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22 September 2010

Online at <https://mpra.ub.uni-muenchen.de/30422/>
MPRA Paper No. 30422, posted 22 Apr 2011 12:00 UTC

India's Trilemma: Financial Liberalization, Exchange Rates and Monetary Policy*

March 25, 2010

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Abstract

A key challenge for macroeconomic policy in open economies is how to simultaneously manage exchange rates, interest rates and capital account openness—the trilemma. This paper calculates a trilemma index for India and investigates its evolution over time. We find that financial integration has increased markedly after the mid-2000s, with corresponding limitations on monetary independence and exchange rate stability. In addition, we empirically confirm a rise in one trilemma variable is traded-off with a drop in the weighted sum of the other two, i.e. the trilemma configuration is binding in India. Finally, we consider the implications of changes in the trilemma index for macroeconomic outcomes. We find that greater monetary independence systemically contributes to lower inflation, so the twin goals of exchange rate stability and capital account openness may create policy dilemmas in particular economic environments. Exchange rate stability is associated with less inflation volatility, suggesting that there may be secondary benefits channeled through import and commodity prices. In these relationships, however, changes in international reserves are not statistically significant, suggesting that foreign exchange market intervention has not mitigated the trilemma tradeoff in India.

Keywords: Financial trilemma, Indian economy, International reserves, Foreign exchange intervention, Monetary policy, Capital account opening.

JEL Classification: E4, E5, F3, F4

* An earlier version of this paper was presented at the 7th NIPFP-DEA Research Meeting held in New Delhi, India, August 31-September 1, 2010. We are grateful to conference participants and an anonymous referee for helpful comments. We thank Yuhua Xue for excellent research assistance.

1. Introduction

A key challenge for macroeconomic policy in open economies is how to simultaneously manage exchange rates, interest rates and capital account openness—the open economy trilemma. The basic premise of the international policy trilemma principle is that a tradeoff exists between interest rate policy (monetary policy) independence, exchange rate stability, and financial integration and that changing one component is necessarily associated with a corresponding change in a combination of the other two components.

The trilemma principle has come into greater focus in recent decades as emerging markets aim at exchange rate and macroeconomic stability while becoming increasingly integrated into world financial markets.¹ The trend towards greater financial globalization in most emerging markets around the world is well documented and has imposed a new set of challenges for policymakers (Lane and Milesi-Ferretti; 2003, 2007). Today most emerging markets operate in the range of partial financial integration with regulations restricting the flow of funds and ‘managed’ floating regimes with central banks actively intervening in foreign currency markets (Aizenman, 2010).²

India also fits this general pattern, following a nuanced path of gradual capital account liberalization. Since the early 1990s, the macro-economic environment in India has changed substantially from being tightly controlled and regulated to one experiencing gradual deregulation and liberalization (Shah, 2008; Mohan and Kapur, 2009). These developments and structural changes have impacted the financial environment and external constraints facing Indian policymakers, and may have influenced operating procedures and effective policy tradeoffs between the trilemma choices. In particular, the trilemma principle predicts that India’s experience with increasing financial integration would likely have been accompanied, *ceteris paribus*, by a loss of monetary

¹ Aizenman (2010) provides a detailed description of the trade-offs faced by countries in making policy choices in context of the trilemma. Aizenman, Chinn, Ito (2008, 2010) have investigated the trilemma empirically in a cross-section of a large number of countries.

² A few countries, notably China, have resisted this trend. China maintains strict controls on international capital flows, which, together with a massive buildup in international reserves, allow maintenance of a rigid exchange rate and a large degree of monetary independence (Glick and Hutchison, 2009).

independence and/or loss of exchange rate stability. Evidence of increasing financial integration, for example, is closer linkage of short-term interest rates in India with those abroad (Hutchison, Kendall, Pasricha and Singh, 2010; Hutchison, Pasricha and Singh, 2010).

To what extent has financial integration imposed greater constraints on exchange rate and interest rates policies in India? What has been the cost of international financial liberalization in terms of macroeconomic policy? This paper addresses these questions by measuring the tradeoff between financial integration, exchange rate stability and monetary independence in India. We calculate a trilemma index for India and investigate its evolution over time using a methodology developed and employed for a cross-section of countries by Aizenman, Chinn and Ito (2008, 2009 and 2010). A novel aspect of their work is measuring the trilemma over a large cross section of countries while simultaneously taking into account the role of international reserves in macroeconomic management. We focus on India in our work, detail the evolution of the trilemma over time, associate changes in the macroeconomic policy tradeoff with financial liberalization and measure the extent to which international reserve management has played a role.

Previewing the results, our empirical measures confirm earlier research findings that financial integration has increased markedly after the mid-2000s. The rise in financial integration, in turn, has come with corresponding limitations on monetary independence and exchange rate stability. We find that this classic dilemma holds for India, in that greater monetary independence is empirically and systematically associated with lower inflation. On the other hand, exchange rate stability lowers inflation volatility, perhaps by stabilizing import and commodity price volatility. Capital account openness is associated with higher inflation volatility, as India struggles to balance financial globalization with domestic monetary stability. India has actively managed its exchange rate, building up a high level of international reserves by intervening heavily in the foreign exchange market (sterilized intervention), and has maintained some control over monetary policy. Active intervention in foreign exchange markets and maintaining a degree of control over international capital flows has proved a potent combination of policy instruments in India.

Section 2 provides a narrative account of the process of financial integration in India, and describes how it was led both by explicit policy decisions and private market forces in India and abroad as part of a broader trend of financial globalization. Measuring the evolution of the trilemma index in India is the subject of section 3. The extent to which financial integration has impacted the trilemma facing India monetary authorities is evaluated empirically in section 4. Section 5 discusses how changes in the external constraints, as represented by shifts in the trilemma indices, have influenced inflation and inflation volatility outcomes in India. Section 6 concludes the paper with a summary and discussion of future research directions.

2. The Trilemma, financial liberalization and international reserves in India

The Indian economy witnessed several structural changes during the past two decades. Following a balance of payments crisis in 1991, a deeper and more comprehensive series of liberalization and deregulation measures were implemented with regard to the banking sector and financial markets. Between 1992 and 1997, lending rates of commercial banks were deregulated, and the issue of ad hoc treasury bills was phased out (thereby eliminating automatic monetization of the budget deficit). In 1994, India switched over to a mainly market-determined exchange rate system and instituted current account convertibility. Over the 1990s, the exchange rate depreciated substantially against the US dollar, continuing a process that had begun in the 1980s.

Starting in 1998, the RBI undertook strong monetary policy measures (increasing interest rates and withdrawing liquidity) to deal with concerns about excessive liquidity and speculation in the foreign exchange market. The foreign exchange market was characterized by a high degree of volatility following the onset of the Asian financial crisis towards the end of 1997 and beginning of 1998. These emergency measures were gradually reversed once the threat had abated of the crisis spilling over to India.

During the subsequent period, through the mid-2000s, the RBI continued to refine its approach to macroeconomic management. With global and domestic inflation relatively low, the RBI set a band for target inflation of 4-5%, which was low by historical standards. Moreover while domestic fixed income markets continued to be thin

(as opposed to vibrant stock exchanges), especially for corporate bonds, a market for government securities began developing in this period. Against this background, in the next couple of subsections we analyze the role played by capital account liberalization and reserves management in altering the trilemma trade-offs faced by Indian policy-makers.

2.1 Financial integration and policy trade offs

Over the past 15 years or so the RBI continued to gradually ease capital controls, with implications for the functioning of domestic financial markets. Relaxations of capital controls included easing of requirements for and caps on foreign institutional investors (FIIs), streamlining of approval processes, and allowing FIIs to hedge exchange rate risk in currency forward markets. However, with regard to capital account liberalization, Indian policy-makers adopted a cautious stance from the very start (Hutchison, Kendall, Pasricha and Singh, 2010) as a result of which the process has been a continuous albeit a slow and gradual one. This perhaps was partly due to possible linkages between capital account and current account transactions such as capital outflows and trade mis-invoicing and partly owing to external events such as the Asian financial crisis, which reignited the debate on capital account openness for emerging markets.

Hence though the Indian economy has witnessed gradual financial liberalization over the past couple of decades but substantial controls on capital inflows continue to exist, as documented in Box 1. These restrictions can be best described as “complex, discretionary and fragmented” as in Hutchison, Pasricha and Singh (2010). Moreover, compared to other emerging market economies, India still has a relatively low degree of financial integration when measured as total external assets and liabilities as a percent of GDP.

The economy also started witnessing sharp increases in capital inflows over the last decade, especially in the years prior to the recent global financial crisis that started in 2007. Unlike the fast-growing East Asian economies, India has mostly run current account deficits, albeit modest, so there have been net capital inflows over most of its history. Earlier aid flows, however, have been displaced by private direct and portfolio

investment from abroad (Hutchison, Pasricha, Singh, 2010). Large capital inflows in some circumstances may increase the domestic money supply and put pressure on the exchange rate to appreciate. Moreover, given the relatively low exchange rate flexibility, the gradual process of capital account liberalization has the potential to cause distortions in the monetary policy. Thus, during this period, the RBI faced the traditional trilemma problem of maintaining an independent monetary policy in the face of international capital inflows and a desire to stabilize the exchange rate. The RBI also actively engaged in sterilization of inflows and began to accumulate foreign exchange reserves.

Like most emerging market economies, India suffered from the spillover effects of the current global financial crisis. This recent episode again reflects the trilemma at work in Indian monetary policy making, in this instance where capital outflows and reserve losses (to limit exchange rate depreciation) presents a contractionary influence on domestic monetary policy. In particular, one of the main effects of the global financial crisis on the Indian financial markets, particularly following the collapse of Lehman Brothers in September 2008, was in the form of reduction in net capital inflows. The withdrawal of funds from the Indian equity markets, along with reduced access of Indian entities to funds from international markets put significant pressure on dollar liquidity in the domestic foreign exchange market. As described in the IMF country report for June 2009, while foreign direct investment (FDI) continued to remain strong, external commercial borrowings were less than half of their 2007-08 levels. Portfolio outflows amounted to US\$9 billion in 2008Q2-Q4. This led to depreciation pressures and higher volatility in the foreign exchange market. In the event of such large capital outflows, the RBI undertook foreign exchange intervention measures to limit pressures on domestic liquidity, which in turn resulted in large losses in foreign exchange reserves.³ Reserves fell by US\$2.8 billion to US\$248 billion by 2009Q1.

The picture however has changed dramatically over the last year as the global economy has begun to climb upwards from the trough of the recession, again switching the particular constraints associated with the trilemma. The Indian economy has been among the first to recover from the crisis. Improved growth prospects have been

³ For more detail, see IMF (2009) and RBI(2009)

accompanied by large capital inflows. Investments of Foreign Institutional Investors (FIIs) have gone up by US \$22.8 billion during 2009Q2-2009Q4, as against a net withdrawal of US \$11.9 billion during the corresponding period of the previous financial year. Consequently, the Indian rupee appreciated by 11.24 percent against the US dollar as on January, 2010 compared to March, 2009. Inflation pressures have also been intensifying even as financial markets seem to have regained lost ground and growth seems to be approaching pre-crisis levels. Headline (WPI) inflation averaging at 10% or more, has fuelled debate as to whether the RBI should be tightening its monetary policy stance. In context of these international and domestic macro developments, the question of where India stands today with respect to the financial trilemma becomes even more significant and pertinent.

2.2 Foreign exchange reserve management and intervention

India has had an active foreign exchange management policy, with effective intervention in the foreign exchange market and very large growth in foreign exchange reserves. Foreign exchange reserves climbed from around USD \$150 billion in mid-2005 to over USD \$300 billion in mid-2010, a doubling in just five years and making India one of the largest reserve-holding countries in the world. The dramatic rise in reserves during this period indicates substantial and sustained USD purchases, and sales of the Indian currency, in the foreign exchange market by the authorities in order to limit rupee appreciation. This is shown in Figure 1. Since India had a current account deficit in the balance of payments during this period, so official purchases of foreign exchange were off-setting the substantial private capital inflows into India. These capital inflows are related in turn to partial relaxation of capital account restrictions, one part of the trilemma.

Another element of the trilemma tradeoff is the extent to which the accumulation of foreign exchange reserves has had a substantial impact on monetary policy. Figure 2, showing the rise of the monetary base and its two main components (net domestic credit and international reserves), suggests that it has had a substantial impact. The major asset of the Reserve Bank of India supporting the growth of central bank money (reserve money) is international reserve assets. These have accumulated so rapidly in recent years

that the central bank has been forced to sell off government securities (decline in net domestic assets) in order to maintain monetary control (IMF Country Report 10/73, Table 4; March 2010). The RBI attempted to limit the impact of international reserves on the money supply, but to what extent was it able to maintain monetary control in light of financial liberalization and large inflows of capital into India?

3. Data and Methodology

Our approach to analyzing India's response to the trilemma follows Aizenman, Chinn and Ito (2008, 2010). We first construct indices for each of the three policy objectives of the trilemma: monetary independence, exchange rate stability and capital account openness (or financial integration). We then estimate a linear model for the trilemma configuration that is revealed by the data, by regressing a constant on the three indices. Next, we examine the impact of changes in international reserve accumulation on the outcomes of India's monetary policy in the context of the trilemma.

We depart from Aizenman, Chinn and Ito in several respects. While they use cross-country data and time-averages of annual data, so that their major source of variation is across countries, we use data for a single country. Furthermore, the data is higher frequency, being quarterly, and subject therefore to substantial time variation. Indeed, we find that there is variation in the results across three equal sub-periods into which we divide our sample. We also use a different measure of capital account openness than the preceding authors. Finally, our exploration of the impacts of reserve changes and sterilization efforts also marks a departure from Aizenman, Chinn and Ito.

3.1 Data

The data extends from 1996Q2 to 2009Q3, covering 54 quarters.⁴ For the trilemma indices, we have quarterly data on GDP, foreign investment inflows and foreign investment outflows, all from the Reserve Bank of India (RBI) website (Database on the Indian Economy). The exchange rate is a weekly series obtained from the Global

⁴ These periods correspond to 1996-97: Q1 to 2009-10: Q2 according to the Indian fiscal year accounting.

Financial Database (www.globalfinancialdata.com). We use the nominal Rupee-to-US dollar exchange rate. We use the weekly series to construct a quarterly index of exchange rate stability, as described in the next subsection. From the same source, we use weekly 90-day rates on government securities for the US and India. The correlations between these are used to create a quarterly index of monetary independence, again as described in the next subsection.

To examine the impact of international reserves, we again use data from the RBI. In our analysis we use changes in reserves, taken directly from a quarterly series in the RBI database.

The policy outcomes we examine are inflation and inflation volatility. For both measures, we begin with the weekly Wholesale Price Index (WPI), from the RBI database. We then calculate weekly annual inflation figures. Averaging these for each quarter produces a quarterly inflation series. The standard deviation for each quarter yields our inflation volatility series.

3.2 Methodology and Estimation

The key constructs for examining the policy configuration with respect to the trilemma are indices of monetary independence (MI), exchange rate stability (ES) and capital account openness (KO). These indices are constructed as follows.

MI Index

We follow Aizenman, Chinn and Ito in measuring MI as the reciprocal of the correlation of interest rates in the home country (here India) and the base country (here the United States). Quarterly correlations are calculated using weekly interest rate data. The interest rates are on 90-day government securities. The precise formula is:

$$MI = 1 - \frac{\text{corr}(i_i, i_j) - (-1)}{1 - (-1)}$$

The scaling ensures that the index lies between 0 and 1, with the highest value indicating the greatest degree of monetary independence. The plot of the MI index is shown in Figure 3.

ES Index

The ES index is calculated using quarterly standard deviations of the change in the log of the Rupee-US dollar exchange rate, and the index is then constructed according to the formula:

$$ERS = \frac{0.01}{0.01 + stdev(\Delta(\log(exch_rate)))}$$

Again, the scaling ensures that the index lies between 0 and 1, with the highest value indicating the greatest degree of exchange rate stability. The evolution of this index for the sample period is shown in Figure 4.

KO Index

For construction of the KO index, we depart from Aizenman, Chinn and Ito, who use the Chinn-Ito index. For India, this index is essentially constant over the entire period, and may not capture well the changes that have been occurring in India's management of the capital account. Even other de jure measures such as that of Nayyar (2006) are not suitable, since they are only annual, and are not available for the latest part of our sample period. Therefore, we chose to go with a simple de facto measure of capital account openness, using the ratio of the sum of inward and outward foreign investment flows to GDP.

This measure also has drawbacks, since it is a function not only of the policy stance, but also of market sentiment. However, we believe it is a reasonable way of capturing changes in India's effective openness to international capital flows, and how those have changed over time. This index is easy to construct as a quarterly series. One other point should be noted: the KO index is not theoretically constrained to lie between 0 and 1 – the upper bound cannot be imposed. However, for the sample period, it is easily met. As

we shall see in the next section, scaling issues are partly dealt with in the regression analysis for the trilemma policy configuration. The KO index for the sample period is shown in Figure 5.

4. Empirical Results: Policy Stance

In this section, we first examine the policy stance with respect to the trilemma, using the indices constructed in the previous section, and then relate the trilemma stance to the accumulation of foreign reserves, using the techniques introduced by Aizenman, Chinn and Ito.

4.1 Measuring the trilemma policy configuration

The central idea for measuring the trilemma policy configuration is that an increase in one of the indices must be balanced by a decrease in another, since there is an overall constraint on the three indices – all three cannot reach their maximum values simultaneously. At the same time, there is no reason for policymakers to not try for a combination of the three indices that is as high as possible, if all three objectives of monetary independence, exchange rate stability and capital openness (or financial integration) are desirable for some reason. However, the latter is an empirical question, and can be examined using the method of Aizenman, Chinn and Ito.

The approach used is to regress a constant (we use the value 2) on the three indices. Of course, the constant term is omitted on the right hand side of the estimation equation. Since, unlike ACI, we are using a time series for a single country to estimate the trilemma configuration, and the period under consideration was one of dramatic changes in external conditions as well as shifts in policy stances, we divide the entire sample period into three equal sub-periods of 18 quarters each. This allows one to see how differences in policy across different segments of this 13.5 year span have played out. The results are reported in Table 1A.⁵ The coefficients are not always estimated with

⁵ In addition to dividing the entire sample period into three equal sub-periods, we also used an alternative truncation scheme based on the different exchange rate regimes characterizing the Indian economy over the sample period from 1996 to 2009. We based our sub-periods on the regime classifications in Shah, Patnaik, Sethy and Balasubramaniam (2011) and our results were very similar to those reported in Table 1A thus attesting to the robustness of our findings.

great precision (particularly those for monetary independence), but the overall fit is extremely good, reflected in the very high R-squared numbers.⁶ This is consistent with the kind of results obtained by ACI, but it should be noted again that these results are obtained for a single country and a sample that incorporates short-run variability associated with quarterly data.

Table 1A also reports the means of the three indices for each of the three sub-periods. According to these measures, monetary independence is in an intermediate range in all three sub-periods. It falls in the second period, and then partially recovers. Exchange rate stability is quite high in the first two periods, then falls somewhat. Capital account openness increases a little from the first to the second period, then dramatically in the third period.

Following ACI, the key measure of the trilemma policy configuration is obtained by examining the contribution of each policy dimension to the total – here set to be 2. This can be calculated quarter-by-quarter, but we calculate and report the average contributions, by multiplying the coefficients by the means for each sub-period. The results are quite striking. Given the high goodness of fit, it is unsurprising that the contributions sum up to close to 2 in each sub-period. The contributions themselves are of great interest in terms of the trilemma policy configuration and how it changes over time.⁷ The story they tell is as follows:

- Exchange rate stability receives high policy weight throughout the entire 13.5 year period.
- In the second sub-period, as capital openness or financial integration increases, monetary independence is completely lost, whereas there is an attempt to retain, or even strengthen, exchange rate stability.
- In the third sub-period, as capital openness continues to increase, some exchange rate stability is sacrificed to recover some monetary independence, though the final

⁶ Since there is no constant term on the right hand side, the R-squared is non-centered. The goodness of fit is to be interpreted just as that, and does not imply any desirable statistical properties.

⁷ Here we can explain why there is some freedom from scaling issues with respect to the capital openness index not being constrained to a maximum of one, in the final analysis. Suppose that, for example, the KO index were multiplied by 2, so that average capital openness was doubled in the new measure. First, relative values over time would still have the same proportions. Second, the regression coefficient would be halved, so that the contribution would be unaffected by the rescaling.

configuration involves less monetary independence and greater financial integration, as compared to the first sub-period.⁸

The story that emerges from Table 1 is consistent with the broad outlines of what happened in India over this period. The variation in policy stances with respect to the trilemma may have not corresponded exactly to the three sub-periods we have chosen—but the policy stances themselves were not sharply discrete events. However, that makes the results even more striking, in our view. Our results suggest that the ACI approach can be used effectively for single country time series, and not just for panels or cross-sections with time variation smoothed out.

4.2 Trilemma policy stance and reserve accumulation

An important part of the ACI analysis is their connection of reserve accumulation to the trilemma policy configuration. The broad idea is that reserve accumulation gives policymakers more flexibility in dealing with the short-run tradeoffs between monetary independence and exchange rate stability, where financial integration is a given. This is examined in the context of regressions that examine the role of reserves in achieving certain policy goals, and we present such results shortly. However, we first illustrate this fourth policy dimension with the diamond graph developed by ACI. Again, the difference here is that the graph represents a single country's experience, rather than any kind of average over a group of countries. The diamond graph, Figure 6, shows that India has increased its ratio of reserves to GDP along with its increase financial integration, as it has tried to balance monetary independence and exchange rate stability. The story in Figure 6 is that of Table 1, with the addition of the changing role of foreign reserves. Finally, Figure 7 shows the increase in international reserves over the time period under consideration.

⁸ It is worth noting here that these results are at best indicative and the econometric properties of the same need further investigation, which is left as a future task.

5. Trilemma and Inflation: Impacts on macroeconomic outcomes

We have measured the policy trilemma in India over time and find that rising financial integration has come at the cost of monetary independence and exchange rate stability. The overriding macroeconomic question, of course, is how the change in the trilemma configuration has influenced inflation and inflation volatility in India.⁹ Has the trilemma been binding, in terms of a clear tradeoff between internal and external policy objectives, in the Indian context? Has the loss of monetary independence associated with greater capital market liberalization or an exchange rate stability objective been associated with deterioration in inflation performance? Has the heavy intervention in foreign exchange markets, and the associated rise in international reserve holdings, given the RBI more leverage and thereby mitigated the effects of the loss of monetary independence on inflation?

To address this issue empirically, we explore the linkages between inflation (and inflation volatility) and our time-varying measures of the policy goals associated with the trilemma configuration. Specifically, we regress inflation (inflation volatility) against a constant, the lagged dependent variable and two of three indices of the trilemma configuration—monetary independence index (MI) and the exchange rate stability index (ES). The third index, capital account openness—KO—is a linear combination of MI and ES since the three indices together sum to two effective instruments, so we also report regressions where the set of explanatory variables is MI and KO (leaving out ES).¹⁰ Finally, we also consider the role of increasing international foreign exchange reserves as a percentage of GDP (Res/GDP)¹¹.

The expectation (maintained hypothesis) is that greater monetary independence is likely to lower inflation and inflation volatility. Greater exchange rate stability and

⁹ In a cross section of countries, ACI consider the relationship between the trilemma configuration (assumed constant over time) and output volatility, inflation and inflation volatility. Since output data is not available for sufficiently high frequencies to allow construction of a quarterly output volatility series, we focus on inflation and inflation volatility.

¹⁰ We also consider the set of explanatory variables as ES and KO (dropping MI), but the results were not significant due to high multicollinearity between ES and KO (the correlation is -0.6)—exchange rate stability comes at the cost of capital account liberalization. These results are not reported for brevity but are available from the authors upon request.

¹¹ We also considered the level of international reserves as a percentage of GDP as an explanatory variable. The results were qualitatively very similar and are not reported for brevity but are available from the authors upon request.

capital market openness, in tandem with the loss of monetary independence, may come at the cost of higher inflation and greater inflation volatility. Intervention in the foreign exchange market, measured by changes in international reserves, may soften the trilemma trade-off, particularly between exchange rate stability and monetary policy independence, and thereby contribute to lower inflation and less inflation volatility.

The results are shown in Table 2. Columns (1)-(3) present the results where the dependent variable is the level of inflation. (Newey West standard errors are shown in parentheses below the individual coefficient estimates). The key empirical result in columns (1)-(3) is the greater monetary independence leads to lower inflation. This result is robust and highly statistically significant. Once controlling for monetary independence, the international variables (capital market liberalization, exchange rate stability and change in international reserves) have the expected signs (positive) but are not statistically significant. About fifty percent of inflation variation is accounted for by the trilemma policy configuration and, in addition to MI (and the constant term), lagged inflation is highly significant. The change in international reserves is not statistically significant, suggesting that foreign exchange market intervention has not mitigated the trilemma tradeoff nor reduced inflation once controlling for the other policy constraints.¹²

Columns (4)-(6) present the results where the dependent variable is inflation volatility. Interestingly, the key determinants of inflation volatility contrast sharply with the determinants of the level of inflation. In particular, the international policy indices are statistically significant in these regressions while the monetary independence index is not. Greater exchange rate stability is associated with lower inflation volatility and greater capital account openness is associated with higher inflation volatility. (Changes in international reserves are again not statistically significant). The latter result is predicted by theory-- greater capital account openness may lead to a loss of monetary control and hence greater inflation variability. However, the simple Mundell-Flemming framework would also suggest a positive correlation between greater exchange rate stability and inflation volatility since the implication is that monetary independence is reduced. In our

¹² We also considered interaction terms of the changes in reserves (and reserve levels) with monetary independence, in order to measure nuances in how the trilemma constraints may have changed over time with an active intervention policy. None of these results were statistically significant, however, and are omitted for brevity.

regressions, however, we are holding constant monetary independence (MI). The result that exchange rate stability leads to greater inflation stability may therefore be working through a secondary channel -- more stable import and commodity prices.

Overall, it is striking that the results distinguish so sharply between the dominant policy determinant of the level of inflation (MI) and the dominant policy determinants of the volatility of inflation (ES and KO).

6. Conclusion

The “impossible trinity” or trilemma refers to the argument that an open economy cannot simultaneously maintain a fixed exchange rate, an independent monetary policy and an open capital account. It may choose any of these three policy goals at any given time, but not all of them together. This constitutes a primary challenge faced by most emerging market economies that have embraced capital account liberalization. India-one of the fastest growing emerging market economies today is no exception, especially since the Indian economy has only a partially open capital account and a ‘managed’ floating exchange rate regime. In the context of the current global financial crisis of 2008-09 emerging market economies including India, have been experiencing capital inflow surges and face the dual policy challenge of maintaining a stable exchange rate and retaining monetary policy autonomy.

Against this background, the question as to where India stands today with respect to the financial trilemma, is a highly significant and pertinent one. In this paper we empirically explore this question and associated issues, such as accumulation of international reserves and sterilization by the RBI. Specifically, using quarterly data from 1996 to 2009, we construct trilemma indices for each of the three policy objectives: monetary independence, exchange rate stability and capital account openness, for India following the methodology developed for a cross-section of economies by Aizenman, Chinn and Ito (2008). Our empirical analysis confirms that an increase in financial integration, especially after the mid 2000s, has changed the policy trade-offs facing emerging market economies like India. The increase in capital account openness has come at the cost of reduction in monetary policy independence or of limitations on exchange rate stability. We also find that the loss of monetary independence associated

with both greater exchange rate stability and more financial openness poses a challenge to policymakers—the loss of monetary autonomy is correlated with higher inflation in India. Greater financial integration, once controlling for monetary independence and exchange rate stability, is associated with greater inflation volatility in India. On the other hand, we find that a secondary benefit of greater exchange rate stability is lower inflation volatility.

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Box I: A Few Major Capital Account Restrictions in India

Portfolio Investment:

By the Foreign Exchange Management Act, FIIs, Non-Resident Indians (NRIs), and Persons of Indian Origin (PIOs) are allowed to invest in primary and secondary capital markets in India through the portfolio investment scheme (PIS). Under this scheme, FIIs and NRIs are permitted to acquire shares or debentures of Indian companies through Indian stock exchanges. The ceiling for overall investment for FIIs is 24% of the paid up capital of the Indian company and 10% for NRIs and PIOs. FII inflows into Indian equities have gone up steadily ever since the markets were opened in 1993. With the exception of 1999 and 2009, net flows have been positive. FIIs own 16% of equities (worth US\$147bn) of India's biggest 500 companies and account for 10-15% of equity volumes.

In the wake of the global financial crisis of 2008-09 and heightened capital outflows, curbs on foreign issuance of equity derivatives (P-notes) imposed in October 2007 have been removed. Annual limits on FII holdings of corporate bonds and government bonds have also been raised from US\$3 billion to US\$15 billion and from US\$3 billion to US\$5 billion, respectively. Restrictions on FII allocations across equity and debt instruments have also been removed.

Foreign Direct Investment:

FDI in India is limited at 74% in private banks and telecoms, 51% in single-brand retailing, 26% in insurance, defense and oil refining and 20% in radio and it is prohibited in retail trading, atomic energy, real estate and agricultural businesses.

External Commercial Borrowing (ECB):

ECBs are being permitted by the Government of India for providing an additional source of funds to Indian corporates and public sector units. ECBs face a minimum average maturity of 3 years (up to US\$20 million) and 5 years (US\$ 20-500 million). The Reserve Bank of India (RBI) has eased the norms for raising funds through ECBs. With a view to liberalizing the ECB guidelines, RBI has decided that henceforth, Indian corporates can avail ECB of an additional amount of US\$250 million with average maturity of more than 10 years, over and above the existing limit of USD 500 million, during a financial year.

Source: IMF Country Report (June, 2009); RBI Website.

Table 1A: Trilemma Indices for India, 1996 – 2009

		1996:Q2 to 2000:Q3	2000:Q4 to 2005:Q1	2005:Q2 to 2009:Q3
Means	MI	0.5348	0.4197	0.4828
	ES	0.7601	0.8107	0.5901
	KO	0.0385	0.0788	0.3140
Coefficients	MI	0.640 (0.442)	-0.063 (0.130)	0.515** (0.229)
	ES	1.798** (0.314)	2.041*** (0.100)	2.294*** (0.525)
	KO	6.169* (3.104)	4.021*** (1.042)	1.148 (1.131)
Observations		21	18	15
R-squared		0.9738	0.9921	0.9710

Notes: Newey-West Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 1B: Trilemma Contributions

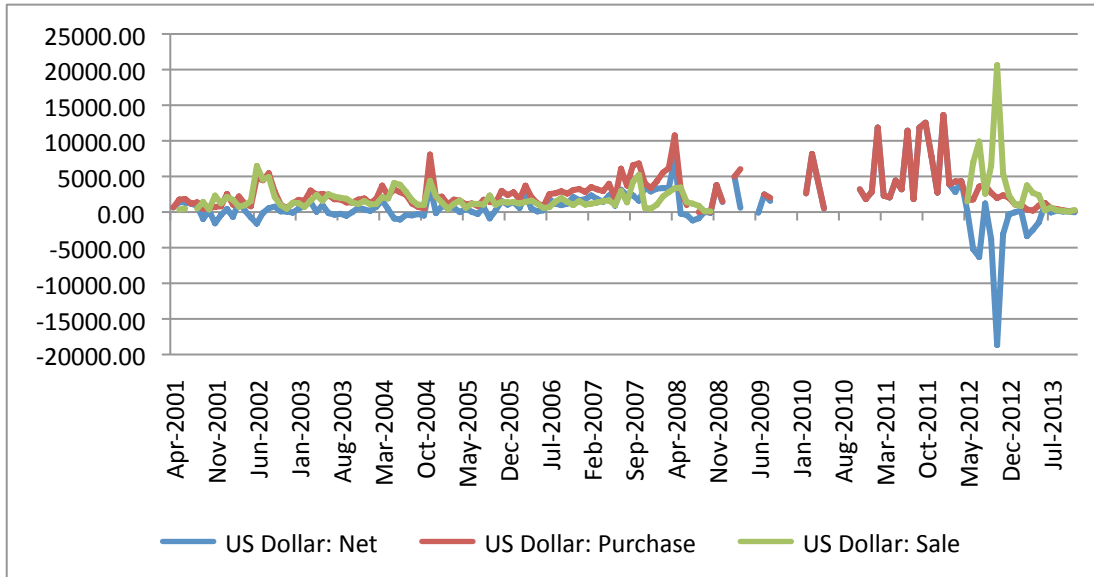
		1996:Q2 to 2000:Q3	2000:Q4 to 2005:Q1	2005:Q2 to 2009:Q3
Contributions	MI	0.342	-0.026	0.249
	ES	1.367	1.654	1.354
	KO	0.238	0.317	0.361
Sum of contributions		1.947	1.945	1.963

Table 2: Inflation, Trilemma Contributions and Change in Reserves

Variables	Inflation			Inflation Volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged Dependent Variable	0.712*** (0.104)	0.694*** (0.113)	0.706*** (0.104)	0.146 (0.140)	0.211 (0.154)	0.131 (0.144)
MI	-0.017** (0.007)	-0.018*** (0.007)	-0.017** (0.008)	-0.001 (0.002)	-0.002 (0.002)	-0.001 (0.002)
ES	0.005 (0.022)		0.006 (0.022)	-0.009* (0.005)		-0.008* (0.005)
KO		0.011 (0.023)			0.007* (0.004)	
Δ Res/GDP			0.024 (0.046)			0.014 (0.019)
Constant	0.018 (0.018)	0.022*** (0.008)	0.013 (0.018)	0.012** (0.005)	0.005*** (0.001)	0.012** (0.004)
Observations	53	53	53	53	53	53
R-Squared	0.4984	0.5019	0.4996	0.1792	0.1349	0.1897

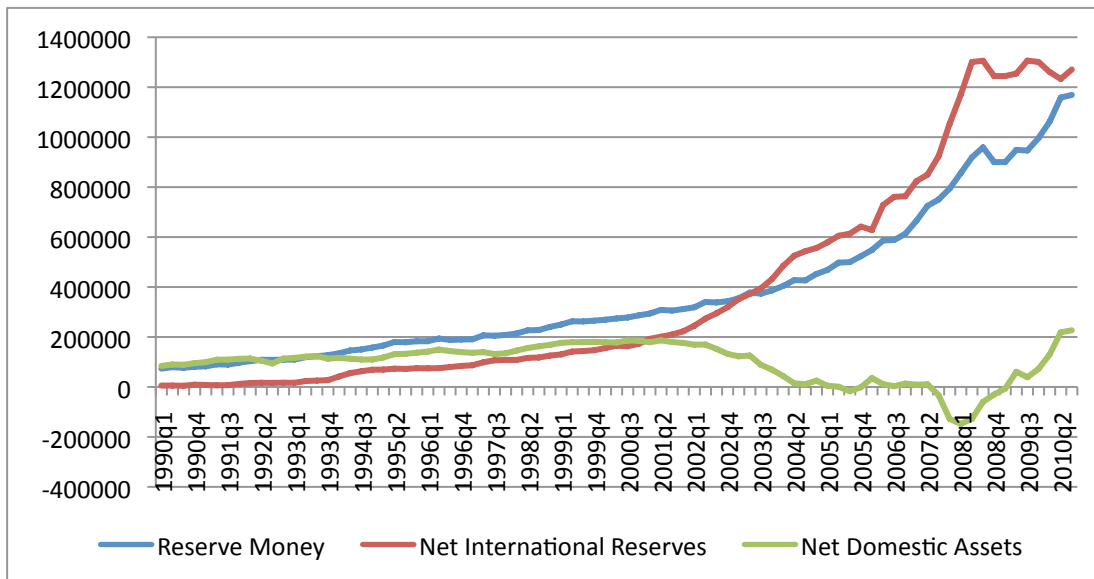
Notes: Newey-West Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Mean of Inflation is 0.050 and mean of inflation volatility is 0.006

Figure 1: Foreign Exchange Market Intervention



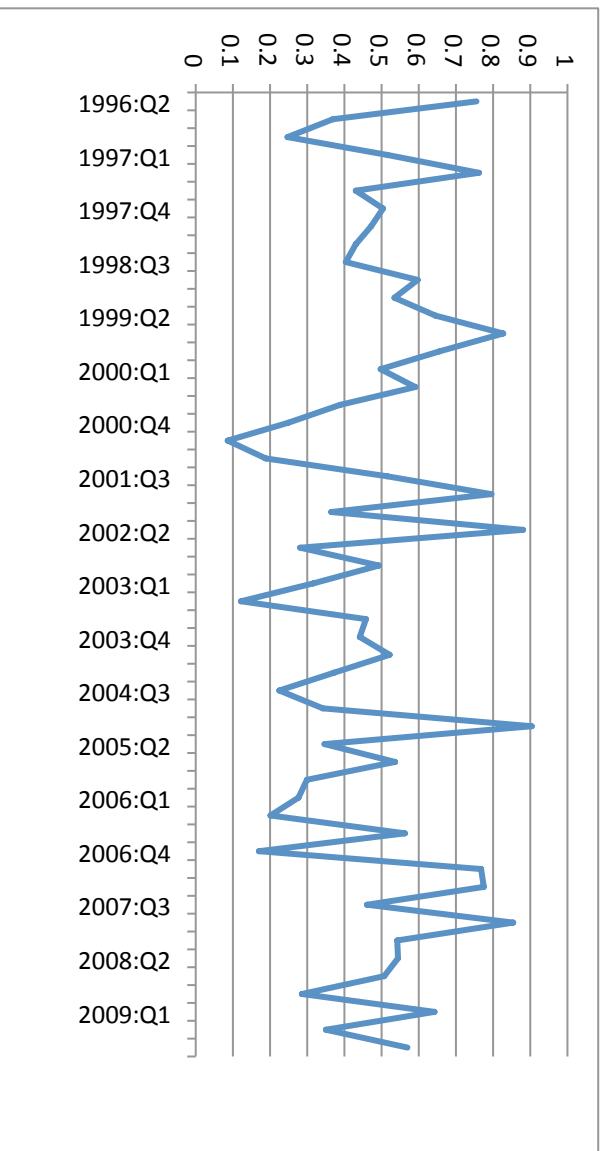
Source: CEIC Asia Database

Figure 2: Evolution of Monetary Base



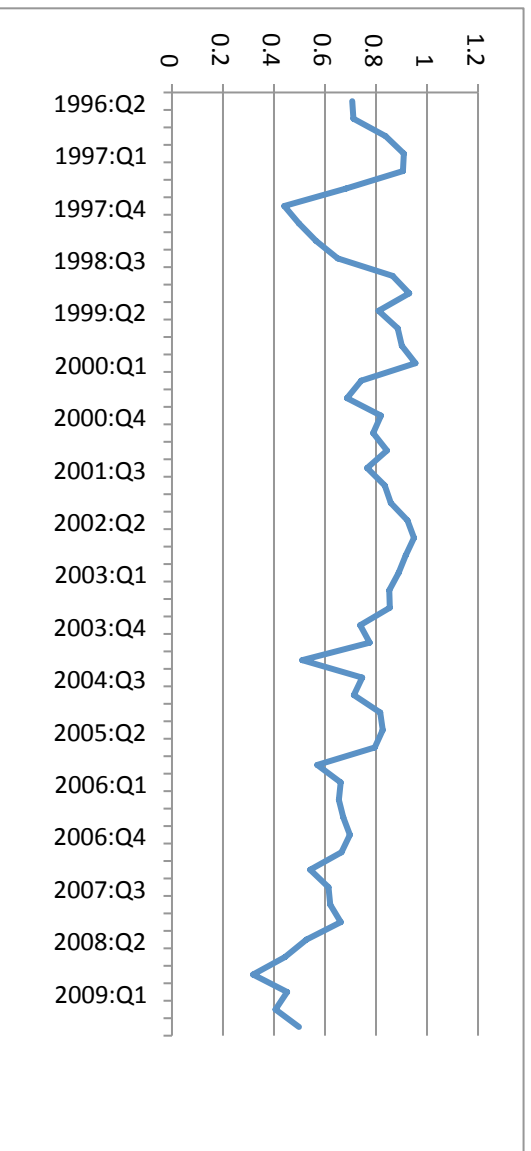
Source: Reserve Bank of India.

Figure 3: Monetary Independence Index



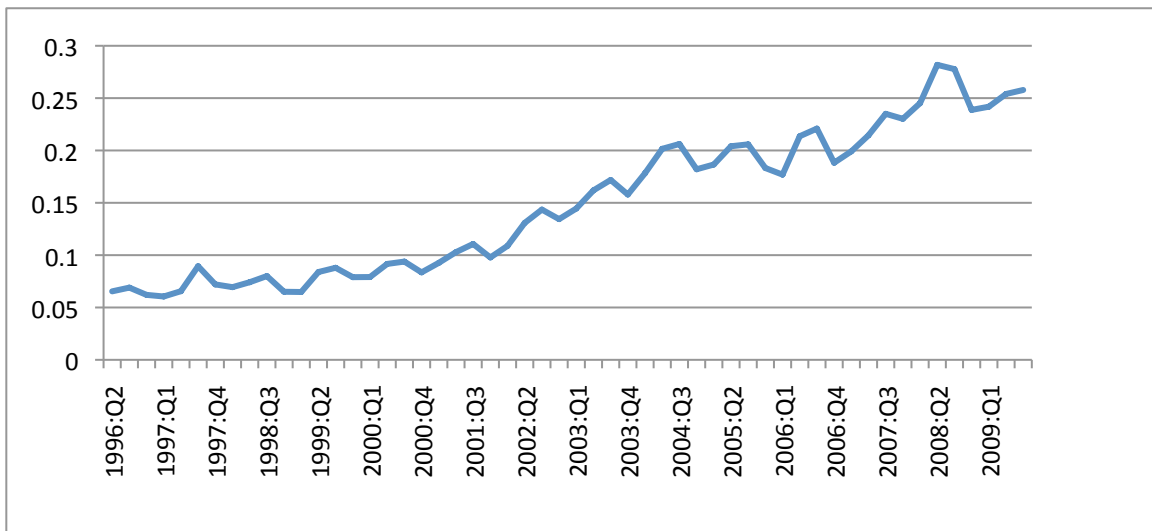
Source: Reserve Bank of India Database and authors' calculations

Figure 4: Exchange Rate Stability Index



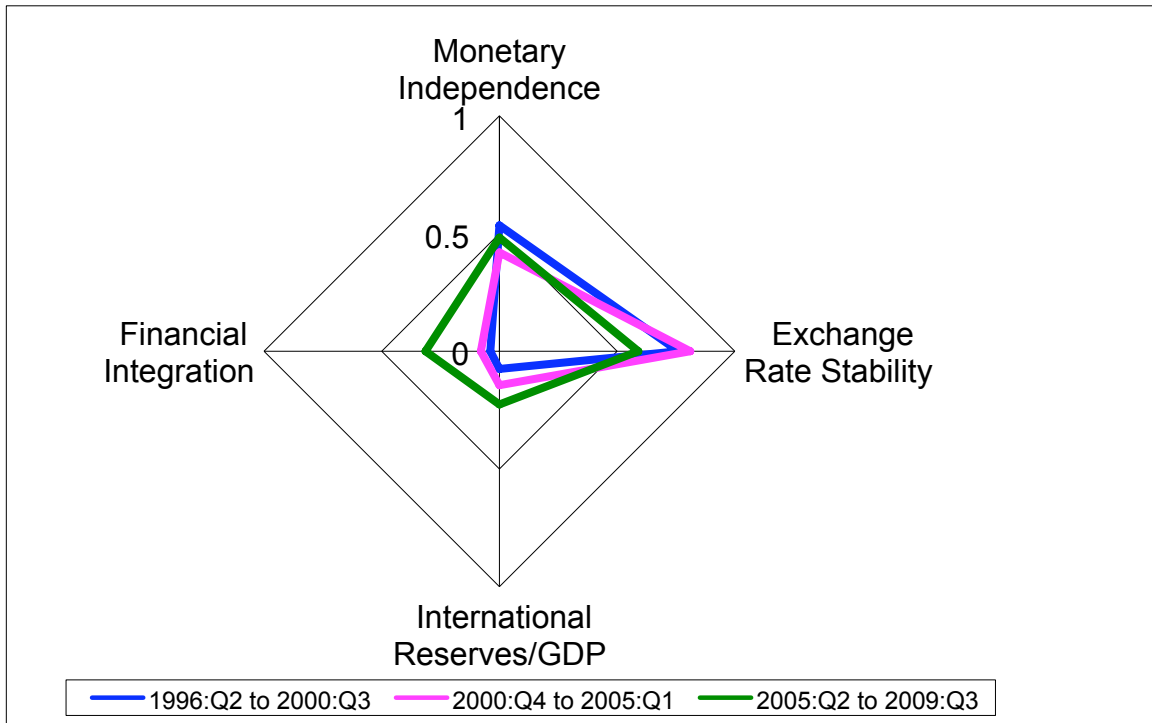
Source: Reserve Bank of India Database and authors' calculations

Figure 5: Capital Account Openness Index



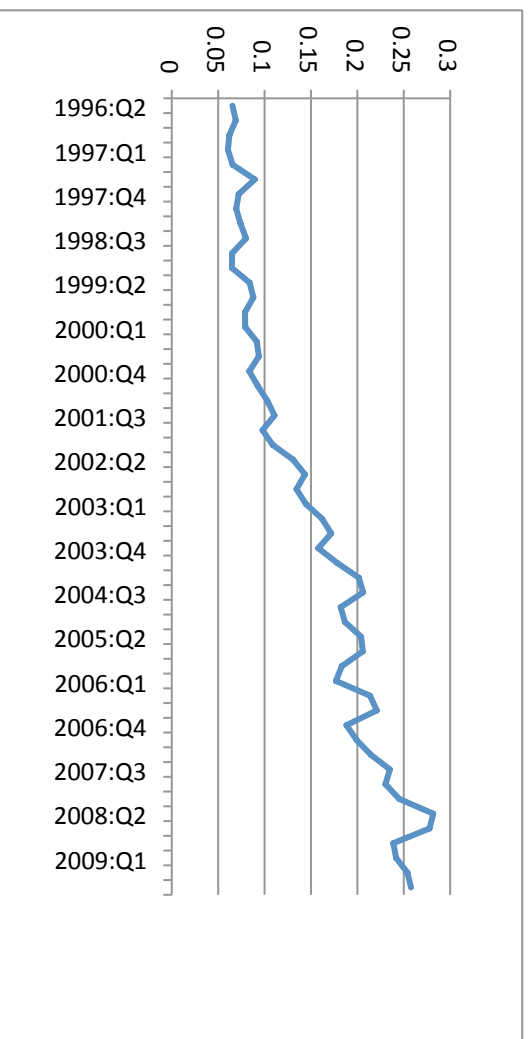
Source: Reserve Bank of India Database and authors' calculations

Figure 6: The Trilemma and Reserve Accumulation



Source: Authors' calculations; See section 4 in text for further detail.

Figure 7: Reserves-GDP Ratio



Source: Reserve Bank of India Database and authors' calculations