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Study of the Trilemma Policies and their Impacts on Inflation, Growth and Volatility for Brazil

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Abstract - This paper finds support for the trilemma for Brazil, suggesting that the three trilemma policies are binding and constrained. Adopting an independently floating exchange rate regime, Brazil has pursued the policy combination of monetary independence and financial integration in recent years. More exchange rate stability or more financial integration reduces the inflation rate, and more financial integration reduces inflation volatility. More monetary inde-pendence reduces the growth rate. More financial integration reduces output volatility. Hence, more exchange rate stability and more financial integration produce positive benefits whereas more monetary independence yields a negative impact on the growth rate.

Keywords : *trilemma; exchange rate stability; monetary independence; financial integration; inflation; growth; volatility.*

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Study of the Trilemma Policies and their Impacts on Inflation, Growth and Volatility for Brazil

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Abstract - This paper finds support for the trilemma for Brazil, suggesting that the three trilemma policies are binding and constrained. Adopting an independently floating exchange rate regime, Brazil has pursued the policy combination of monetary independence and financial integration in recent years. More exchange rate stability or more financial integration reduces the inflation rate, and more financial integration reduces inflation volatility. More monetary independence reduces the growth rate. More financial integration reduces output volatility. Hence, more exchange rate stability and more financial integration produce positive benefits whereas more monetary independence yields a negative impact on the growth rate.

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I. Introduction

Many countries have considered or applied exchange rate stability, monetary autonomy and free capital mobility in order to protect the value of their currency, engage in monetary tightening or easing to dampen an over-heated economy or to improve a sluggish economy, and attract foreign investments to promote economic growth. The trilemma of international economics and finance suggests that only two of these three policies can be achieved simultaneously (Ghosh, Gulde and Ostry, 1997; Edison, Klein, Ricci and Sløk, 2002; Prasad, Rogoff, Wei and Kose, 2003; Levy-Yeyati and Sturzenegger, 2003; Eichengreen and Leblang, 2003; Frankel, Schmukler and Serven, 2004; Shambaugh, 2004; Obstfeld, Shambaugh and Taylor, 2005, 2009, 2010; Henry, 2006; Kose, Prasad, Rogoff and Wei, 2006; Prasad and Rajan, 2008; Aizenman, Chinn and Ito, 2008b, 2011a; Aizenman and Ito, 2012; and others). The U.K. pursues monetary independence and free capital flows and adopts an independently floating exchange rate regime. Hong Kong has a currency board arrangement, permits free capital mobility, and allows the internal interest rate to follow the world interest rate. China pursues a crawling peg exchange rate system and independent monetary policy and imposes some controls on international capital flows.

This paper tests the trilemma hypothesis and examines potential effects of these three trilemma policies on inflation, economic growth, inflation volatility and output volatility for Brazil. The study of this subject is important. Brazil is the largest country in South America and is expected to consider whether the trilemma policies would result in low inflation, high economic growth and less volatility.

Several recent studies have examined the related subjects. Based on a sample of 155 countries including Brazil during 1973–2000, Shambaugh (2004) shows that the trilemma is a reasonable guide for policy study, that countries adopting fixed exchange rates would follow the interest rate in the base country more closely than countries pursing floating exchange rates, and that monetary autonomy would decrease due to the pursuit of a fixed exchange rate regime.

Based on a sample of 18 industrial countries and 28 developing countries, Frankel, Schmukler and Serven (2004) find that although several large advanced countries can select their own rates over the long run, most other countries with flexible exchange rates react fully to international interest rates in the long run. In the short run, countries with flexible exchange rates respond to international interest rates with slower speed, suggesting that they possess some degree of monetary autonomy.

Using a multi-country sample including Brazil in the post-Bretton Woods data, Obstfeld, Shambaugh and Taylor (2005) reveal that the trilemma can be considered as a guide for macroeconomic policy framework. Countries without pegging exchange rates and capital controls would retain sufficient amount of monetary autonomy whereas countries pegging exchange rates and not having capital controls would lose significant monetary autonomy.

Using a large sample of 179 countries including Brazil, Aizenman, Chinn and Ito (2008b) indicate that greater exchange rate stability leads to more inflation or output volatility and a lower inflation rate; greater monetary independence results in higher inflation; and more financial integration lowers the inflation rate. Aizenman, Chinn and Ito (2011a) state that those emerging market countries with more converged policies and relatively large foreign reserves would experience less output volatility whereas those countries with relatively low foreign reserves would suffer more output volatility. Aizenman and Ito (2012) find that the three macroeconomic policies in emerging economies are converging toward an intermediate ground as they

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pursue managed exchange rates backed up by large international reserves, some degree of monetary autonomy, and restrained financial integration. These emerging economies experience less output fluctuations whereas emerging economies with relatively low international reserves as a percent of GDP would suffer relatively high output fluctuations if they select policy divergence.

a) The Model

Extending Aizenman, Chinn and Ito (2008b, 2011a), Aizenman and Ito (2012) and other previous studies, we can express the trilemma equation as:

$$K = f(ES_t, MI_t, FI_t) \quad (1)$$

where

K = a constant,
ES = exchange rate stability,
MI = monetary independence, and
FI = financial integration or free capital mobility.

If the goodness of fit in equation (1) is relatively high, it suggests that these tree policies are binding and constrained. An increase in the value of one of the trilemma policies will reduce the value of one or both of the other policies. Note that equation (1) is written in the general form because different functional forms such as the linear, log-log, log-linear and linear-log relationships will be considered and tested.

We test potential impacts of exchange rate stability, monetary independence and financial integration on the inflation rate, the growth rate of real GDP, inflation volatility and output volatility:

$$Y_t = h(ES_t, MI_t, FI_t) \quad (2)$$

Where Y represents one of the following dependent variables

π = the inflation rate,
GY = the growth rate of real GDP,
VI = inflation volatility, and
VY = output volatility.

More exchange rate stability is expected to stabilize the currency value and price level, reduce uncertainty, and help economic growth. On the other hand, more exchange rate stability may increase or reduce inflation or inflation volatility, depending upon whether the pegged anchor currency would appreciate, depreciate or be volatile. Depending upon monetary easing or tightening, the timing and the magnitude, more monetary independence may increase or reduce the inflation rate, the growth rate of real GDP, inflation volatility and output volatility. More capital inflows are expected to increase aggregate demand and the supply of funds, reduce lending rates, help economic growth, and may increase or reduce the inflation rate or inflation volatility. However, large amounts of abrupt capital outflows would reduce aggregate demand, destabilize an economy, cause currency depreciation, hurt economic growth, and may increase or reduce the inflation rate or inflation volatility (Chinn and Ito, 2008b; Aizenman, Chinn and Ito, 2011a; Aizenman and Ito, 2012).

b) Empirical Results

ES, MI and FI are obtained from Aizenman, Chinn and Ito (2008b, 2010, 2011b) and Chinn and Ito (2006, 2008) and have values ranging from zero to one. A higher value of ES, MI or FI indicates more exchange rate stability, monetary independence or financial integration. Exchange rate stability is represented by:

$$ES = 0.01/[0.01 + s(\Delta \log(\varepsilon))] \quad (3)$$

Where s and ε stand for the standard deviation and the nominal exchange rate. Monetary independence is measured by:

$$MI = 0.5 - c(i, i^*)/2 \quad (4)$$

Where c, i and i* stand for the correlation coefficient, the money market rate in Brazil and the money market rate in the U.S. The index for financial integration is derived from the information regarding the requirement of the surrender of export proceeds, the presence of multiple exchange rates, and restrictions on current and capital account transactions, which are published by the International Monetary Fund. π is represented by the percent change in the consumer price index. VI is represented by the standard deviation of the inflation rate over a five-year period. GY is measured by the percent change in real GDP. VY is measured by the standard deviation of GY over a five-year period. The consumer price index and real GDP are obtained from the International Financial Statistics published by the International Monetary Fund and updated based on the data from the Central Bank of Brazil. The sample period ranges from 1970 to 2010.

In Table 1, the trilemma equation is estimated for the linear, log-log, log-linear and linear-log relationships. To avoid any negative values when a logarithmic scale is used, a value of 2 is added to ES, MI and FI, and a value of 2 is assigned to the constant K in equation (1). As shown, relatively high values of R-squared suggest that the goodness of fit is relatively high. Hence, there is support for the trilemma hypothesis, and the three trilemma policies have a tradeoff and are constrained. The coefficients are significant at the 1% level regardless of the functional forms used. The log-linear regression performs better than the linear, log-log and linear-log regressions due to smaller values of the mean absolute percent error or

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Akaike information criterion. The log-log, linear and linear-log regressions rank second, third and fourth, respectively. According to the magnitude of the estimated coefficients in the log-linear regression, Brazil places similar weights on exchange rate stability, monetary independence and financial integration.

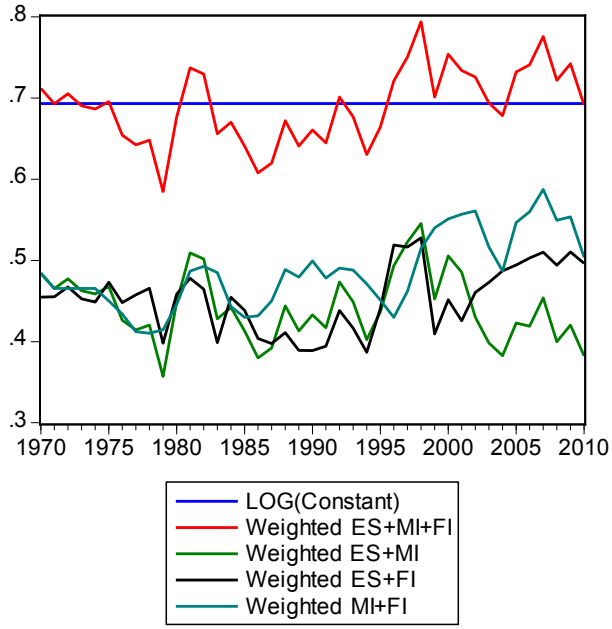
Based on the estimated coefficients in the log-linear regression, Graph 1 presents the logarithmic value of the constant, the predicted value of the regression, and three different policy combinations, namely, exchange rate stability and monetary independence, exchange rate stability and financial integration, and monetary independence and financial integration. The policy mix of exchange rate stability and monetary independence had been dominant during 1997-1998. Due to the 1997 Asian crisis and 1998 Russian crisis, the Brazilian authority switched from an adjustable band exchange rate regime to an independently floating exchange rate regime on February 1, 1999. Since 1999, the policy combination of monetary independence and financial integration has been prevalent. At present, the policy mix of exchange rate stability and financial integration ranks second whereas the policy combination of exchange rate stability and monetary independence ranks third.

Table 1 : Estimated Regressions for the Trilemma Test

Variables	Linear	Log-log	Log-linear	Linear-log
Exchange rate stability	0.438[a] (4.395)	0.629[a] (4.289)	0.152[a] (4.395)	1.816[a] (4.289)
Monetary independence	0.457[a] (4.318)	0.885[a] (6.000)	0.159[a] (4.318)	2.554[a] (6.000)
Financial integration	0.579[a] (4.392)	0.657[a] (4.615)	0.201[a] (4.392)	1.895[a] (4.615)
R^2	0.9983	0.9977	0.9983	0.9977
AIC	-1.067	-0.860	-3.187	1.259
MAPE	5.334	11.324	3.688	16.803

Notes : Figures in the parenthesis are t-statistics. Superscript letter a indicates that a coefficient is significant at the 1% level. There is no intercept in the estimated regression. In the log-linear form, the dependent variable is transformed into the logarithmic scale. In the linear-log form, the independent variables are transformed into the logarithmic scale. Sample period: 1970-2010.

Graph 1 : Analysis of Different Policy Combinations



Note: ES, MI and FI stand for exchange rate stability, monetary independence and financial integration, respectively.

As Table 2 shows, the regressions for the inflation rate and inflation volatility have higher explanatory power than the regressions for the growth rate and output volatility. The inflation rate is negatively affected by exchange rate stability and financial integration. More financial integration reduces inflation volatility. More monetary independence reduces the growth rate. Output volatility is negatively associated with financial integration.

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Table 2 : Estimated Regressions for the Inflation Rate, the Growth Rate, Inflation Volatility and Output Volatility

	Inflation Rate	Inflation Volatility	Growth Rate	Output Volatility
Constant	2265.474[a] (3.167)	983.850[c] (2.082)	9.051[a] (3.844)	4.515[a] (3.964)
Exchange rate stability	-1716.093[a] (-2.856)	558.734 (1.529)	0.057 (0.021)	-0.022 (-0.019)
Monetary independence	-675.521 (-0.867)	-561.058 (-1.503)	-8.884[a] (-2.936)	-1.033 (-0.749)
Financial integration	-2980.051[a] (-3.618)	-1526.433[b] (-2.779)	-1.846 (-0.514)	-3.916[a] (-3.244)
R^2	0.490	0.817	0.203	0.280

Notes: Figures in the parenthesis are t- statistics. The superscript a, b or c indicates that the coefficient is significant at the 1%, 5% or 10% level. Sample period: 1970-2010.

II. Summary and Conclusions

This paper has tested the trilemma hypothesis that only two of the three trilemma policies can be achieved simultaneously and studied their potential impacts on inflation, growth and volatility for Brazil. It has found support for the trilemma for Brazil, implying that the relationship among exchange rate stability, monetary independence and financial integration is constrained and binding. The policy combination of monetary independence and financial integration has been prevalent since 1999. More exchange rate stability reduces the inflation rate. More monetary independence reduces the growth rate whereas more financial integration reduces the inflation rate, inflation volatility and output volatility. In comparison, the findings that more exchange rate stability or more financial integration reduces the inflation rate are similar to that reported by Aizenman, Chinn and Ito (2008b). Other results in the paper are different from those found by Aizenman, Chinn and Ito (2008b). Therefore, a study of the trilemma and impacts of the trilemma policies for an individual country may generate different outcomes from those studies based on a pooled data with a large number of countries.

There are several policy implications. The adoption of an independently floating exchange rate policy makes it possible for Brazil to pursue the policy combination of monetary independence and financial integration. As the annual inflation rate of 5.81% and the money market rate of 10.87% in December 2011 in Brazil are higher than those in most advanced countries, there may be room for a change in monetary policy so that positive benefits would be achieved. While an independently floating exchange rate regime is expected to result in a fair value of the *real* exchange rate, large exchange rate volatility may lead to more inflation or output volatility. Brazil may continue to achieve more financial integration as it yields positive benefits. When there are more sample data, these regressions may need to be re-estimated in order to determine whether the results would remain similar.

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