Determinants of foreign portfolio flows to Indian debt market

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Abstract

Purpose – The volatile nature of foreign portfolio flows, especially flows into debt market, has large implications on financial and macroeconomic stability in recipient countries. It is necessary to identify the main drivers of portfolio investments in bond market of developing economies to design effective policies to enhance resilience of the economy and help in managing capital flow volatility. The determinants of foreign portfolio investment to Indian equity market have been examined in literature, but flows to bond market remain unexplored. Thus, the purpose of this paper is to identify the possible determinants of foreign portfolio flows to Indian bond market both in the short and in the long run.

Design/methodology/approach – This study carries out a time series analysis by deploying autoregressive distributed lag (ARDL) approach to cointegration of monthly data of the period from January 2002 to December 2016 for the Indian economy. A mix of pull and push factors has been analysed in this study. Domestic growth, domestic stock market performance, interest rate differential, exchange rate, volatility in exchange rate, stock market returns in other emerging economies, foreign output growth and dummy variables to trace the external developments such as global financial crisis and unconventional monetary policies of advanced economies have been used as explanatory variables.

Findings – The dominant pull factor such as interest rate differential explains the dynamics of flows in Indian bond market. The relationship between capital movements and interest rate differentials is the most accepted paradigm in international finance (Haynes, 1988). Among other domestic factors are stock market performance, volatility in exchange rates and domestic growth rates which are found to be significant drivers of foreign portfolio bond flows to India. The study also confirmed that global conditions could induce a fast outflow of capital from India.

Research limitations/implications – The study concludes that both domestic factors and external factors are equally important in determining the foreign portfolio investments in the Indian debt market.

Practical implications – The empirical analysis conducted in this study suggests that direct and indirect measures can be taken to increase and stabilise foreign investments in the Indian bond market. Direct policy measures refer to those tools which are under the ambit of policymakers. Indirect measures comprise those tools that are not under the direct control of the fiscal and monetary authorities but require coordinated efforts of the government and private sector. In this context, strengthening of not only financial and economic but also administrative institutions will be necessary. Creditworthiness and policy credibility should be improved to address erratic foreign portfolio investment in debt market of India.

JEL classification – F21, F32, F41, C32

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Originality/value – This study is an original research study. This study adds to the existing literature and is expected to guide policymakers on the specific aspect of the management of capital flows as it gets affected by changes in monetary and fiscal policies.

Keywords ARDL model, Foreign portfolio investment in debt, Long-run coefficients, Short-term dynamics

Paper type Research paper

1. Introduction

The penetration of global finance took place when global investors crossed borders in search of higher yield and to diversify the risk of their portfolios. This has resulted in investments in stocks, bonds or other financial assets by foreign investors in the host country (the recipient of such investments). There are many cross-country studies which have suggested the benefits of diversification across the globe (Levy and Sarnat, 1970; Grauer and Hakansson, 1987; Harvey, 1991; Clark and Berko, 1996). Portfolio flows not only benefit the foreign investors but also play a vital role in the development of financial markets of the host countries. Most developing countries usually suffer from low savings and high investment requirements, so foreign portfolio investment has become crucial source of financing current account imbalances. The sharp surge of foreign investment to developing countries since the early 1990s has raised significant issues concerning the factors that motivate these flows and their impact on the performance of developing countries. Foreign portfolio investments have witnessed a significant rise post-global financial crisis, though accompanied by the episodes of quick reversal in the wake of European crisis and taper tantrum. The volatile nature of portfolio flows, especially into the debt market, has large implications on financial and macroeconomic stability in recipient countries.

A large amount of extant literature assesses the determinants of foreign portfolio flows either as aggregate foreign portfolio flows, which is a sum of flows into equity and debt markets, or foreign portfolio investments into equity. There exists some similarity in determinants of investments into equity and debt funds; however, the latter may differ from the former in both characteristics of holdings and profile of investors. Equity fund investors follow past performances of investment (Gruber, 1996; Sirri and Tufano, 1998), while this need not necessarily be so for investment in bonds. As postulated under Mundell–Fleming model, flows in bonds are supposed to be risk neutral under the aegis of uncovered interest rate parity (Carlin and Soskice, 2006). Empirical evidence also supports this conjecture and suggests that variations in returns among different bond funds tend to be narrower than those among equity funds, and also bond fund investors tend to be more risk averse and sophisticated than equity fund investors (Sirri and Tufano, 1998; Barber *et al.*, 2005; Zhao, 2005). Given such distinction between the behaviour of bond fund investors and that of equity fund investors, the drivers of foreign portfolio flows into the debt market need to be studied separately, which is the primary contribution of this study.

Against this background, it is necessary to identify the main drivers of portfolio flows into the bond market of developing economies to design effective policies to enhance resilience and help in managing capital flow volatility (Taylor and Sarno, 1997; Hannan, 2017; Pagliari and Hannan, 2017). In light of this, the seminal work of Calvo *et al.* (1993, 1996) provides important insights. It proposed that determinants of capital flows are motivated by confluence of factors which can be classified under two main headings, namely, global or "push" factors and country-specific or "pull" factors, throughout the literature. Initially, the increase in foreign capital flows was considered to be a function of domestic factors, namely, high domestic output growth, booming stock markets and sound institutional framework,

among others. However, it became clearer that global developments such as unconventional monetary policy of advanced economies and business cycles of industrial economies emerged as the other major factors driving the international capital mobility.

The Indian debt market was opened for foreign investors in 1995, three years later than foreign investments were allowed to invest in equity market. The portfolio investors can invest into Indian bond market by purchasing the following:

- government dated securities/treasury bills;
- listed non-convertible debentures;
- bonds issued by an Indian company; and
- units of domestic mutual funds (either directly from primary market or through stock exchanges).

However, investments by portfolio investors in bonds – which are further divided into government bonds and corporate bonds – are subject to regulatory limits which are revised by the Securities and Exchange Board of India (SEBI) and the Reserve Bank of India (RBI) from time to time. In recent times, RBI has increased the limit for foreign portfolio investors (FPIs) to buy government bonds to 6 per cent of outstanding stock of securities in 2019-2020 from 5.5 per cent in 2018-2019. However, the limits for FPI investment in state development loans (SDLs) and corporate bonds have been kept unchanged at 2 and 9 per cent of outstanding stocks, respectively. Accordingly, the revised limit for FPI investment in debt for 2019-2020 has been set at ₹698,300 crore for the first half and ₹746,500 crore for the second half of the financial year, against the current limit of ₹649,900 crore[1]. Further, to attract stable and long-term foreign investments, a new channel of investment, namely, Voluntary Retention Route (VRR), is introduced to FPIs to encourage them to invest in Indian debt markets over and above their investments through the regular route. Under this scheme, FPIs will be given greater operational flexibility in terms of instrument choices along with exemptions from specific regulatory requirements[2].

Notwithstanding this, the Indian bond market is in its nascent stage and has received on an average around one-fourth of the total foreign portfolio investments in the past two decades, while the rest went to Indian equity markets. Foreign portfolio investment in bond market is at a much smaller scale, which can be attributed to the prevalent regulatory limits on foreign portfolio investments and the existence of a shallow corporate bond market (Patnaik *et al.*, 2013). Nonetheless, it is pertinent to mention that foreign investments in bonds are picking up pace, and there have been a few episodes when the flows in debt market outpaced flows in equity market as witnessed in 1998-1999, 2011-2012 and 2014-2015. A steep fall in investments in equity was witnessed in 2011-2012, while investments in debt recorded a rise. Further, foreign portfolio flows to Indian debt market quickly revived post-crisis and spiraled to ₹2,851bn during 2009-2010 and 2014-2015 from a meagre of ₹187.7bn during 2002-2003 to 2007-2008. Nonetheless, there was a net sale of bonds by FPIs of ₹280bn in 2013-2014 in the wake of the announcement of a withdrawal of quantitative easing by the USA (Figure 1). In short, foreign investments in bond market in India have been quite volatile over the years. As these large and sudden inflows and outflows have strong implications on stability of exchange rate, independence of monetary policy and financial stability of the economic system, it is worthwhile to determine the drivers of foreign portfolio flows in Indian bond market. Moreover, identifying the relative importance of push and pull factors is vital for designing effective policy and thus worthy of investigation.

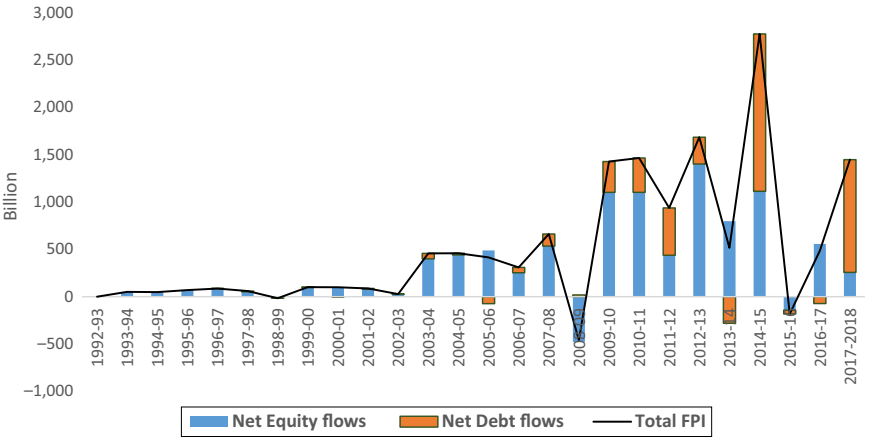


Figure 1.
Trends in net foreign portfolio inflows to India (₹bn)

Source: NSDL

As per the existing literature, there are many studies (Kumar, 2001; Batra, 2003; Rai and Bhanumurthy, 2004; Kumar, 2011) that have pinpointed country-specific factors or pull factors, such as high domestic growth, stable exchange rate and stock market returns, as having been responsible for the rise in foreign portfolio inflows to India. While other studies (Gordon and Gupta, 2003; Kaur and Dhillon, 2010; Verma and Prakash, 2011; Garg and Dua, 2014; Srinivasan and Kalaivani, 2015) found both domestic factors and global factors like fall in interest rate, weak growth prospects, fall in US market returns and global financial crisis impacting foreign portfolio inflows in India. However, our study finds that none of these existing studies have specifically investigated the determinants of foreign portfolio inflows to Indian bonds as most of them have focussed either on aggregate foreign portfolio investments in India, which is aggregate of investments into equity and debt, or on only foreign investments into equity. As portfolio flows in debt have been rising in recent times and the government has also been easing restrictions on it, it is opportune to investigate the determinants of portfolio flows in Indian bonds for better policy prescriptions. Thus, this study contributes to the existing literature on the drivers of foreign portfolio flows to Indian bond market as these flows have undergone a structural change during the examined period, while no major alteration is observed in the direction of flows in equity.

In light of this, we empirically analysed the drivers of portfolio flows to Indian bond market by using autoregressive distributed lag (ARDL) approach to cointegration developed by Pesaran *et al.* (2001). This approach has certain economic advantages over other single cointegration mechanisms, as it avoids endogeneity problems and does not suffer from the inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle–Granger and Johansen cointegration methods. It is applicable irrespective of whether the underlying variables are I(0) or I(1) or a combination of both, while cointegration approach imposes a restrictive assumption where all the variables need to be either I(0) or I(1). In addition, ARDL approach estimates long-run and short-run parameters of the model simultaneously. Also, different variables can be assigned different lag lengths as they enter the model. A monthly time series from January 2002 to December 2016 for all the variables have been considered to conduct the empirical analysis. The main findings of this study can be summarised as – interest rate differential is the most significant pull factor for portfolio flows in bonds, suggesting that when interest rates were

higher in the host country than foreign interest rates, it encouraged FPIs to make investments into the Indian bond market, and thus reinforcing the findings of the Mundell–Fleming model. Stock market performance, volatility in exchange rates and domestic growth rates are found significant drivers, among the pull factors. While among push factors, external shocks emanating from the winding up of unconventional accommodative monetary stance of the advanced economies including the USA has significantly affected the foreign portfolio investments in Indian bonds. It is to be noted that these long-run estimates of foreign investments in debt also remain robust in the short-run estimation. The study concludes that both pull and push factors are equally important in determining the foreign portfolio inflows in the debt market of India.

The paper is arranged as follows: Following this introduction, Section 2 outlines a review of selected literature. Data and econometric methodology adopted for the analysis are discussed in Section 3. Section 4 summarises the main empirical results of the study. Final conclusions are outlined in Section 5.

2. Review of selected literature

There has been a high degree of integration among global capital markets. Large groups of investors including banks, corporations, etc., look for higher returns after adjusting for currency risks in financial markets of different economies. This makes capital flow out from the countries offering low return to countries offering a higher return – as postulated under the Mundell–Fleming model in 1960 by Robert Mundell[3]. Likewise, portfolio allocation theory also finds evidence that capital flows are determined by two factors, namely, rates of return and risk, with positive responses to rates of return and negative responses to risk. Asset holders make higher returns by investing large amount of funds across borders. Likewise, FPIs move their investments to other countries and invest in their stock and bond markets to gain higher returns. For instance, advanced economies, at the time of global financial crisis, maintained almost zero policy rates that caused a large amount of capital inflows into emerging markets. Other theories which support why global investors travel across borders and trade in stock market can be explained by "Base-broadening Hypothesis". It suggests that increase in foreign investments raise the investors' base and also divide the risk among a large number of investors. Consequently, this reduces the required risk premium and raises the equity price (Clark and Berko, 1996; Fratzscher, 2012). Likewise, "Positive Feedback Hypothesis" asserts that FPIs enter into the stock market when it is bullish in nature so that they can make higher returns. On the contrary, as per the "Negative Feedback Hypothesis", foreign institutional investors (FIIs) invest when stocks are bearish in host countries and when there is an expectation of a rise in equity indexes at the time of exit.

The determinants of foreign capital flows are broadly described by two theories such as push factor and pull factor theories (Calvo *et al.*, 1993; Chuhan *et al.*, 1998; Hernandez and Rudolph, 1994; Taylor and Sarno, 1997; Ul-Haque *et al.*, 1997). The drivers of capital flows were initially thought to be domestic factors such as high economic growth and sound institutional framework. Over time, it became clearer that global factors (or push factors) such as declining international interest rates, fall in global growth and growing trend towards international diversification (Calvo *et al.*, 1996) play important role in determining the capital flows. Further, money demand and productivity (MDP) framework by Ul-Haque *et al.* (1997) postulates causes of capital flows to changes in money demand function, productivity of domestic capital and external financial conditions such as international interest rates. Under this framework, a rightward shift of the money demand function and increases in productivity of domestic capital tend to generate capital inflows, others things equal. It is to be noted that these pull factors result into sustained capital flows and explain causes of inflows.

Taylor and Sarno (1997) analysed long-run and short-run determinants of portfolio flows to bond market of developing countries of Latin America and Asia by using cointegration techniques and seemingly unrelated error-correction models. They found that push factors including interest rate on US bonds play a dominant role in explaining the determinants of flows to bond market of developing countries. Likewise, a study by Agarwal (1997) explored determinants of foreign portfolio investment to six developing Asian countries. It was found that rate of inflation, real exchange rate and index of economic activity are significant factors of portfolio investment, while the balance of payment indicators such as total foreign trade, foreign direct investment (FDI) and current account deficit had no impact on determining these flows. Vita and Kyaw (2008) examined the significance of the determinants of foreign direct investment and portfolio flows to five developing countries and across different time horizons. This study used structural vector autoregressive (VAR) model, variance decomposition and impulse response function and found that foreign output and domestic productivity are the most important drivers in explaining the variations in capital flows to developing countries. A recent study by Ahortor and Olopoenia (2010) used a dynamic stochastic general equilibrium analysis approach to determine foreign portfolio flows to Ghana and found that a mix of domestic and global factors influence the portfolio flows.

The drivers of foreign portfolio inflows to India have been investigated by many researchers. Some of them are discussed as follows: Srinivasan and Kalaivani (2015), Garg and Dua (2014), Kaur and Dhillon (2010) explored the determinants of foreign portfolio investments in India by deploying ARDL bounds testing approach. These studies revealed that high economic growth in the domestic country is the dominant pull factor to stimulate foreign portfolio inflows. As per Garg and Dua (2014), Kaur and Dhillon (2010), Rai and Bhanumurthy (2004) and Gordon and Gupta (2003), a bullish stock market stimulates FPIs to invest in India. Verma and Prakash (2011) empirically analysed the sensitivity of various components of capital inflows to interest rate differentials in the Indian context by using cointegration test and Granger causality test in VAR framework. The results indicate that FDI and FII flows in equity, which constitute a majority of net capital flows, are not impacted by interest rates, while, contrary to this, debt flows including external commercial borrowings (ECB) and non-resident Indian (NRI) deposits have been sensitive to interest rate differentials and changes in exchange rates. However, at an aggregate level, cumulative gross capital inflows are impacted by changes in interest rate. Likewise, Garg and Dua (2014) did not find any evidence where foreign portfolio investments to India were influenced by differential interest rates. Among push factors, volatility in the US equity market encourages FPIs to invest in the Indian stock market (Kalaivani, 2015) and also the booming stock markets of other emerging economies (Gordon and Gupta, 2003). In contrast, Garg and Dua (2014) found that higher equity returns of other emerging economies, measured by Morgan Stanley Capital International (MSCI) index, negatively affects foreign portfolio flows to India. Among other external factors, Gordon and Gupta (2003) found that lower foreign interest rates encourage foreign portfolio equity flows into India.

After reviewing the literature on the determinants of foreign portfolio flows, it is found that none of these studies have investigated the determinants of foreign portfolio inflows to Indian bonds, though a majority of the studies have focussed on aggregate foreign portfolio investments in India. The bond market of India is in its nascent stage in comparison to equity markets and has consequently received less attention by researchers and policymakers. Moreover, the volatile nature of foreign portfolio flows in debt has large implications on financial and macroeconomic stability of the Indian economy. Against this background, it is necessary to identify the main drivers of portfolio flows to bond market of

developing economies to design effective policies to enhance resilience and help in managing capital flow volatility (Taylor and Sarno, 1997; Hannan, 2017; Pagliari and Hannan, 2017). Thus, it would be valuable to study the determinants of foreign portfolio investments in bonds. This study endeavours to do the same in the sections that follow.

3. Methodology and data

3.1 Methodology

On the basis of the foregoing literature review, the objective of this study is to investigate whether the pull or the push factors (or, if a combination of the two, the relative contribution of each type) determine the foreign portfolio investment to Indian bonds. Towards this endeavour, the empirical analysis will be based on a three-stage process. Firstly, the order of integration of all the variables will be checked using augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests. Secondly, the long-run (level) equilibrium relationships among the variables will be explored by using ARDL approach to cointegration developed by Pesaran *et al.* (2001). Another name for ARDL model is bound test. The third and the final step involves the determination of short-run coefficients by estimating an error correction model associated with long-term estimates.

It is to be noted that ARDL single cointegration approach has various advantages over other single cointegration procedures. Firstly, it is applicable irrespective of whether the underlying variables are I(0) or I(1) or a combination of both. Secondly, the bound test approach, which measures cointegration among the variables, has a non-standard distribution and is used to measure long-term association between the variables, irrespective of whether the underlying variables are I(0), I(1) or fractionally integrated. The only condition is that none of the underlying variables should be I(2). Thirdly, it estimates long-run and short-run parameters of the model simultaneously. Fourthly, it avoids problems of endogeneity as associated with Engle–Granger method. As a result, this method presents unbiased estimates of the long-run model and valid t-statistic even if some of the explanatory variables are found to be endogenous (Harris and Sollis, 2003). A general form of ARDL model can be represented as:

$$y_t = \alpha + \sum_{i=1}^{p} \delta_i \, y_{t-i} + \sum_{J=1}^{k} \sum_{i=0}^{qj} \beta j, i \, X_{j,t-i} + \varepsilon_t \quad (1)$$

wherein some of the explanatory variables may not have any lagged terms in the model like $q_j = 0$; p indicates number of lagged term of own variable and q_j refers to number of lagged term of explanatory variables. In simple words, dependent variable is regressed over its own lagged value plus level and lagged values of independent variables. However, number of lagged value of dependent and independent variables can differ in ARDL model and are determined by lag selection criteria.

The long-run coefficients or level coefficients of the explanatory variables are estimated by transforming the equation (1) as following:

$$\theta j = \left(\sum_{i=1}^{xj} \beta j, i \right) \div \left(1 - \sum_{i=1}^{p} \delta_i \right) \quad (2)$$

where numerator is sum of value of coefficients, say independent variable X_1, obtained in level and all lag forms from equation (1), while denominator is one minus sum of lagged values of dependent variable y. In this way, level (or long-run) relationship can

be derived for all the variables from equation (1) and using the transformation as depicted in equation (2).

Before estimating the ARDL models, it is necessary to investigate the existence of long-run relationships between the variables. We applied bound testing approach suggested by Pesaran *et al.* (2001) as it is the first step towards ARDL approach to cointegration. This test is used when all the variables are not integrated of same order, that is, they are either I(0) or I(1) or a combination of both, but none of them has to be I(2), as discussed earlier. It is based on Wald Test or F-Statistic, whereby it involves testing of null hypothesis of $a_1 = a_2 = a_3 = \ldots\ldots = a_k = 0$ stating that no long-run relation is established against the alternative hypothesis of $a_1 \neq a_2 \neq a_3 \neq \ldots\ldots \neq a_k \neq 0$, should be performed for equation (3). In other words, first, we estimated the following equation (3) from equation (1) by differencing it, and then we tested for null hypothesis of $a_1 = a_2 = a_3 = \ldots\ldots = a_k = 0$ using Wald Test. Pesaran *et al.* (2001) provide two sets of critical values for a given significance level for the F-statistic. One set assumes that all variables are stationary at level and so provides lower bound value, while the other set assumes they are all stationary after first difference and provides upper bound value. If the value of computed F-statistic is higher than upper critical bounds value, then the null hypothesis of no cointegration is rejected. In other words, a long-run relationship is established between the variables. If the F-statistic falls below the lower bound critical value, then it implies no cointegration. However, if the computed F-value lies between the upper and lower bound, then the test becomes inconclusive.

$$\Delta y_t = a_0 + a_1 y_{t-1} + a_2 x_{1,t-1} + a_3 x_{2,t-1} + \ldots\ldots + a_k x_{k,t-1} + \sum \lambda i \, \Delta y_{t-i} + \sum \lambda it \, \Delta x_{1,t-i} + \ldots\ldots + \sum \lambda ki \, \Delta x_{k,ti} + u_t \quad (3)$$

Given the existence of a long-run relationship, ARDL cointegration procedure for foreign portfolio investment in debt (FPD) was implemented to estimate the parameters of equation (2). We selected the lags of ARDL (p,q) model, where *p* stands for lag value of own variable (or dependent variable), and *q* stands for lag value of other variables (independent variables), with the help of Akaike information criterion (AIC). A maximum lag value of four has been used for implementing the test to minimise loss of degrees of freedom. In the final step, short-run dynamics of the model are estimated by transforming equation (3), and it also contains speed of adjustment parameter known as error correction mechanism (ECM). It is a means of reconciling the short-run behaviour of an economic variable with its long-run behaviour. We have carried out all the econometric exercises by using EViews 9.

3.2 Data

The data used in this study to carry out the empirical analysis of determining the factors of foreign portfolio flows to Indian debt market are described in this section. We have considered monthly time series from January 2002 to December 2016 for all the variables. Data for dependent variable, i.e. net foreign portfolio flows into Indian bonds (FPD), have been culled from National Securities Depository Limited (NSDL), which is an Indian central securities depository. On the basis of select literature discussed, we undertook following independent variables to determine the factors of FPD.

- *Domestic growth (y).* An economy at a high growth trajectory tends to attract foreign investors as it is likely that they will make good returns. Moreover, growth in domestic output is an indicator of robust macroeconomic fundamentals and strong institutional framework, which altogether underpins the foreign investors'

confidence to invest in the host country. As a result, foreign portfolio investments in bonds are positively related to domestic growth. Because of the lack of monthly time series on domestic growth, we have proxied it by year-on-year growth of monthly index of industrial production (IIP) for India. The data has been culled from the *Handbook of Statistics on the Indian Economy*, RBI.

- *Domestic stock market performance.* Booming stock markets (SM) may motivate portfolio investors to invest in equity markets to make quick gains. However, this may discourage FPIs to invest in government and corporate bonds, and thus, we can expect a negative relationship between foreign portfolio flows into debt market and domestic stock market performance. Monthly average of BSE SENSEX is considered as proxy for domestic SM performance and is extracted from RBI statistics.
- *Interest rate differential* (i-i*). The difference in the interest rates between the recipient country and the source country could significantly affect foreign portfolio flows and within that, especially flows into bonds. According to the Mundell–Fleming model, capital moves into that country where interest rates are higher, assuming stable exchange rates and similar tax patterns. So, portfolio investments in bonds can rise if higher interest rates are offered in the home country as rising interest rates inversely affects bond prices by changing its yield. We described interest rate differentials (i-i*) as the difference between 91-day Treasury bill rate for India and three-month Treasury bill rate for the USA. US Treasury bill rate is proxied as foreign interest rate. The data has been obtained from the RBI's monthly bulletin for India and IMF Statistics for the USA.
- *Exchange rate* (e). Flexible exchange rates play a dominant role in cross-border flows. A capital can earn a return not only through yield on assets but also through a change in exchange rate overtime. When the domestic currency, say rupee, of the host country falls, the foreign investors stand to lose from their current Indian holdings, leading to a possible pull out from the market because of the fear of further decline. At the same time, the decline in rupee will attract the prospective investors in the Indian debt market because a strong dollar will help FIIs buy more securities in rupee terms. Thus, we can expect a positive relationship of FII purchases and sales in the debt market with exchange rate. Export-based nominal effective exchange rate (NEER) with reference to 36 currencies has been considered as exchange rate, and the data for the same has been taken from the *Handbook of Statistics on the Indian Economy*, RBI. Therefore, an appreciating exchange rate of the host country is expected to stimulate the foreign portfolio flows, and vice-versa also holds.
- *Exchange rate volatility*, VOL (e). A stable exchange rate is desirable for foreign investors. High volatility in exchange rates poses higher uncertainty to foreign investors and thus impedes them from making investments in the host country. The data for variability (or variance) in the exchange rate is generated by using univariate Generalized AutoRegressive Conditional Heteroscedasticity GARCH (1, 1) model[4], as used by Garg and Dua (2014). We expect a negative relationship between net foreign portfolio flows in debt and the exchange rate volatility.
- *Stock market returns in other emerging markets* (MSCI). An investor invests in assets across countries as a way to diversify their portfolio. Two emerging economies might act as competitors to each other, and higher returns in one emerging market tend to cause lower foreign investments in other emerging markets. Alternatively, as per Buckberg (1996), emerging markets receive a higher

share of capital than advanced economies which is only possible when emerging economies as a whole perform better. This implies that equity market of each emerging economy has higher chances of receiving foreign funds. Higher stock market returns would dissuade FPIs to invest in debt market and thus a negative relationship between net foreign portfolio flows in debt and stock market returns in other emerging market is expected. We used MSCI emerging markets index to estimate stock market returns in emerging economies.

- *Foreign output growth* (y*). A higher output growth in a group of advanced economies represents greater opportunities of profitability in these countries and thus greater funds available for investments in emerging economies. Therefore, we presume a positive relationship between the dependent variable and foreign output growth. We measured this variable by taking annual growth rate of monthly IIP for Organisation for Economic Co-operation and Development (OECD) countries.
- *Global financial crisis, 2008* (Dummy 1). Global financial crisis caused a sharp reversal of portfolio flows from bond markets. To take this effect into account, we have incorporated a dummy variable in our analysis. We expect a negative relationship between portfolio flows in debt market and the global financial crisis, *a priori*. The crisis variable is represented as "Dummy 1" in the model.
- *Unconventional monetary policy of advanced economies (Dummy 2).* In the wake of global financial crisis of 2008, the advanced economies resorted to accommodative monetary policy stance to pump in the much-needed liquidity in their economies. This led to plummeting of interest rates as they reached close to zero, and subsequently, large amount of capital inflows were witnessed by emerging economies. However, when the growth prospects of advanced economies including the USA improved, they decided to gradually rollback the expansive monetary stance. As a result, US Fed made an announcement of US bond tapering in May 2013 which triggered massive sales of bonds by FPIs from emerging economies including India. To incorporate this effect, we have considered a dummy variable and the same has been represented in the model as "Dummy 2". *A priori*, we expect a negative relationship between portfolio flows in debt and Dummy 2.

The model selection is based on AIC, and maximum of four lags for dependent variable and for explanatory variables have been considered. In this process, the automatic selected model consists three lags of the dependent variable (FPD), four lags of interest rate differential (i-i*), two lags of exchange rate (e), four lags of stock market returns in other emerging markets (MSCI), four lags of domestic stock market performance (SM), no lags for exchange rate volatility, one lag for domestic growth (y), zero lag for foreign output growth (y*), one lag for global financial crisis dummy (Dummy1) and four lags for Dummy 2 representing unconventional monetary policy of advanced economies, have been taken.

The basic form of our model is as following:

Foreign portfolio investment in debt is a dependent variable (FPD).

$$\begin{aligned}\mathrm{FPD}_t = {} & a + \delta_1 \mathrm{FPD}_{t-1} + \delta_2 \mathrm{FPD}_{t-2} + \delta_3 \mathrm{FPD}_{t-3} + \beta_1 i - i^*_t + \beta_2 i - i^*_{t-1} \\ & + \beta_3 i - i^*_{t-2} + \beta_4 i - i^*_{t-3} + \beta_5 i - i^*_{t-4} + \beta_6 e_t + \beta_7 e_{t-1} + \beta_8 e_{t-2} \\ & + \beta_9 \mathrm{MSCI}_t + \beta_{10} \mathrm{MSCI}_{t-1} + \beta_{11} \mathrm{MSCI}_{t-2} + \beta_{12} \mathrm{MSCI}_{t-3} + \beta_{13} \mathrm{MSCI}_{t-4} \\ & + \beta_{14} \mathrm{SM}_t + \beta_{15} \mathrm{SM}_{t-1} + \beta_{16} \mathrm{SM}_{t-2} + \beta_{17} \mathrm{SM}_{t-3} + \beta_{18} \mathrm{SM}_{t-4}\end{aligned}$$

$$+\beta_{19}\mathrm{VOL}(e)_t + \beta_{20}y_t + \beta_{21}y_{t-1} + \beta_{22}y^*_t + \beta_{23}\mathrm{Dummy1}_t + \beta_{24}\mathrm{Dummy1}_{t-1} + \beta_{25}\mathrm{Dummy2}_t + \beta_{26}\mathrm{Dummy2}_{t-1} + \beta_{27}\mathrm{Dummy2}_{t-2} + \beta_{28}\mathrm{Dummy2}_{t-3} + \beta_{29}\mathrm{Dummy2}_{t-4}$$

4. Empirical results

To demonstrate the primary features of the data series used in this study, we have calculated descriptive statistics (DS) which is presented in Table I. These are estimated for all variables individually, each comprising 180 observations, as our times series is from January 2002 to December 2016 (15 years × 12 months). On an average, India received ? 14.8bn net foreign portfolio flows in bonds in a month during the span of 2002 and 2016. The maximum net inflows by FPIs were around ₹229bn, while net outflows were higher and amounted to ₹331bn. Both of these high inflows and outflows reflect volatility in the Indian bond market. Coming to interest rate differential (i-i*), on an average, Indian interest rates are 5.4 per cent higher than US interest rates. The maximum difference has been around 12 per cent, and occasionally, US interest rates were higher than interest rates in India by a marginal 0.36 per cent. The highest value attained by MSCI index is $1,337 and the lowest is $266. The mean value of nominal effective exchange rate indicates depreciation of Indian rupee against foreign currencies by 13.8 per cent.

Monthly average of Indian stock markets represented by SENSEX (SM) has observed a peak of ₹28,952 and the lowest value has been ₹2,949. On an average, it has stayed around ₹15,000 during a month. The average Indian growth rate proxied by IIP had been close to 6 per cent during 2002 to 2016. The average monthly growth in OECD countries (y*) had been 5 per cent between the period January 2002 to December 2016 and witnessed the lowest of interest rates of −7.5 per cent.

We have tested for the stationary properties of our time series data to rule out any possibility of spurious regression results. The results of the ADF and PP unit root test show that some variables are I(1) and some are I(0) at level (Table II). Foreign portfolio flows in debt are stationary at level, so is the growth rate of the economy, while the rest of the variables are stationary at first difference. However, some variables such as domestic stock market performance and growth in foreign output are I(0) by ADF test but are I(1) by PP test. As PP test is a non-parametric test, its results are better over ADF test. Thus, we consider these variables as I(1). As variables have different orders of integration, we have decided to apply ARDL. The results of unit root with trend and intercept are depicted in Table II. From Table I, we find that the time series of debt flows depict deviations from its mean value because of volatility in its flows, so we have also conducted unit root tests with intercept as well, results of which are shown in Appendix. These results are consistent with

	FPD (₹bn)	i-i* (%)	MSCI ($)	e (or NEER)	SM (₹)	VOL (e)	y (%)	y* (%)
Mean	14.8	5.36	810.75	90.07	15,119.9	198.4	5.9	5.01
Maximum	229.35	11.94	1,337.45	107.20	28,952.9	913.78	26.7	17.7
Minimum	−331.35	−0.36	266.10	69.95	2,949.75	0.87	−7.24	−7.51
SD	67.30	2.47	271.57	10.87	7,711.56	263.58	5.92	4.82

Source: Authors' calculations

Table I.
Descriptive statistics

Table II.
Unit root tests

Variables	ADF (with trend and intercept) Levels	(*p*-value)	First difference	(*p*-value)	Decision	PP (with trend and intercept) Levels	(*p*-value)	First difference	(*p*-value)	Decision
FPD	−7.51	0.00	–	–	I (0)	−7.62	0.00	–	–	I (0)
i-i*	−2.47	0.33	−14.30	0.00	I (1)	−2.43	0.36	−14.56	0.00	I (1)
e	−2.43	0.36	−10.52	0.00	I (1)	−2.21	0.47	−10.45	0.00	I (1)
MSCI	−1.63	0.77	−11.75	0.00	I (1)	−2.02	0.58	−11.83	0.00	I (1)
SM	−3.46	0.04	–	–-	I(0)	−2.96	0.14	−10.69	0.00	I(1)
VOL(e)	−1.76	0.71	−4.99	0.00	I(1)	−2.11	0.53	−10.90	0.00	I(1)
y	−3.60	0.03	–	–	I(0)	−5.99	0.00	–	–-	I(0)
y*	−4.17	0.00	–	–	I(0)	−3.12	0.1	−7.89	0.00	I(1)

Source: Authors' calculations

unit root tests results obtained in Table II and hence deny the possibility of any spurious regression results. Further, for the robustness of the empirical results, diagnostic tests have also been carried out including the stability tests in the following section[5].

Before moving to ARDL cointegration results, we have imposed maximum four lags for dependent variable and four lags for independent variables, and the model selection is based on AIC to select the maximum lags. Thereafter, we checked for ARDL bound testing approach. The bound test results conclude that there is a strong cointegration relationship among the foreign portfolio flows into Indian debt market and its determinants as computed F-statistic is greater than upper bound, when measured at 1 per cent level of significance (Table III). This further implies that there is some adjustment process in the short-run which prevents the errors from becoming larger and larger in the long-run relationship. For robustness of results, we have undertaken two models mentioned as Model 1 and Model 2 in Table III. Model 1 is a standard regression model carrying i-i*, e, MSCI, SM, VOl (e), Y, Dummy1 and Dummy2 as independent variables. Model 2 contains one additional variable, that is, Y* over Model 1.

Further, we have also investigated for diagnostic tests to assess the robustness of ARDL model, that is, Breusch–Godfrey serial correlation LM test to detect the presence of autocorrelation and Breusch–Pagan–Godfrey (BPG) test to identify any heteroscedasticity present in the model. Their results are presented in Table IV. As *p*-value of F-statistic is not less than 5 per cent level of significance, we cannot reject the null hypothesis of no autocorrelation. It means that there is no evidence of autocorrelation in the disturbance of error term. Likewise, the BPG test indicates that the errors are homoscedastic and independent of regressors. Both these tests establish the validity and reliability of ARDL model.

Table III.
ARDL bound testing approach for cointegration, dependent variable: net foreign portfolio investments in debt

Computed *F*-statistic	Critical *F*-value (99%) Lower bound	Upper bound
Model I: FPD = f(i-i, e, MSCI, SM, VOL(e), y, Dummy 1, Dummy 2)*		
$F = 5.09$	2.79	4.1
Model II: FPD = f (i-i, e, MSCI, SM, VOL(e), y, y*, Dummy 1, Dummy 2)*		
$F = 4.60$	2.65	3.97

Source: Authors' calculations

4.1 Stability tests

The presence of long-run relationship between the variables does not necessarily signify that estimated coefficients are stable as argued by Bahmani–Oskooee and Chomsisengphet (2002). The stability of coefficients of regression is largely examined by means of Chow (1960), Brown *et al.* (1975), Hansen (1992) and Hansen and Johansen (1993). Chow test requires information on structural breaks in the estimation procedure, and its shortcomings are very well mentioned in Gujarati (2003). Stability tests by Hansen (1992) and Hansen and Johansen (1993) require all the variables to be stationary at I(1), and also, they only consider long-run parameter constancy and ignore the short-run dynamics of the model. Hence, cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) stability tests (Brown *et al.*, 1975), which are based on the recursive regression residuals, may be used to that end. The additional benefit of these test is that they also incorporate the short-run dynamics to the long-run, through residuals. CUSUM and CUSUMSQ tests are carried out by graphical representation and are based on recursive regression residuals and are plotted against the breakpoints of the model. If plots of these statistics lie within the critical bounds of 5 per cent level of significance, one can assume that coefficients of a given regression are stable. Results of these tests are shown in the later sections.

4.2 Long-run coefficients of autoregressive distributed lag model

After finding the long-term association between the variables, we can estimate the long-run and short-run coefficients using the ARDL model. The estimated long-run coefficients of foreign portfolio flows in debt are presented in Table V. The differential between domestic and foreign interest rates has a positive influence on portfolio flows in Indian debt market and is statistically significant at 1 per cent level, indicating that investments in bonds are highly sensitive to differential interest rates. As domestic bond offers higher interest rates than foreign bond, they attract foreign investors to come and invest in India. Post the global financial crisis, the Indian debt market witnessed an increase in foreign investments in response to the expansionary monetary policy stance of advanced economies. The result reinforces the findings of the Mundell–Fleming model.

The estimated coefficients of stock market returns in other emerging markets (MSCI) have a positive impact on portfolio investments in Indian bonds, albeit it was not expected *a priori*. Higher equity returns in emerging markets should have adversely affected portfolio investments in Indian bond market. But the estimated positive coefficient might indicate that a part of foreign capital also flows to bond markets out of total capital to be invested in emerging markets. This might be possible when foreign investors want to reap the benefits of relatively stable returns offered by bond markets. Further, it indicates that high-performing equity markets of emerging economies do influence the bond market of India (Gordon and Gupta, 2003).

The estimated coefficient on domestic stock market performance is found to be negative as expected and is statistically significant at 5 per cent or lower. The negative long-run

Diagnostic tests	Model 1 ARDL	Model II ARDL
Serial correlation LM test (*F*-statistics)	0.63 [0.64]	0.58 [0.67]
Heteroscadasticity BPG test (*F*-statistics)	1.13 [0.30]	1.16 [0.26]

Note: Brackets comprise *p*-value
Source: Authors' own calculations

Table IV.
Diagnostic tests: dependent variable: net foreign portfolio investments in debt

Table V.
Estimated long-run coefficients using the ARDL model; dependent variable (FPD)

Variable	Dependent variable: net foreign portfolio investments in debt (₹bn) Model I ARDL	Model II ARDL
i-i*	22.9 [0.00]*	21.60 [0.00]*
e	1.60 [0.52]	1.60 [0.51]
MSCI	0.10 [0.11]	0.11 [0.08]***
SM	−0.009 [0.02]**	−0.009 [0.01]*
VOL(e)	−0.24 [0.04]**	−0.25 [0.03]**
y	7.24 [0.00]*	6.31 [0.01]*
y*	–	1.38 [0.48]
Dummy 1	−53.78 [0.03]**	−59.00 [0.02]**
Dummy 2	−283.31 [0.00]*	−291.15 [0.00]*
Intercept	−305.83 [0.23]	−300.37 [0.2]

Notes: brackets comprise *p*-value and *; **; ***indicate significance at 1, 5 and 10 per cent level, respectively
Source: Authors' own calculations

coefficient denotes that higher returns on equity lead to a decrease in portfolio investments in debt market as foreign investors find it more profitable to invest in the equity market.

An appreciation of exchange rate of the host country provides higher returns to the foreign investor at the time of exit, but in our study, portfolio flows in debt have not been impacted by exchange rates, but they have been highly influenced by variability in exchange rates. It indicates that currency risk significantly discourages foreign investors to invest in Indian bond market.

The long-run coefficient of economic growth in domestic markets is positive and statistically significant at 1 per cent level. It denotes that macroeconomic stability of the host country is vital in attracting portfolio flows in debt. Moreover, accelerating growth rate uplifts market sentiments, draws attention of foreign investors and encourages them to invest in India. The next variable, foreign output growth, which is represented by output growth in OECD economies, though positively influences portfolio investments in Indian debt market, is found to be statistically insignificant. It may indicate that expansion in global growth may not directly stimulate funds in the bond market, and probably motivate investors towards high yielding equity markets (Garg and Dua, 2014).

Coming to external shocks, the long-run coefficient of dummy for global financial crisis is negative and statistically significant. It indicates that there is a reversal of portfolio flows in wake of the global financial crisis. Another dummy variable, which is to capture the impact of the unexpected withdrawal (or the winding up) of expansionary monetary policy of advanced economies on the foreign portfolio flows in bonds, is found negative and statistically significant at 1 per cent. For instance, the announcement of withdrawal of monetary stimulus by the USA in June 2013 caused the plummeting of portfolio flows from equity and debt markets. This is because investors wanted to gain from the rising yields of US securities in response to the partial withdrawal of large scale bond-buying program of US Fed.

4.3 Short-run dynamics of autoregressive distributed lag model

The results of short-run dynamics for foreign portfolio flows in debt are presented in Table VI. It is worth highlighting that most of the conclusions obtained from the long-run estimates remain robust in short span of time. Importantly, in the long-run equilibrium,

Variable	Dependent variable: change in net foreign portfolio investments in debt(Δ FPD) (₹bn) Model I ARDL	Model II ARDL
Δ FPD (−1)	−0.19 [0.05]**	−0.17 [0.06]***
Δ i-i*	11.92 [0.07]***	10.73 [0.10]***
Δ e	5.53 [0.08]***	5.54 [0.08]***
Δ MSCI	0.01 [0.82]	0.02 [0.79]
Δ SM	0.01 [0.02]**	0.01 [0.02]**
Δ VOL(e)	−0.14 [0.03]**	−1.49 [0.02]**
Δ y	2.16 [0.05]**	1.94 [0.09]***
Δ y*	–	0.82 [0.48]
ECM (−1)	−0.58 [0.00]*	−0.59 [0.00]*
R^2	0.62	0.63
Durbin–Watson	1.90	1.90
F-statistics	7.72 [0.00]*	7.46 [0.00]*

Notes: brackets comprise *p*-value and *; **; ***indicate significance at 1, 5 and 10 per cent level, respectively
Source: authors' own calculations

Table VI. Short-run relationship ARDL model; dependent variable FPD

foreign exchange rate may not have any impact on the debt flows; however, to bring back any short-term disequilibrium in debt flows to long-term equilibrium, among others, foreign exchange rate plays a significant role. Further, the estimated lagged value of error correction coefficient (ECT) is negative and statistically significant at 1 per cent level, thereby corroborating the established long-run equilibrium relationships between the competing variables. The magnitude of ECT coefficient of –0.58 implies that the speed of convergence is of 58 per cent, which infers a quick convergence towards long-run equilibrium in case any disequilibrium arises.

4.4 Stability of autoregressive distributed lag models

We shall investigate the stability of coefficients of regression models. For this, we apply CUSUM and CUSUMSQ stability tests (Brown *et al.*, 1975) as explained in the earlier section. According to the following graphs (Figures 2 and 3), there are no instability issues with both

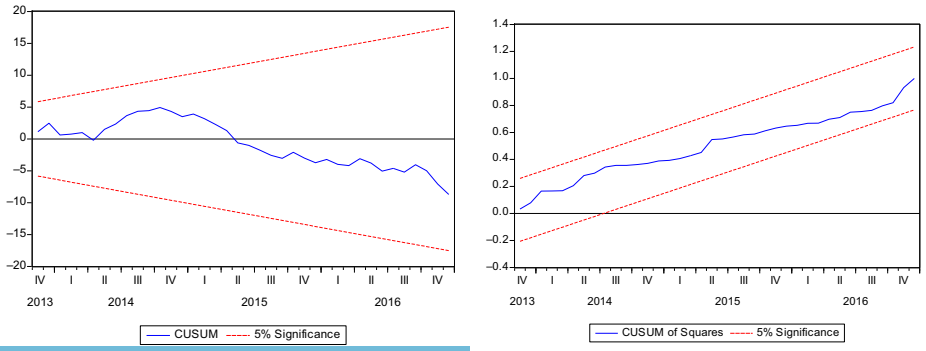
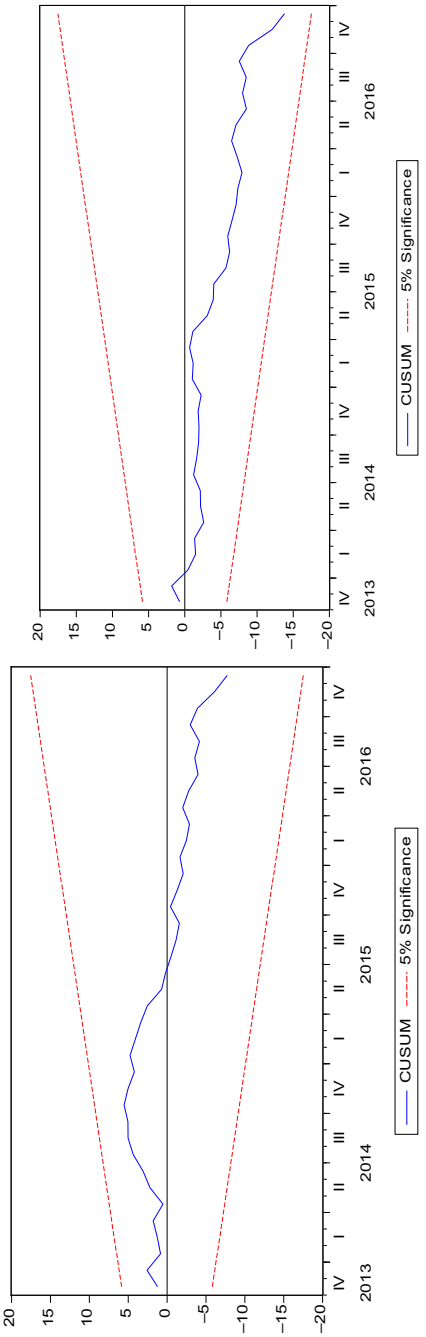


Figure 2. Stability test: CUSUM and CUSUMSQ (Model 1)



Source: Authors' own calculations

Figure 3.
Stability test: CUSUM and CUSUMSQ (Model 2)

the Models 1 and 2. This is because plots of the CUSUM and CUSUMSQ statistics lie within the critical bounds of 5 per cent level of significance, implying that the model has stable parameters over the time. In other words, CUSUM and CUSUMSQ do not touch the red lines, connoting that short-run and long-run estimated coefficients in the ARDL model are stable.

5. Conclusion

In this study, we used ARDL approach to cointegration in an attempt to probe into the long-run and short-run determinants of foreign portfolio flows to Indian debt market. We investigated whether pull factors or push factors mattered in the determination of these flows. Our study found that when interest rates were higher in the host country than foreign interest rates, it encouraged FPIs to make investments into the Indian bond market, thus reinforcing the findings of the Mundell–Fleming model. The dominant pull factor, namely, interest rate differential, explains the dynamics of flows into bonds, and our results are consistent with those of Taylor and Sarno (1997) and Ahortor and Olopoenia (2010). In contrast, study by Garg and Dua (2014) on aggregate foreign portfolio flows to India did not find interest differential as a stimulating factor which may be attributed to the composition of foreign portfolio flows taken.

Among other domestic factors such as stock market performance, volatility in exchange rates and domestic growth rates are found significant drivers of foreign portfolio flows to bonds in India. Our study also confirmed that global conditions could induce a fast outflow of capital from India (Garg and Dua, 2014; IMF, 2017). For instance, external shocks emanating from the winding up of unconventional accommodative monetary stance of the advanced economies including the USA have significantly adversely affected these foreign portfolio flows to India. Further, it is worthy to highlight that these long-run estimates of foreign portfolio investments in debt also remain robust in the short-run estimation. Thus, this study concludes that both pull factors and push factors are equally important in determining the foreign portfolio investments in the debt market of India.

The empirical analysis conducted in this study suggests that direct and indirect measures can be taken to increase and stabilise foreign investments in the Indian bond market. Direct policy measures refer to those tools which are under the ambit of policymakers. On the one hand, monetary policy authorities could influence capital flows into bonds through interest rate and exchange rate channels. In this context, the domestic interest rate could be lowered over time, although reduction in interest rates may seem to be in disagreement with existing theory and practice. Over a period, however, it will prove to be a prudent policy as it would help stabilise the domestic financial market and also enable its integration into the global financial market where the current levels of interest rates are much lower than the domestic rates. Of course, steps to reduce the rate of domestic inflation and to lower the risks associated with financial transactions in the economy have to be taken if this is to be done. On the other hand, fiscal authorities can raise public expenditure and adopt distortionary tax rate to boost the economic growth, and that would in turn influence capital flows into debt market. Apart from these, indirect policy measures can also impact foreign investments. Indirect measures comprise those tools that are not under the direct control of the fiscal and monetary authorities but require coordinated efforts of the government and private sector. In this regard, both the government and the private sector should take measures to portray India as a country that is attractive for investors and ready for substantial portfolio inflows. For this, the strengthening of not only financial and economic but also administrative institutions will be necessary. Creditworthiness and policy credibility should be improved to address volatile private inflows in Indian debt market.

Notes

1. www.rbi.org.in/Scripts/NotificationUser.aspx?Id=11513&Mode=0
2. FPIs will be free of macro-prudential regulations provided they voluntarily commit to retain a required minimum percentage of their investments in India for a period of their choice. However, the minimum retention period shall be of three years or as decided by RBI.
3. As proposed by Mundell—Fleming model, foreign capital freely traverse across borders in search of higher return until interest rate differential among economies persists. This induces the linking of returns or yields in capital markets in different countries together; however, this phenomenon works only under certain assumptions of perfect mobility of capital and fixed foreign interest for an economy.
4. We have used the simplest form of GARCH model which is GARCH(1,1) that measures conditional variance by using one-year lagged value of squared residual, α (volatility observed in previous period) and one-year lagged value of GARCH, β, i.e. last period's forecast variance. In this way, the GARCH (1,1) model with one-year lag generates the conditional variance for each observation in the sample. As this model is appropriate in explaining volatility clustering and fat tails, we have used this model to measure the volatility.
5. It may be noted that the high variation in the dependent variable from its mean value reflects high volatility in foreign portfolio flows to the Indian bond market. The removal of these data points is not always desirable, as it may improve the "fit" of the regression at the cost of destroying some of the most important information in the data (University of Pennsylvania, Resource Material).

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Appendix

	ADF (with intercept)					PP (with intercept)				
Variables	Levels	(*p*-value)	First difference	(*p*-value)	Decision	Levels	(*p*-value)	First difference	(*p*-value)	Decision
FPD	−7.50	0.00	–	–	I(0)	−7.71	0.00	–	–	I(0)
i-i*	−1.66	0.44	−14.34	0.00	I(1)	−1.45	0.56	−14.56	0.00	I(1)
e	−0.92	0.7	−10.54	0.00	I(1)	−0.80	0.81	−10.49	0.00	I(1)
MSCI	−1.92	0.32	−11.73	0.00	I(1)	−2.07	0.26	−11.80	0.00	I(1)
SM	−0.93	0.78	−10.63	0.00	I(1)	−0.92	0.78	−10.72	0.00	I(1)
VOL(e)	−0.14	0.94	−9.90	0.00	I(1)	−0.09	0.96	−9.84	0.00	I(1)
y	−2.87	0.05	–	–	I(0)	−4.70	0.00	–	–	I(0)
y*	−4.19	0.00	–	–	I(0)	−3.10	0.02	–	–	I(0)

Source: Authors' calculations

Table AI.
Unit root tests

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