. In contrast, both portfolio capital and bank lending respond more to both global drivers. A related observation is that portfolio and loan flows react mainly to the global "push" factors (due to economic conditions in high-income countries), as opposed to country-specific "pull" variables.

Second, comparing portfolio with loan flows, the latter clearly responds more to the latent factors during the QE period (the coefficient on the indicator variable is 0.021 versus 0.018), suggesting that more so than for the other flows, QE operated through channels other than the modeled channels to boost bank lending. In contrast, measurable transmission channels for QE are routinely larger for portfolio flows. For example, the coefficient on the yield curve (corresponding to the portfolio rebalancing channel) is an order of magnitude as large as that for loans; an analogous argument can be made for the short-term interest rate (for the liquidity channel). The number of statistically significant coefficients is also larger for portfolio flows.[44]

Taken together, these first two findings strongly suggest that it is portfolio flows, and especially bond capital, that are most sensitive to QE. In contrast, FDI – which is the most stable component of cross-border financial flows – tends to respond to structural, long-term determinants, such as the institutional rating of the economy. This is consistent with our understanding that portfolio flows react most to the various effects of *conventional* monetary policy – after all, monetary policy is generally effective only in the short run, and portfolio flows are by definition the most easily reassigned – and this bias toward shorter-term flows evidently carries over to unconventional monetary policy as well. The effects of QE on bank lending – which one may regard as an intermediate category between short-term portfolio debt and the longer-term direct equity – neatly fall between the effects on these two extremes.

Turning to the portfolio flow decompositions, we first note that the statistically significant coefficients in columns (*D1*) and (*D4*) are broadly comparable, which lends credibility to our use of the fund inflows data. In terms of the decomposition, it is notable that while bond flows appear to react to more transmission channels than equity flows – debt is associated with changes in the VIX as well as the global PMI,[45] while equity is not – the *magnitude* (and standard errors) of the coefficients on equity is generally larger than those for debt. Alternatively, although bond flows are liable to react to a wider range of possible QE transmission channels, equities react more strongly to the few channels to which they do react to.

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[43] Both variables consistently enter with a positive and significant coefficient across our baseline and robustness specifications.

[44] The relative insensitivity of bank lending to observable fundamentals in specification (*D2*) may strike some as contrary to findings, especially from the crisis literature, that loans appear to respond to key global factors during crisis events (Adams-Kane et al., 2015; Broner et al., 2013). We do not see an inconsistency here, since loan flows may well respond strongly to fundamentals in a crisis environment (which we control for), but not under non-crisis conditions. Moreover, it is important to recognize that our results pertain to *post-2000 data only*, which is our period of interest. Consequently, studies that rely on a longer span of bank lending data may well uncover somewhat different relationships.

[45] This coefficient is negative, which indicates that inflows into debt decrease when global growth prospects improve. This outcome is consistent with substitution into riskier assets when growth outlooks turn upward.

6.3. Accounting for commonality in gross inflows

Given the strong representation of global factors in our baseline specification, it is natural to question how pervasive this source of commonality is in our data. In this subsection, we probe the relative importance of our global factors using a principal components approach inspired by Longstaff et al. (2011).[46]

We construct two alternative global factors from our gross inflows data: a factor constructed from the varimax orthogonal rotation of the first principal component of the vector of gross inflows (which we term *PC1*) and a proportion-weighted sum of the first three principal components (which we term *PC3*).[47] We then use the global factor – which by construction captures the common elements among cross-country gross inflows – as a dependent variable in regressions where we include our global variables as regressors.

Table 6 reports our results from this exercise. The first two columns report (OLS) regressions for, respectively, the first and weighted principal components, using only global variables as covariates. Since our goal is to ascertain the relative importance of these global variables in gross inflows, this pair of specifications represents our main results of interest.[48]

We find that all global variables included in our extended baseline specification contribute substantially to the common variation across cross-country gross inflows. The adjusted R^2 is extremely high – 0.92 and 0.91 – and the point estimates of coefficients are both statistically significant, economically large, and carry signs consistent with our earlier findings. As before, there is evidence that these global variables operate along all three channels we consider in this paper. Overall, these results echo the findings in the literature that global macroeconomic variables dominate movements in international financial markets, as verified for international equity market returns (Baker et al., 2012), portfolio capital flows (Fratzscher, 2012), and sovereign credit default swap spreads (Longstaff et al., 2011).

For robustness, we also consider, using the *PC3* factor,[49] the incremental inclusion of several country-specific controls: the cross-country averaged interest rate differential (*C3*), the average growth differential (*C4*), both differentials (*C5*), and with both differentials as well as additional basic controls from the extended specification (*C6*).[50] We regard these results as mainly of supplementary value – in the sense that they help us better understand the relative importance of the global factors – since it is difficult to interpret the contribution of an "average" interest rate or growth differential to the common global factor in gross inflows.

With this caveat in mind, we make a two additional points with regard to these latter specifications. First, and most important, there is little additional gain from including country-specific explanatory variables: the improvement in the adjusted R^2 from including these variables is miniscule, which is also verified in the final row of Table 6, where we report the gain in the fit from including these additional country-specific regressors.[51] Second, most of the global variables from the different channel retain their significance, which corroborates their inclusion in our baseline analysis.

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[46] In contrast to Longstaff et al. (2011), we extract principal components directly from actual gross inflows, rather than its correlation matrix. We then use this extracted factor *directly* as our dependent variable in the analyses that follow (as an aggregate time series), rather than perform country-specific or panel regressions.

[47] The first three components had eigenvalues in the excess of 3, and cumulatively explain slightly more than half of the cross-country variation. Including the next 7 components (all components that have eigenvalues greater than unity) increases the explained variation to 87 percent, but at the cost of the weighted-sum component being comprised of a very large number of (linearly uncorrelated) subcomponents, none of which singularly contribute much to the overall variance in the data.

[48] In contrast to the baseline, these specifications omit a lagged dependent variable, which enter with an insignificant coefficient.

[49] Results with the *PC1* factor were qualitatively similar, although standard errors were slightly larger. These are available on request.

[50] These are total developing country GDP, the growth rate for the developing world, and average institutional risk rating.

[51] This is computed from taking one minus the ratio of the adjusted R^2 of specification in question and specification (*C2*).

Table 6
Regressions for principal components of gross financial inflows, balanced quarterly panel, 2000Q1–2013Q2.[a]

	C1	C2	C3	C4	C5	C6
	1PC	*3PC*	*3PC*	*3PC*	*3PC*	*3PC*
All QE episodes	0.902 (0.34)**	1.534 (0.71)**	0.594 (0.24)**	1.012 (0.40)**	0.588 (0.29)*	0.862 (0.39)*
	Liquidity channel					
3M T-bill rate	–1.727 (0.52)***	–2.329 (1.16)*	–1.289 (0.56)**	–1.838 (0.52)***	–1.283 (0.61)*	–0.702 (0.61)
Money supply	–16.740 (6.29)**	–29.119 (13.29)**	–5.165 (8.47)	–19.694 (7.65)**	–5.014 (10.57)	15.830 (14.47)
	Portfolio balance channel					
Yield curve	–1.869 (0.46)***	–2.680 (1.17)**	–1.174 (0.50)**	–2.017 (0.48)***	–1.166 (0.56)*	–0.605 (0.76)
Interest rate differential	–	–	0.125 (0.04)**	–	0.126 (0.05)**	0.197 (0.09)*
Global PMI	0.257 (0.07)***	0.395 (0.16)**	0.188 (0.06)***	0.280 (0.08)***	0.187 (0.08)**	0.146 (0.10)
Growth differential	–	–	–	0.086 (0.13)	–0.003 (0.11)	0.086 (0.26)
	Confidence channel					
VIX	–0.085 (0.02)***	–0.161 (0.04)***	–0.082 (0.02)***	–0.086 (0.02)***	–0.082 (0.02)***	–0.062 (0.03)**
Crisis dummies	Yes	Yes	Yes	Yes	Yes	Yes
Basic controls	No	No	No	No	No	Yes
Adj. R^2	0.924	0.906	0.945	0.921	0.940	0.936
Gain in fit (%)	–	–	4.3	1.7	3.8	3.3
N	24	24	24	24	24	24

[a]All level variables are in logarithmic form, but rates, indices, and indicator variables are untransformed. The dependent variable is either the varimax orthogonal rotation of the first principal component (1PC) or proportion-weighted sum of the first three principal components (3PC). Heteroskedasticity and autocorrelation-robust standard errors are reported in parentheses. A time trend, constant term, and crisis-related dummies (crisis period and post-crisis) were included in the regressions, but not reported.
*Indicates significance at 10 percent level, **indicates significance at 5 percent level, and ***indicates significance at 1 percent level.

7. Conclusion

In this paper, we have engaged in two exercises: first, to document the effect of quantitative easing policies in the United States (and to a lesser extent, the high-income G4) on gross financial inflows in developing economies; and second, to examine whether the effects of QE were more operative on certain classes of financial flows.

We find evidence of transmission of quantitative easing to gross inflows to developing countries along liquidity, portfolio rebalancing, and confidence channels. In addition to these observable effects, we also identify a distinct increase in inflows during the QE period – of a magnitude at least as large as any given observable channel – that we attribute to latent factors, and for which we regard as the lower bound of a QE effect. We also find heterogeneous effects, especially with regard to type of flow: portfolio flows appear to drive many of our results in the panel, with FDI remaining largely insensitive to QE-related channels. In contrast to previous work, we are able to demonstrate that the latent effect we identify operates over and above other observable channels of QE, as well as rule out the possibility that these effects are due to changing elasticities of each channel, or to variations in financial market expectations.

Our results suggest that long-standing concerns of developing-country policymakers about spillover effects of monetary policy from large developed markets – framed mainly in terms of *conventional* monetary policy – carry over to unconventional policies such as QE. Monetary easing by high-income central banks tends to promote financial flows; to the extent that these (mainly portfolio) flows are not well-absorbed by the relatively shallow financial markets in developing economies, QE may in fact pose risks to these countries' financial stability. Moreover, since such spillovers occur along multiple transmission channels, the strategies available for mitigating the potential adverse effects from such flows are uncertain.

We regard our paper as a contribution to understanding and quantifying the potential implications of quantitative easing policies on developing countries, in particular on gross financial flows to them. Future research in this vein can adopt our identification approach to expand our knowledge of the scope of the impact of QE on developing nations, to factors such as the real exchange rate and their financial markets. Future work can also perform counterfactuals based on actual realizations of monetary policy normalization from QE, following its implementation.

Appendix. Supplementary material

Supplementary data to this article can be found online at doi:10.1016/j.jimonfin.2016.02.009.

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