Determinants of Bond Flows to Emerging Markets: How Do They Change Over Time?

August 2014

Yasemin Erduman
Neslihan Kaya
DETERMINANTS OF BOND FLOWS TO EMERGING MARKETS: 
HOW DO THEY CHANGE OVER TIME? *

Yasemin ERDUMAN (a)    Neslihan KAYA (b)

Abstract

The recent episodes of capital flows to emerging market economies in the aftermath of the global financial crisis once again highlighted the importance of appropriate policy design to cope with strong and volatile capital flows, that are effective not only during surges but also during reversals, in order to ensure financial and macroeconomic stability in recipient countries. The design of such policies necessitates a good understanding of the determinants of capital flows to EMEs, as well as an exploration of how their relative importance changes over time. In this paper we investigate the time varying nature of the determinants of bond flows with a focus on the global financial crisis period. We estimate a time varying regression model using Bayesian estimation methods, where the posterior distribution is approximated by Gibbs sampling algorithm. Our findings suggest that the interest rate differential is the most significant pull factor of portfolio bond flows during the examined period, along with the inflation rate, while the growth rate does not seem to play a significant role. Among the push factors, global liquidity is the most important driver of bond flows. We find that it mattered the most, when unconventional monetary easing policies were first announced; and that its importance as a determinant of portfolio bond flows seems to decrease over time, starting with the Eurozone crisis, and diminishing with the tapering talk. Global risk appetite and the risk perception towards the emerging countries are also found to have relatively small and stable significant effects on bond flows.

JEL codes: F21; F32; G11.

Keywords: capital flows, pull factors, push factors, emerging markets, Bayesian estimation, Gibbs sampling.

* The views expressed here are of our own and do not necessarily reflect those of the Central Bank of the Republic of Turkey. We would like to thank Ozan Ekşi for his valuable contribution through our discussions on the subject, as well as the anonymous referee for kind comments and suggestions.

(a, b) Central Bank of the Republic of Turkey, Research and Monetary Policy Department, Istiklal Cad., No: 10, Ulus, 06100, Ankara, Turkey. E-mail: yasemin.barlas@tcmb.gov.tr; neslihan.kaya@tcmb.gov.tr.
1. Introduction

Once the financial crisis hit the global economy in late 2008, capital flows to emerging market economies (EMEs) dropped sharply, as they witnessed huge outflows from both bond and equity markets. However, in the aftermath of the crisis, the expansionary policies pursued by advanced economies and ample global liquidity conditions once again drove investors towards riskier and higher yielding assets of emerging markets. Thus, because of their relatively stronger growth outlook and higher interest rates, coupled with rising risk appetite, EMEs witnessed a surge of capital flows in 2009 and 2010, mainly in the form of portfolio flows.

Given the past experience from the 1994 Mexican crisis and the 1997 Asian crisis (both of which were preceded by waves of strong and volatile portfolio inflows often referred to as “hot money”), this latest wave of capital inflows to EMEs raised concerns over potential negative consequences on the recipient countries and once again highlighted the importance of designing appropriate policies, that are effective not only during surges but also during reversals, to ensure financial and macroeconomic stability. A good understanding of the determinants of these flows is surely a prerequisite for the design of such policies. Nonetheless, this task necessitates not only determining the factors that drive capital flows to EMEs, but also exploring how their impact on flows changes over time.

Ever since the seminal work of Calvo, Leiderman and Reinhart (1993), determinants of capital flows are categorized under two main headings, namely, the pull factors and the push factors throughout the literature. The pull factors are associated with the country specific factors that attract capital flows. If pull factors are in effect to attract capital flows, then an appropriate design of policies in the recipient country would limit potential macro financial imbalances caused by these flows. On the other hand, push factors are associated with the external common conditions that drive flows. In such a case, the effectiveness of domestic macro policies to mitigate the potential adverse effects of the flows on the recipient country would be limited.

It is documented in the literature that the relative importance of the determinants of capital flows varies over time. However, there are not too many studies modelling the time varying nature of
the determinants of capital flows. Fratzscher (2011) employs a factor model coupled with a dataset of high-frequency portfolio capital flows to 50 economies and shows that push factors were overall the main drivers of capital flows during the crisis, while pull factors were mainly dominant in explaining the dynamics of global capital flows in 2009 and 2010, particularly for the emerging economies. Lo Duca (2012) models the time varying nature of the drivers of portfolio equity flows by estimating a model with regression coefficients that endogenously vary over time, by means of a Kalman filter approach. The estimation results reveal that major changes in the importance of drivers of flows coincide with important market events/shocks, and that investors pay more attention to regional developments in emerging markets in periods when market tensions are elevated.

This paper contributes to the literature on the determinants of capital flows by investigating the time varying nature of the determinants of bond flows, with specific attention to the global financial crisis period. The choice of bond flows as a dependent variable is for the following reasons: Firstly, while there are different measures of capital flows, we know that portfolio flows are the most affected form of capital flows during the crisis era. Second, emerging market portfolio flows can now be tracked from a new database that provides timely, high frequency data with portfolio choice breakdown for bond and equity markets. Third and more importantly, among the portfolio flows, we observe a structural change in bond flows through the examined period, while no alteration is evident in the course of equity flows. As to our knowledge, this is the first attempt to investigate the changes in the determinants of portfolio bond flows, with a focus on the global financial crisis era. For this purpose, we estimate a time varying regression model in a state space form, using Bayesian estimation methods, where the posterior distribution of the entire model is approximated by Gibbs sampling algorithm. It is documented in the literature that Bayesian estimation and Gibbs sampling algorithm works extremely well in estimations of state space models, especially in small samples where maximum likelihood can be computationally inefficient (Blake & Mumtaz, 2012).¹

The determinants of bond flows to EMEs are investigated for the 2005 - 2013 period, using monthly data. The main findings can be summarized as follows: the growth rate does not seem to play

---

¹ Chapter 3 of Blake & Mumtaz (2012) shortly discusses why classical approaches to state space modelling can be computationally inefficient and elaborates on the advantages of employing Gibbs sampling algorithm for state space models.
a significant role in affecting portfolio bond flows during the examined period. Our interpretation is that increasing globalization and greater financial integration over the past two decades may have lessened the effect of growth rate as a determinant of bond flows. The inflation rate has a significant negative effect on portfolio bond flows, which is large and stable until late 2008, and even larger after the global financial crisis, until the break of the Eurozone debt crisis in early 2010. The results show that its effect slowly decreases till there is some relief from the debt crisis in 2011 and remains at a steady level thereafter. The interest rate differential is the most significant pull factor of portfolio bond flows during the examined period, the effect of which has been strong and stable, despite a small decline in the coefficient due to the global financial crisis. Among the push factors, global liquidity has been the most important. While its coefficient has been on a moderate rise between 2007 and late 2008, it declines sharply during the global crisis period. However, with the introduction of quantitative easing (QE) policies by major advanced country central banks, the effect of global liquidity on bond flows quickly rises and reaches far beyond its pre-crisis levels. Our findings suggest that global liquidity mattered the most, when unconventional monetary easing policies were first announced, and its importance as a determinant of portfolio bond flows seems to decrease over time, starting with the Eurozone crisis, and diminishing with the tapering talk. As for the risk appetite, VIX index consistently displays a significant negative effect on bond flows. The importance of the VIX index reaches to a peak during the crisis period and slowly decreases thereafter until 2012. The risk perception for emerging countries has a small but significant negative effect on bond flows. The importance of EM risk is relatively stable, slowly decreasing until 2010, and rising at a gentle pace afterwards.

The paper is organized as follows: in section 2 we provide a brief history of capital flows to EMEs; in section 3 we introduce the model, the data and the methodology we use in the study; in section 4 we present the main findings of the paper, and section 5 concludes.

2. Capital flows from an historical perspective

Historically, emerging economies experienced three episodes of massive capital inflows (Figure 1). The first episode started in 1990 and ended with the Asian crisis in 1997, which left many
emerging economies with financial strains from a major capital flow downturn. In response, many EMEs have significantly improved their macroeconomic fundamentals, undergone structural reforms in the subsequent period and accordingly enhanced the composition of capital inflows through an improved debt structure, a larger share of flows in the form of foreign direct investment, and greater access to international debt markets (Suchanek & Vasishtha, 2010). As the global financial system went through a phase of greater integration, the EMEs improved on capital account openness and became more closely tied by increased trade and financial linkages with the rest of the world, which in turn increased fund flows; hence capital inflows to EMEs accelerated again in 2002. In this second wave of capital flows to EMEs, FDIs constituted around 80 per cent of total financial flows on average, portraying a healthier financial account composition (Figure 2).

The third wave of capital flows to EMEs emerged in the aftermath of the 2008-2009 global financial crisis. When the crisis broke up in the third quarter of 2008, it not only drifted the world economies into prolonged recessions, but also caused emerging market capital flows to contract by an enormous proportion. In this period, EMEs witnessed sizeable net outflows from portfolio and other investments, while FDIs remained resilient. After the crisis, the expansionary monetary policies pursued by the advanced country central banks and the introduction of QE policies led to ample global liquidity conditions. The loss of confidence in advanced country assets in the post financial crisis period and the uncertainty about the speed of recovery in the developed world increased the interest on
emerging country assets. Owing to better growth prospects than their advanced counterparts and higher yielding assets, along with rising risk appetite, EMEs attracted a third wave of capital inflows, mostly in the form of portfolio flows. During this third wave, the rising interest rate differential between advanced and emerging countries, as well as the preference of short-term assets due to increasing uncertainty, have led international investors to become more inclined towards emerging market bond funds compared to equity funds, thereby leading to a structural break in the former (Figure 3, Figure 4). According to Barlas & Kaya (2013), the fact that emerging markets had enough room to decrease interest rates to foster domestic economic activity in the face of worsening global growth outlook and expectations that monetary policies could further be eased, have contributed to the increase in the return prospects on investments on EME bonds. Moreover, the loss of confidence in advanced country bonds which were once known as safe-haven assets and the relatively underinvestment in emerging country bonds in the pre-crisis period were the other factors that led to stronger capital flows to EMEs bond funds during this period.

In addition to strength, portfolio flows in the post-crisis period were also characterized by being markedly more volatile. Higher frequency data on portfolio flows reveals the extent to which the volatility of different asset classes has risen since 2009 (Figure 5). One apparent reason for the increasing volatility is that portfolio investments steadily became more sensitive to shifting conditions.

---

2 Despite highly stimulatory monetary policies, the recovery in advanced countries remained sluggish due to deleveraging of both the household, the banking and the private sector balance sheets, with collapses in consumption rates and hardly operative credit channels, especially in the Eurozone.
in the global financial conditions and the global business cycle, rather than country specific factors (IMF, 2014).

![Figure 5 The Evolution of Portfolio Flows to EMEs (52 week cumulative, billion US dollars)](image)

3. The Model, Data and Methodology

3.1. Time Varying Parameter Model and the Data

In order to find out whether the determinants of bond flows to emerging markets have witnessed a structural change following the global financial crisis, we estimate the following time varying parameter equation for bond flows:

$$BF_t = \alpha_t P h_t + \beta_t P l_t + \epsilon_t$$

where $BF_t$ is bond flows at time $t$. The determinants of capital flows are categorized as push and pull factors, which is represented by $Ph_t$ and $Pl_t$, respectively. Throughout the literature, global liquidity and investors’ risk appetite are considered as important push factors of capital flows. On the other hand, pull factors of capital flows mostly cover the country specific variables, such as the economic growth rate, the interest rate and the inflation rate.

The concept of global liquidity and how it is to be measured have recently become hotly debated policy topics. While the term “global liquidity” continues to be used in a variety of ways, the common element in all definitions is a reference to the ease of financing. Traditionally, global liquidity is defined as the sum of narrow money created by central banks and international reserves within advanced economies (ECB, 2011). However, greater global financial integration, recent
financial innovations that led to alternative channels of access to credit, and the growing importance of emerging markets necessitated a broader definition. According to the Committee on the Global Financial System (CGFS) global liquidity has both an official and a private component (BIS, 2011). The official component, namely the central bank liquidity, is the amount of funds unconditionally available to settle claims through monetary authorities, while liquidity generated outside the public sector by the financial and non-financial institutions refers to the private component. This second component is created to a large degree through cross-border operations of banks and other financial institutions and is considered a key determinant of funding conditions globally.

To our common knowledge, in the aftermath of the recent global financial crisis, the QE policies of advanced economies have been one of the main sources of excess global liquidity. Thus, in this study, we stick to a more traditional definition of global liquidity and measure the global liquidity by the sum of the total assets of the Federal Reserve Bank (Fed) and the European Central Bank’s (ECB) balance sheets (measured in US dollars), which were the two central banks that resorted to QE most heavily. This is firstly because we are more interested in the effect of advanced country monetary policies on capital flows and secondly because cross border flows are to some extent integrated in the private component of global liquidity definition. This variable is used in logarithms.

As for the other push factors, we use the monthly difference of the VIX index in order to track the changes in the global risk appetite, while the Emerging Markets Bond Index (EMBI) serves as a measure to capture the risk perception towards the emerging markets.

On the other hand, pull factors of capital flows mostly cover the country specific variables. In this study, we capture the country specific variables by the annual growth rate of industrial production, the CPI based annual inflation rate and the policy rate differential between the emerging markets and the US. All of the pull factors are GDP weighted aggregations for 23 emerging economies, selected to

---

3 The Bank of England and the Bank of Japan also introduced similar quantitative easing programmes during the period under investigation, the international spillover effects of which are less pronounced.
represent a wide range of countries from different geographies of emerging Asia, Europe, Latin America and Middle East and Africa\textsuperscript{4}.

The dataset consists of monthly data from 2005:M1 to 2013:M12. Bond flows data is compiled from Emerging Portfolio Fund Research (EPFR) database and is adjusted for price and exchange rates. It is an aggregated measure of portfolio bond flows to all emerging markets. The most important advantage of using this database is that it provides high frequency and timely data, as an alternative to IMF’s Balance of Payments Statistics and Institute of International Finance’s (IIF) regular EMEs capital flows reports that are published with considerable time lags and with lower frequency. The EPFR database contains daily, weekly and monthly flows by more than 8,000 bond funds; and is being widely used by credible organizations such as the IMF and the ECB. It provides a fairly representative sample in capturing the market capitalization in bonds for most countries\textsuperscript{5}. Lo Duca (2012), Miao & Pant (2012) and Fratzcher (2011) are some of the other studies that have lately used this database to analyze capital flows.

A graphical representation of all variables used in the analysis is provided in Appendix A.

### 3.2. State Space Representation of the Model

The above time varying parameter equation 1 can be put in the following state-space form:

\[ Y_t = \theta_t X_t + \epsilon_t, \quad \epsilon_t \sim \mathcal{N}(0, R) \] \hspace{1cm} -2-

\[ \theta_t = \theta_{t-1} + v_t, \quad v_t \sim \mathcal{N}(0, Q) \] \hspace{1cm} -3-

where \( \theta_t = \{ a_t, \beta_t \} \).

In equation 2, \( Y_t \) represents an observable dependent variable, which corresponds to bond flows to emerging economies; \( BF_t \) in the model. \( X_t \) is the vector of explanatory variables that capture the push and pull factors; \( PH_t \) and \( PL_t \) in the model. \( \theta_t \) is the vector of corresponding coefficients and, as shown in equation 3, it evolves as an AR(1) with a unit root coefficient.

\textsuperscript{4} Countries included in the analysis are: Brazil, Mexico, Colombia, Peru, Chile, Venezuela, China, Indonesia, Malaysia, Phillipines, Thailand, South Korea, India, Taiwan, Russia, Turkey, Poland, Hungary, Kazakhstan, South Africa, Israel, Lebanon and Egypt. As of 2012, these countries constitute the 95 percent of bond flows to emerging economies.

\textsuperscript{5} Although there is not an official figure regarding the representative power of the database on a global scale, Fratzcher (2011) argues that its coverage ratio of assets varies between 5 and 20 per cent for the countries. For instance, for Turkey, we see that the coverage of bond holdings in Turkey of foreign residents is around 10.8 per cent between 2005-2008; and its coverage ratio increased to 17.9 per cent in the aftermath of the global financial crisis.
3.3. Estimation

The time-varying parameter model above is estimated via Bayesian methods using Kalman filtering and the posterior distribution of the entire model is approximated by Gibbs sampling algorithm. Bayesian methods can obtain joint posterior distributions of parameters and unobserved states which are mixtures (multiplications) of the prior information and the “current information” that is, the data. However, in many cases, these joint distributions are difficult or impossible to characterize analytically, but distributions of parameters and unobserved states conditional on each other are easier to characterize or simulate. Hence, the posterior distribution of the entire model is approximated by Gibbs sampling algorithm, which iteratively draws parameters and unobserved states conditional on each other, from joint distributions. In our model, the unobserved states are the time-varying coefficients ($\theta_t$) and the parameters are the variance of the time varying (observation) equation ($R$) and the variance of the innovations in coefficients ($Q$).

In order to have posterior results for the state space form, we run the Gibbs sampler for 12,000 replications, with 10,000 burn-in replications discarded and 2,000 replications retained. All priors and initial values to initiate the Gibbs sampling algorithm are set using pre-sample data information from 2004:M3 to 2005:M10. First, we estimate OLS regressions for the pre-sample data and use the point estimate of coefficients as the prior mean for $\theta_0$ and its asymptotic variance $\bar{P}$ as the prior variance. Second, we use an inverse-Wishart distribution as the prior for $Q$ with degree of freedom $T_0 = 20$ and prior $Q_0 = T_0 \times \bar{P} \times 3.5e^{-03}$. Third, the prior for the variance of the time varying regression equation is inverse gamma with the scale parameter equal to 0.1. Appendix B provides, in detail, the steps of the Gibbs sampling algorithm.

4. Results

Figure 6 displays the obtained time varying coefficients from the model. The fluctuations in $\theta$s provide evidence for the appropriateness of estimating a time varying regression model to explain the portfolio bond flows to emerging economies. The estimated $\theta$s show that there has been considerable changes in the relative importance of the determinants of portfolio flows both on the onset of the global financial crisis and in its aftermath. Moreover, the estimation results clearly mark some
important dates of events or shocks (such as the Eurozone debt crisis or the Fed’s tapering signal) that have occurred during the period under review, depicted through the turning points in time varying coefficients.

**Figure 6** Time varying coefficients of the determinants of portfolio bond flows

<table>
<thead>
<tr>
<th>Growth rate</th>
<th>Inflation rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="graph_growth_rate.png" alt="Graph" /></td>
<td><img src="graph_inflation_rate.png" alt="Graph" /></td>
</tr>
<tr>
<td>Interest rate differential</td>
<td>Global liquidity</td>
</tr>
<tr>
<td><img src="graph_interest_rate_differential.png" alt="Graph" /></td>
<td><img src="graph_global_liquidity.png" alt="Graph" /></td>
</tr>
<tr>
<td>Risk appetite</td>
<td>EM risk</td>
</tr>
<tr>
<td><img src="graph_risk_appetite.png" alt="Graph" /></td>
<td><img src="graph_em_risk.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

**Note:** The figures report the time varying coefficients (solid line) for each of the explanatory variables included in the model described in section 3.1 and the confidence bands for the time varying coefficients (dotted lines). We displayed the 68 per cent confidence interval bands in the figure, as it is the common practice in Bayesian analysis. The estimates with 90 per cent bands produce similar results and are available from the authors upon request.

The growth rate does not seem to play a significant role in affecting portfolio bond flows during the examined period. The estimated coefficient for growth carries a positive sign, which is in line with the theory, but its confidence bands comprise the x-axis most of the time, implying statistical insignificance. While this would be a surprising finding if we had been examining data starting from the 1990s, for the period under investigation one can argue that the impact of growth rate on capital flows has gradually diminished due to increasing globalization and greater financial integration. During the 1990s, while emerging markets were going through a phase of financial liberalization,
international investors were in search of high yielding investment opportunities. The growth potential of emerging markets was one of the main factors that nourished investor appetite at the time: the stronger the growth outlook was, the more likely the higher expected returns were. Once investors started to head funds to emerging markets with sound fundamentals, emerging markets gained greater access to international debt markets. As Suchanek and Vasishtha (2010) suggest, markets for domestic fixed-income securities in these countries, which were relatively underdeveloped until the late 1990s, later became a major source of financing and until 2007 benign global financial conditions allowed them to assure longer-term funding and to improve their debt structures. The establishment of strong financial linkages may have lessened the effect of growth rate as a determinant of bond flows in this context. All in all, for the examined period, it would not be misleading to say that the growth rate’s effect on bond flows is relatively small and stable over time, only getting looser during the global financial crisis and the Eurozone debt crisis, but recovering to its former levels afterwards.

The inflation rate has a significant negative effect on portfolio bond flows. High inflation rates not only worsen macro fundamentals in emerging markets, but also decrease the real return of international investors from investments in local currency, discouraging portfolio flows. The effect of inflation rate on bond flows is found to be large and stable until late 2008 and gets even larger after the global financial crisis, until the break of the Eurozone debt crisis in early 2010. The results show that its effect slowly decreases till there is some relief from the debt crisis in the Euro area in 2011 and remains at a steady level thereafter.

The interest rate differential is the most significant pull factor of portfolio bond flows during the examined period, which is in line with our expectations. Although we observe a small decline in the coefficient due to the global financial crisis, it gradually returns back to its pre-crisis levels in the aftermath of the crisis. Yet, we can interpret that the effect of the interest rate differential on bond flows has been strong and stable as suggested in the literature. Thus, our findings confirm that, in an environment of deteriorating global economic outlook, increased uncertainty and ample liquidity conditions; relatively higher yields of fixed-income low maturity emerging market assets have
significantly contributed to the surge in capital flows to emerging market bond funds in the post-crisis period.

Among the push factors, global liquidity has been the most important. Our results indicate that global liquidity has played a major role in the determination of portfolio bond flows on the onset of the global financial crisis. Between 2007 and late 2008, we can see that its coefficient has been on a moderate rise. It declines sharply during the global crisis period, due to panic, plummeted confidence and increased uncertainty. However, with the introduction of QE by major advanced country central banks, the effect of global liquidity on bond flows quickly rises and reaches far beyond its pre-crisis levels. Our results are justified by the surge in capital flows to EMEs in the aftermath of the global crisis, which is to a large extent the spill-over effect of the abundant global liquidity, resulting from the expansionary monetary policies of the advanced world, originally designed to spur economic activity in their home countries. The breakup of the Eurozone debt crisis in early 2010 lessens the importance of global liquidity conditions considerably. Given the high uncertainty and low investor confidence of the times in which the probability of double-dip recessions were discussed, the coefficient falls to a level even lower than the trough of the global financial crisis. Afterwards, the effectiveness of global liquidity conditions of portfolio bond flows fluctuates, marking some dates like the Eurozone banking crisis in 2011 on the way, up until 2013. In May 2013, we observe another sharp drop in the coefficient, corresponding to the “tapering talk”, which signalled the possibility of the Fed to taper its large-scale asset purchases and to gradually end its quantitative easing program, which in turn triggered a massive capital outflow from EMEs. However, we should mention that after this date, the effect of global liquidity on portfolio bond flows becomes insignificant. In short, our findings suggest that global liquidity mattered the most, when QE was first announced, and its importance as a determinant of portfolio bond flows seems to decrease over time, starting with the Eurozone crisis, and diminishing with the tapering talk.

As for the risk appetite, the change in the VIX index consistently displays a significant negative effect on bond flows. The importance of investors’ risk appetite reaches to a peak during the
crisis period and slowly decreases thereafter until 2012. The effect of risk appetite on bond flows turns out to be lower than its pre-crisis levels after this date and remains relatively steady afterwards.

The risk perception for emerging countries has a small but significant negative effect on bond flows. The importance of EM risk is relatively stable, slowly decreasing until 2010, and rising at a gentle pace afterwards. One explanation why the coefficient does not alter during the global financial crisis may be that the global financial crisis drastically changed the risk perception towards advanced countries, instead of emerging markets.

5. Conclusion

The interest rate differential emerges to be the most significant pull factor of portfolio bond flows to emerging markets between 2005 and 2013. While its overall effect has been strong and relatively stable, we observe that its importance as a determinant of bond flows has been on a moderate rise in the post-Lehman period, confirming the attraction of relatively higher yields on fixed-income low maturity emerging market assets. The inflation rate, both by acting as a macroeconomic stability indicator and by altering the expected return on investments, is found to effect portfolio bond flows negatively. While its impact on flows is large and stable until late 2008, it gets more pronounced in early 2010, and slowly decreases thereafter. The growth rate, on the other hand, seems to have no significant effect on bond flows during the examined period, which we see as a natural consequence of increasing globalization and greater financial integration that took place over the past two decades.

Among the push factors, global liquidity is the most important driver of bond flows. Defined by the sum of total assets of the Fed and the ECB, we find that the global liquidity conditions mattered the most, when unconventional monetary easing policies were first announced. Triggering a surge in capital flows to emerging country bond markets in the aftermath of the crisis, global liquidity’s role in determining portfolio bond flows starts to decrease during the Eurozone crisis and diminish with the Fed’s signal to taper its large scale asset purchases. Global risk appetite and the risk perception towards the emerging countries are also found to have relatively small and stable significant effects on bond flows.
Designing an appropriate monetary policy to cope with strong and volatile capital flows to ensure financial and macroeconomic stability is a hard-enough task for emerging country central banks. Policy making in an environment, in which the parameters are beyond control, is even harder. As our findings suggest, the global liquidity and the interest rate differential are the key drivers of emerging market bond flows during the examined period, both of which are largely affected by advanced country monetary policies. The spill-over effects of these policies correspondingly gave rise to introduction of new macro-prudential policy tools in emerging countries such as Brazil and Turkey, to counter the adverse effects of increasing capital inflows in the post-Lehman period. Even the IMF changed its long defended argument against capital controls and gave the green light to measures for managing capital flows at the time. On the other hand, the capital flow reversal in emerging markets triggered by the Fed’s tapering signal in May 2013 implies that global liquidity will continue to play the major part in determination of capital flows to emerging markets in the near future; along with the expected interest rate rise in the US which will alter the interest rate differential. Hence, the tapering talk also marks the start of another challenging period for emerging country central banks.

All in all, the effectiveness of the capital management measures taken by the emerging country central banks in the aftermath of the global financial crisis should be evaluated taking into account the strength of the exogenous factors. In other words, given the strong impact of external determinants on capital flows, one should know that the efficacy of domestic responses could only be limited, and hence their success could be to a certain extent.
REFERENCES


APPENDIX A

Graphical Presentations of Variables Used in Analysis

<table>
<thead>
<tr>
<th>Bond flows</th>
<th>Growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Bond flows graph" /></td>
<td><img src="image2" alt="Growth rate graph" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inflation rate</th>
<th>Interest rate differential</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Inflation rate graph" /></td>
<td><img src="image4" alt="Interest rate differential graph" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Global liquidity</th>
<th>Risk appetite</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Global liquidity graph" /></td>
<td><img src="image6" alt="Risk appetite graph" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EM risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="EM risk graph" /></td>
</tr>
</tbody>
</table>
APPENDIX B

Gibbs Sampling Algorithm of Bayesian Estimation for a Time Varying Parameter Model

This appendix elaborates on the Gibbs sampling algorithm, which is utilized to obtain the posterior distribution of the time varying parameter model. All codes are written in Matlab. The steps of the algorithm are outlined below:

**Step 1: Initialization**

Set priors for mean and variance of $\theta_0$. Set priors for $R$ and $Q$: $R_0$ and $Q_0$.

**Step 2: Sample $\theta$ conditional on $R$ and $Q$ using the Carter and Kohn algorithm.**

The model is a linear and Gaussian state space model. Assuming that the prior distribution for $\theta_0$, represented as $p(\theta_0)$, is Gaussian; the conditional posterior distribution of $p(\theta_t/y_t, R, Q)$ is also Gaussian. A forward recursion using the Kalman filter provides expressions for posterior means and the covariance matrix.

$$p(\theta_t/y_t, R, Q) = N(\theta_{t/t}, P_{t/t}),$$

$$P_{t/t-1} = P_{t-1/t-1} + Q,$$

$$K_t = P_{t/t-1}X_t(X_t'P_{t/t-1}X_t + R)^{-1},$$

$$\theta_{t/t} = \theta_{t/t-1} + K_t(y_t - X_t'\theta_{t/t-1}),$$

$$P_{t/t} = P_{t/t-1} - K_tX_t'P_{t/t-1} ,$$

Starting from $\theta_{T/T}$ and $P_{T/T}$, we can run the Kalman filter backward to characterize posterior distributions of $p(\theta^T/y^T, R, Q)$.

$$p(\theta_t/\theta_{t+1}, y^T, R, Q) = N(\theta_{t/t+1}, P_{t/t+1}),$$

$$\theta_{t+1} = \theta_{t/t} + P_{t/t}(P_{t/t} + Q)^{-1}(\theta_{t+1} - \theta_{t/t}),$$

$$P_{t+1} = P_{t/t} - P_{t/t}(P_{t/t} + Q)^{-1}P_{t/t} .$$

We can generate a random trajectory for $T$ using the backward recursion starting with a draw of $\theta^T$ from $N(\theta_{T/T}, P_{T/T})$ as suggested by Carter and Kohn (1994).
**Step 3: Sample Q from the inverse Wishart distribution.**

Conditional on a realization for $\theta^T$, innovations in coefficients, $v_t$, are observable. Assuming the inverse-Wishart for $Q$ with prior $Q_0$ and degree of freedom $T_0$, the posterior is also inverse-Wishart.

$$p(Q / y^T, \theta^T) = IW(Q_1^{-1}, T_1),$$

$$Q_1 = Q_0 + \sum_{t=1}^{T} v_t v_t' , \ T_1 = T_0 + T .$$

**Step 4: Sample R from the inverse Gamma distribution.**

Conditional on a realization for $\theta^T$, residuals of the time-varying regression are observable. Assuming the inverse-Gamma for $R$ with prior $R_0$ and degree of freedom $T_0$, the posterior is also inverse-Gamma.

$$p(R / y^T, \theta^T) = IG(T_1/2, 1/(2R_1)).$$

$$1/R_1 = (1/R_0 + \sum_{t=1}^{T} \epsilon_t \epsilon_t')/2 , \ T_1 = (T_0 + T)/2 .$$

**Step 5: Posterior Inference**

Go back to step 1 and generate new draws of $\theta^T$, $R$, and $Q$. Repeat this $M_0 + M_1$ times and discard the initial $M_0$ draws. Use the remaining $M_1$ draws for posterior inference.
Central Bank of the Republic of Turkey
Recent Working Papers
The complete list of Working Paper series can be found at Bank’s website (http://www.tcmb.gov.tr).

Firm Leverage and the Financial Crisis
(Fatih Altunok, Arif Oduncu Working Paper No. 14/27, August 2014)

Determinants of Capital Structure: Evidence from a Major Developing Economy
(Bülent Köksal, Cüneyt Orman Working Paper No. 14/26, July 2014)

Forward Guidance or Cacophony

Reserve Requirements, Liquidity Risk and Credit Growth
(Koray Alper, Mahir Binici, Selva Demiralp, Hakan Kara, Pınar Özlü Working Paper No. 14/24, July 2014)

Identification of Monetary Policy Shocks in Turkey: A Structural VAR Approach
(Mustafa Kılıç, Cengiz Tunç Working Paper No. 14/23, July 2014)

Is Gold a Safe Haven Against Equity Market Investment in Emerging and Developing Countries?
(Gözde Gürgün, İbrahim Ünalmış Working Paper No. 14/22, July 2014)

Credit Growth, Current Account and Financial Depth

Inflation Dynamics in Turkey: In Pursuit of a Domestic Cost Measure
(Selen Başer Andıç, Hande Küçük, Fethi Öğün Working Paper No. 14/20, June 2014)

Does Effectiveness of Macropudential Policies on Banking Crisis Depend on Institutional Structure?
(Aytül Ganioglu Working Paper No. 14/19, June 2014)

International Evidence on the Interaction between Cross-Border Capital Flows and Domestic Credit Growth
(Yavuz Arslan, Temel Taşkin Working Paper No. 14/18, May 2014)

Cross Sectional Facts on Bank Balance Sheets over the Business Cycle
(Osman Furkan Abbasoğlu, Şerife Genç, Yasin Mimir Working Paper No. 14/17, May 2014)

The Relationship between Inflation Targeting and Exchange Rate Pass-Through in Turkey with a Model Averaging Approach
(Ferhat Arslaner, Doğan Karaman, Nuran Arslaner, Süleyman Hilmi Kal Working Paper No. 14/16, May 2014)

News, Housing Boom-Bust Cycles, and Monetary Policy
(Birol Kank, Wei Xiao Working Paper No. 14/15, May 2014)

Evaluating the Impact of the Post-2008 Employment Subsidy Program in Turkey
(Binnur Balkan, Yusuf Soner Başkaya, Semih Tümen Working Paper No. 14/14, May 2014)

(Neslihan Kaya Working Paper No. 14/13, May 2014)