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Surfing the Waves of Globalization: Asia and Financial Globalization in the Context of the Trilemma

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Abstract:

Using the "trilemma indexes" developed by Aizenman et al. (2010) that measure the extent of achievement in each of the three policy goals in the trilemma—monetary independence, exchange rate stability, and financial openness—we examine how policy configurations affect macroeconomic performances, with focus on the Asian economies. We find that the three policy choices matter for output volatility and the medium-term level of inflation. Greater monetary independence is associated with lower output volatility while greater exchange rate stability implies greater output volatility, which can be mitigated if a country holds international reserves (IR) at a level higher than a threshold (about 20% of GDP). Greater monetary autonomy is associated with a higher level of inflation while greater exchange rate stability and greater financial openness could lower the inflation rate. We find that trilemma policy configurations affect output volatility through the investment or trade channel depending on the openness of the economies. Our results indicate that policy makers in a more open economy would prefer pursuing greater exchange rate stability while holding a massive amount of IR. Asian emerging market economies are found to be equipped with macroeconomic policy configurations that help the economies to dampen the volatility of the real exchange rate. These economies' sizeable amount of IR holding appears to enhance the stabilizing effect of the trilemma policy choices, and this may help explain the recent phenomenal buildup of IR in the region.

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1. Introduction

In the fall of 2008, many countries worldwide got hit by the most severe and persistent crisis since the Great Depression. While advanced economies continued to be in a frail situation in the aftermath of the crisis–the debt crisis in Europe breaking out in 2010, and the U.S. economy, the epicenter of the crisis, and Japan experiencing a sluggish recovery, bigger emerging economies either hardly got their economies scratched by the crisis or made an incredible, quick comeback. Especially, the emerging markets in Asia were resilient to the crisis; after experiencing a sharp drop in their production and exports, emerging Asian economies' gross domestic product (GDP) grew at an average annualized rate of over 10% in the second quarter of 2009 while the U.S. fell by 1%. Emerging East Asia did experience a "V-shaped recovery."

If it comes to pass, the V-shaped recovery in Asia is not unprecedented. In fact, that is how many economies in the region behaved in the aftermath of the Asian crisis of 1997-98. Despite a severe output contraction in 1998, Asian crisis economies exhibited a remarkable comeback with robust growth in exports and output as early as in 1999. Asia's sharp bounce-back this time is not only impressive but also surprising given that, unlike in the aftermath of the Asian crisis, the U.S. economy did not provide the "demand of last resort" (Aizenman and Jinjarak, 2009) that can fill the foregone demand in the world economy.

The Asian economies' resilience to external shocks in this highly globalized world could suggest one hypothesis that economies in the Asian region, most of which are quite open to international trade in goods and financial assets, are better prepared to cope with economic crises in a highly globalized environment. Figure 1 shows that output volatility—measured by the standard deviations of per capita output growth rates—for Asian emerging market economies has been maintained at low levels comparable to those of the industrialized economies. One interesting conjecture is that these countries have adopted international economic policies that have afforded them better macroeconomic performance. This suggests that these economies may have adopted international economic policies that allow them to experience better macroeconomic performance. In this paper, we investigate whether Asian economies are better-suited to cope with globalization by examining their economic performance in the context of international economic policies.

In its effort to examine policy configurations, this paper focuses on a central hypothesis in international finance, namely the "impossible trinity," or the "trilemma." The hypothesis states that a country may simultaneously choose any two, but not all, of the following three goals: monetary independence, exchange rate stability, and financial integration. This concept, if valid, is supposed to constrain policy makers by forcing them to choose only two out of the three policy choices. Given that Asian emerging market economies have collectively outperformed other developing economies in terms of output growth stability, it is possible that their international macro-policy management, determined within the constraint of the trilemma, has contributed to making these economies better prepared for higher vulnerability possibly exacerbated by recent globalization.

Using the "trilemma indexes" that measure the extent of achievement in each of the three policy goals [developed by Aizenman et al. (2008)], this paper will examine how policy configurations based on the trilemma affect macroeconomic performances such as output growth, output volatility, inflation volatility, and the medium rate of inflation for developing countries.

Furthermore, this study focuses on output volatility and attempts to identify the channels by which the trilemma policy choices affect output volatility. We examine the volatilities of investment and the real exchange rate as possible candidate channels. Our exercise should yield conclusions about how policy configurations can vary depending on the extent of openness of the economy.

In Section 2 we briefly review the theory of the trilemma and also assess the development of the three macroeconomic policies based on the trilemma by using the "trilemma indexes." In Section 3 we conduct a more formal analysis on the effect of the policy choices on macroeconomic policy goals, namely, output volatility, inflation rates, and the volatility of inflation. We will examine the implications of the estimation results for Asian economies. In Section 4, we extend our empirical investigation to investigate the channels through which international macroeconomic policy configurations affect output volatility. Finally, in Section 5 we make concluding remarks.

2. The "Impossible Trinity" or "Trilemma": Theory and Evidence

2.1 Brief Review

The current global crisis has put the international financial architecture and individual countries' international macroeconomic policies into question as symbolized by the series of recent G20 meetings. Policy makers dealing with the crisis cannot avoid confronting the "impossible trinity," or the "trilemma"—a hypothesis that states that a country simultaneously may choose any two, but not all, of the three goals of monetary independence, exchange rate stability, and financial integration.

The trilemma is illustrated in Figure 2. Each of the three sides of the triangle—representing monetary independence, exchange rate stability, and financial integration—depicts a potentially desirable goal, yet it is not possible to be simultaneously on all three sides of the triangle. The top vertex, labeled "closed capital markets" is, for example, associated with monetary policy autonomy and a fixed exchange rate regime, but not financial integration.[1]

History has shown that different international financial systems have attempted to achieve combinations of two out of the three policy goals, such as the Gold Standard system – guaranteeing capital mobility and exchange rate stability – and the Bretton Woods system – providing monetary autonomy and exchange rate stability. The fact that economies have altered the combinations as a reaction to crises or major economic events may be taken to imply that each of the three policy options is a mixed bag of both merits and demerits for managing macroeconomic conditions.[2]

Greater monetary independence could allow policy makers to stabilize the economy through monetary policy without being subject to other economies' macroeconomic management, thus potentially leading to stable and sustainable economic growth. However, in a world with price and wage rigidities, policy makers could also manipulate output movement (at least in the short-run), thus leading to increasing output and inflation volatility. Furthermore, monetary authorities could also abuse their autonomy to monetize fiscal debt, and therefore end up destabilizing the economy through high and volatile inflation.

Exchange rate stability could bring out price stability by providing an anchor, and lower risk premium by mitigating uncertainty, thereby fostering investment and international trade. Also,

[1] See Obstfeld, Shambaugh, and Taylor (2005) for further discussion and references dealing with the trilemma.
[2] Aizenman et al. (2008) have statistically shown that external shocks in the last four decades, namely, the collapse of the Bretton Woods system, the debt crisis of 1982, and the Asian crisis of 1997-98, caused structural breaks in the trilemma configurations.

at the time of an economic crisis, maintaining a pegged exchange rate could increase the credibility of policy makers and thereby contribute to stabilizing output movement (Aizenman and Glick, 2009). However, greater levels of exchange rate stability could also rid policy makers of a policy choice of using exchange rate as a tool to absorb external shocks. Prasad (2008) argues that exchange rate rigidities would prevent policy makers from implementing appropriate policies consistent with macroeconomic reality, implying that they would be prone to cause asset boom and bust by overheating the economy. Hence, the rigidity caused by exchange rate stability could not only enhance output volatility, but also cause misallocation of resources and unbalanced, unsustainable growth.

Financial liberalization is perhaps the most contentious and hotly debated policy among the three policy choices of the trilemma. On the one hand, more open financial markets could lead to economic growth by paving the way for more efficient resource allocation, mitigating information asymmetry, enhancing and/or supplementing domestic savings, and helping transfer of technological or managerial know-how (i.e., growth in total factor productivity).[3] Also, economies with greater access to international capital markets should be better able to stabilize themselves through risk sharing and portfolio diversification. On the other hand, it is also true that financial liberalization has often been blamed for economic instability, especially over the last two decades, including the current crisis. Based on this view, financial openness could expose economies to volatile cross-border capital flows resulting in sudden stops or reversal of capital flows, thereby making economies vulnerable to boom-bust cycles (Kaminsky and Schmukler, 2002).

Thus, theory tells us that each one of the three trilemma policy choices can be a double-edged sword, which should explain the wide and mixed variety of empirical findings on each of the three policy choices.[4] Furthermore, to make the matter more complicated, while there are three ways of pairing two out of the three policies (i.e., three vertices in the triangle in Figure 2), the effect of each policy choice can differ depending on what the other policy choice it is paired

[3] Henry (2006) argues that only when it fundamentally changes productivity growth through financial market development, could equity market liberalization policies have a long-term effect on investment and output growth. Otherwise, the effect of financial liberalization should be short-lived, which may explain the weak evidence on the link between financial liberalization and growth.

[4] As for monetary independence, refer to Obstfeld, et al. (2005) and Frankel et al. (2004). On the impact of the exchange rate regime, refer to Ghosh et al. (1997), Levy-Yeyati and Sturzenegger (2003), and Eichengreen and Leblang (2003). The empirical literature on the effect of financial liberalization is surveyed by Edison et al. (2002), Henry (2006), Kawai and Takagi (2008), Kose et al. (2006), Prasad et al. (2003), and Prasad and Rajan (2008).

with. For example, exchange rate stability can be more destabilizing when it is paired with financial openness while it can be stabilizing if paired with greater monetary autonomy. Hence, it may be worthwhile to empirically analyze the three types of policy combinations in a comprehensive and systematic manner.

2.2 Development of the Trilemma Dimensions

Despite its pervasive recognition, there has been almost no empirical work that we are aware of, that tests the concept of the trilemma systematically. Many of the studies in this literature often focus on one or two variables of the trilemma, but fail to provide a comprehensive analysis of all of the three policy aspects of the trilemma.[5] This is partly because of the lack of appropriate metrics that measure the extent of achievement in the three policy goals.

Aizenman et al. (2008) overcame this deficiency by developing a set of the "trilemma indexes" that measure the degree to which each of the three policy choices is implemented by economies for more than 170 economies for 1970 through 2007. The monetary independence index (MI) is based on the correlation of a country's interest rates with the base country's interest rate. The index for exchange rate stability (ERS) is an invert of exchange rate volatility, i.e., standard deviations of the monthly rate of depreciation, using the exchange rate between the home and base economies. The degree of financial integration is measured with the Chinn-Ito (2006, 2008) capital controls index (KAOPEN). More details on the construction of the indexes can be found in Aizenman et al. (2008, 2010), and the indexes are available at http://web.pdx.edu/~ito/trilemma_indexes.htm .

Figure 3 shows the trajectories of the trilemma indexes for different income-country groups. For the industrialized economies, financial openness accelerated after the beginning of the 1990s while the extent of monetary independence started a declining trend. After the end of the 1990s, exchange rate stability rose significantly. All these trends seem to reflect the introduction of the euro in 1999.[6]

[5] Notable exceptions include works by Obstfeld, Shambaugh, and Taylor (2005, 2008, and 2009) and Shambaugh (2004).

[6] If the euro economies are removed from the sample (not reported), financial openness evolves similarly to the IDC group that includes the euro economies, but exchange rate stability hovers around the line for monetary independence, though at bit higher levels, after the early 1990s. The difference between exchange rate stability and monetary independence has been slightly diverging after the end of the 1990s.

Developing economies on the other hand do not present such a distinct divergence of the indexes, and their experiences differ depending on whether they are emerging or non-emerging market economies.[7] For emerging market economies, exchange rate stability declined rapidly from the 1970s through the mid-1980s. After some retrenchment around early 1980s (in the wake of the debt crisis), financial openness started rising from 1990 onwards. For the other developing economies, exchange rate stability declined less rapidly, and financial openness trended upward more slowly. In both cases though, monetary independence remained more or less trendless.

Interestingly, for the emerging market economies, the indexes suggest a convergence toward the middle ground, even as talk of the disappearing middle has been doing the rounds. This pattern of results suggests that developing economies may have been trying to cling to moderate levels of both monetary independence and financial openness while maintaining higher levels of exchange rate stability. In other words, they have been leaning against the trilemma over a period that interestingly coincides with the time when some of these economies began accumulating sizable international reserves (IR), potentially to buffer the trade-off arising from the trilemma.

None of these observations is applicable to non-emerging developing market economies (Figure 3[c]). For this group of economies, exchange rate stability has been the most aggressively pursued policy throughout the period. In contrast to the experience of the emerging market economies, financial liberalization has not been proceeding rapidly for the non-emerging market developing economies.

Furthermore Asia, especially those economies with emerging markets, stand out from other geographical groups of economies.[8] Panel (a) in Figure 4 shows that for Asian emerging market economies, this sort of convergence is not a recent phenomenon. Since as early as the early 1980s, the three indexes have been clustered around the middle range. However, for most of the time, except for the Asian crisis years of 1997-98, exchange rate stability seems to have been the most pervasive policy choice. In the post-crisis years in the 2000s, the indexes diverged, but seem to be converging again in the recent years. This characterization does not appear to be applicable to

[7] The emerging market economies are defined as the economies classified as either emerging or frontier during 1980–1997 by the International Financial Corporation. For those in Asia, emerging market economies are "Emerging East Asia-14" defined by Asian Development Bank plus India.

[8] The sample of "Asian Emerging Market Economies" include Cambodia, China, Hong Kong, India, Indonesia, Rep. of Korea, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

non-emerging market economies (non-EMG) in Asia (b) or Latin America (c). For non-EMG economies in Asia or non-Asian developing economies, convergence in the trilemma configurations seems to be the case in the last decade.

Adding one more dimension to the three trilemma dimensions is helpful to shed further light on the concept of the trilemma. The additional dimension is the role of IR holding. Since the Asian crisis of 1997-98, developing economies, especially those in East Asia and the Middle East, have been rapidly increasing the amount of IR holding. China, the world's largest holder of international reserves, currently holds about $3 trillion of reserves, accounting for 30% of the world's total. As of the end of 2009, the top 10 IR holders are all developing economies, with the sole exception of Japan. The nine developing economies, including China, Republic of Korea (Korea), Russian Federation, and Taiwan, hold more than 50% of world IR. Against this backdrop, it has been argued that one of the main reasons for the rapid IR accumulation is economies' desire to stabilize exchange rate movement. According to one perspective, economies accumulate massive IR to achieve a target combination of exchange rate stability, monetary policy autonomy, and financial openness

For example, a country pursuing a stable exchange rate and monetary autonomy may try to liberalize cross-border financial transactions while determined not to give up the current levels of exchange rate stability and monetary autonomy. This sort of policy combination, however, could motivate the monetary authorities to hold a sizeable amount of IR so that they can stabilize the exchange rate movement while retaining monetary autonomy. Or, if an economy with open financial markets and fixed exchange rate faces a need to independently relax monetary policy, it may be able to do so, though temporarily, as long as it holds a massive amount of IR. Thus, evidently, one cannot discuss the issue of the trilemma without incorporating a role for IR holding.

The "Diamond charts" in Figure 5 are useful to trace the changing patterns of the trilemma configurations while incorporating IR holding. Each country's configuration at a given instant is summarized by a "generalized diamond," whose four vertices measure monetary independence, exchange rate stability, IR/GDP ratio, and financial integration. The origin has been normalized so as to represent zero monetary independence, pure float, zero international reserves, and financial autarky. Figure 5 summarizes the trends for industrialized economies,

emerging Asian economies, non-emerging market developing Asian economies, non-Asian developing economies, and Latin American emerging market economies.

In Figure 5, we can observe again the divergence of the trilemma configurations for the industrial economies over the years—a move toward deeper financial integration, greater exchange rate stability, and weaker monetary independence—while reducing the level of IR holding over years. Asia, especially those economies with emerging markets, appears distinct from other groups of economies; the middle-ground convergence observed for the emerging market group in Figure 3 is quite evident for this particular group of economies. This is not a recent phenomenon for the Asian emerging market economies, however. Since as early as the 1980s, the three indexes have been clustered around the middle range, though exchange rate stability has been the most pervasive policy choice and the degree of monetary independence has been gradually declining. This characterization is not applicable to the other groups of developing economies such as Latin American emerging market economies. Most importantly, the group of Asian emerging market economies stands out from the others with their sizeable and rapidly increasing amount of IR holding, making one suspect potential implications of such IR holdings on trilemma policy choices and macroeconomic performances.

3. Regression Analyses

Although the above characterization of the trilemma indexes allows us to observe the development of policy orientation among economies, it fails to identify economies' motivations for policy changes. Hence, we examine econometrically how the various choices regarding the three policies affect final macro-policy goals, namely, high economic growth, output growth stability, low inflation, and inflation stability.

The estimation model is given by:

$$y_{it} = \alpha_0 + \alpha_1 TLM_{it} + \alpha_2 IR_{it} + \alpha_3 (TLM_{it} \times IR_{it}) + X_{it}\mathrm{B} + Z_t\Gamma + D_i\Phi + \varepsilon_{it} \quad (1)$$

y_{it} is the measure of macro policy performance for country i in year t, i.e., output growth, output volatility, inflation volatility, and the medium-term level of inflation.[9] TLM_{it} is a vector of any

[9] Output growth is measured as the 5-year average of the growth rate of per capita real output (using Penn World Table 6.2); output volatility is measured as the 5-year standard deviations of the per capita output growth rate;

two of the three trilemma indexes, namely, *MI (monetary independence)*, *ERS (exchange rate stability)*, and *KAOPEN (financial openness)*.[10] IR_{it} is the level of international reserves holding (excluding gold) as a ratio to GDP, and (TLM_{it} x IR_{it}) is an interaction term between the trilemma indexes and the level of IR, that may allow us to observe whether IR complement or substitute for other policy stances.

X_{it} is a vector of macroeconomic control variables that include the variables most used in the literature. More specifically, for the estimation on economic growth, X_{it} includes relative income (to the U.S. per capita real income—based on Penn World Table (PWT)), its quadratic term, trade openness, the terms-of-trade (TOT) shock defined as the 5-year standard deviation of trade openness times TOT growth, fiscal procyclicality (measured as the correlations between Hodrick-Prescott (HP)-detrended government spending series and HP-detrended real GDP series), 5-year average of M2 growth, private credit creation (as percent of GDP), the inflation rate, and inflation volatility, with some variation of included independent variables depending on the type of the dependent variable. Z_t is a vector of global shocks that includes the change in U.S. real interest rate, the world output gap, and relative oil price shocks (measured as log of the ratio of oil price index to the world's consumer price index). D_i is a set of characteristic dummies that includes a dummy for oil exporting economies and regional dummies. Explanatory variables that persistently appear to be statistically insignificant are dropped from the estimation. ε_{it} is an *i.i.d.* error term.

The estimation model is also extended by including a vector, $ExtFin_{it}$, of external finances, that includes net foreign direct investment (FDI) inflows, net portfolio inflows, net "other" inflows (which mostly include bank lending), short-term debt, and total debt service. For net capital flows, we use the *International Financial Statistics (*IFS) data and define them as external liabilities (= capital inflows with a positive sign) minus assets (= capital inflows with a negative sign) for each type of flows. Negative values mean that a country experiences a net outflow capital of the type of concern. Short-term debt is included as the ratio of total external

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inflation volatility as the 5-year standard deviations of the monthly rate of inflation; and the medium-term level of inflation as the 5-year average of the monthly rate of inflation.

[10] Aizenman et al. (2008) have shown that these three measures of the trilemma are linearly related. Therefore, it is most appropriate to include two of the indexes simultaneously, rather than individually or all three jointly. That means that for each dependent variable, three types of regressions, i.e., those with three different combinations of two trilemma variables, are estimated.

debt and total debt service as is that of gross national income (GNI). Both variables are retrieved from World Development Indicators (WDI).

The data set is organized into 5-year panels of 1972–1976, 1977–1981, 1982–1986, 1987–1991, 1992–1996, 1997–2001, 2002–2006. All time-varying variables are included as 5-year averages. The regression is conducted for the group of developing countries (LDC). Given that a group of developing countries recently emerged as major players in the world economy, and that these countries share some commonality among them (in terms of high levels of institutional development and/or high degrees of economic openness, etc.), we also focus on a subgroup of developing countries with emerging markets, or just emerging market economies (EMG). The estimation model for economic growth is based upon the one used in Kose et al. (2009), namely, OLS with fixed effects and system GMM, and the model for output volatility, inflation volatility, and the level of inflation is based upon Aizenman et al. (2008), i.e., the robust regression model that down-weights outliers arising in both the dependent variable and explanatory variables such as inflation volatility.

3.1 Estimation Results of the Basic Models

Our discussions on the estimations focus on the regression results pertaining to output volatility and the level of inflation, simply because they are primary concerns of policy makers. As a preliminary exercise, we examined the impact of trilemma policy configurations on per capita output growth by using a parsimonious model akin to that of Kose et al. (2009).[11] Three different types of estimation methods, pooled OLS, Fixed Effects (FE) model (with robust standard errors clustered by country), and system GMM, yielded weak correlation between the trilemma variables and per capita output growth for the sample of developing economies and a subsample of emerging market economies.[12]

One of the reasons for the relatively weak results for the trilemma configurations in the growth regression can be because policy arrangements relevant to the trilemma may primarily affect the volatilities in output or inflation, and then indirectly, output growth. Hnatkovska and

[11] The explanatory variables for the estimation model include income per capita from the initial year of each five-year panel, average investment ratio to GDP, years of schooling (based on Barro and Lee, 2001), population growth, trade openness (=($EX+IM$)/GDP), and private credit creation (% of GDP) as a measure of financial development. The trilemma variables are also included in the same way as mentioned above. Neither the IR variable nor the interaction terms between trilemma variables and IR are included in the estimation because of the lack of theoretical rationale for the link between IR holding and economic growth.

[12] The regression results are available from the authors upon request.

Loayza (2005) find that macroeconomic volatility and long-run economic growth are negatively related, and that the negative link is considerably larger for the last two decades.[13] We next report and discuss the estimations on the effect of the trilemma configurations on other macroeconomic performances, namely, output volatility, inflation volatility, and the level of inflation.

3.1.1 Output Volatility

The estimation results are shown in Tables 1-1 and 1-2. Overall, macroeconomic variables retain the characteristics consistent with what has been found in the literature. In the regression for output volatility (shown in columns (1) through (3) of Tables 1-1 and 1-2), the higher the level of income is (relative to the U.S.), the more reduced output volatility is, though the effect is nonlinear. Output volatility could also increase with a change in U.S. real interest rate, indicating that the U.S. real interest rate may represent the debt payment burden on these economies. The higher the TOT shock, the higher the output volatility that economies experience, consistent with Rodrik (1998) and Easterly, et al. (2001), who argue that volatility in world goods through trade openness can raise output volatility.[14] Economies with procyclical fiscal policy tend to experience more output volatility while economies with more developed financial markets tend to experience lower output volatility, though they are not statistically significant.[15] The results hold qualitatively for the subsample of emerging market economies though the statistical significance tends to appear weaker.

Among the trilemma indexes, monetary independence is found to have a significantly negative effect on output volatility. The greater monetary independence one embraces, the less output volatility the country tends to experience, naturally reflecting the impact of stabilization

[13] They also find that the negative link can be exacerbated by underdevelopment of institutions, intermediate stages of financial development, and inability to conduct countercyclical fiscal policies.

[14] The effect of trade openness is found to be persistently insignificant and is therefore dropped from the estimations. This finding reflects the debate in the literature, in which both positive (i.e., volatility enhancing) and negative (i.e., volatility reducing) effects of trade openness has been evidenced. See Easterly et al. (2001) and Rodrik (1998) for the volatility-enhancing effect of trade openness and refer to Calvo et al. (2004) and Cavallo (2007) for the volatility reducing effect.

[15] For theoretical predictions on the effect of financial development, refer to Aghion, et al. (1999) and Caballero and Krishnamurthy (2001). For empirical findings, see Blankenau, et al. (2001) and Kose et al. (2003).

measures.[16,17] Mishkin and Schmidt-Hebbel (2007) find that economies that adopt inflation targeting—one form of increasing monetary independence—are found to reduce output volatility, and that the effect is bigger among emerging market economies.[18] This volatility-reducing effect of monetary independence may explain the tendency for developing economies, especially non-emerging market ones, to not reduce the extent of monetary independence over years.

Economies with more stable exchange rate tend to experience higher output volatility for both LDC and EMG groups, which conversely implies that economies with more flexible exchange rates will experience lower levels of output volatility, as has been found in Edwards and Levy-Yeyati (2003) and Haruka (2007). However, the interaction term is found to have a statistically negative effect, suggesting that economies holding high levels of IR are able to reduce output volatility. The threshold level of international reserves holding is 13–18% of GDP.[19] Singapore, a country with a middle level of exchange rate stability (0.50 in 2002–2006) and a very high level of IR holding (100% as a ratio of GDP), is able to reduce the output volatility by 2.7-2.9 percentage points.[20] China, whose exchange rate stability index is as high as 0.97 and whose ratio of reserves holding to GDP is 40% in 2002–2006, is able to reduce volatility by 1.4–1.7 percentage points.

When the model is extended to incorporate external finances (results are reported in Tables 2-1 and 2-2), generally, the control variables remain qualitatively unchanged, but the statistical significance of the trilemma variables slightly increase. Greater monetary independence continues to be an output volatility reducer. The nonlinear effect of greater exchange rate stability in interaction with IR holding remains, but the threshold level is found to

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[16] Once the interaction term between monetary independence and IR holding is removed from the estimation model, the coefficient of monetary independence becomes significantly negative with the 5% significance level in model (1) of the LDC sample and in models (1) and (2) of the EMG sample.

[17] This finding can be surprising to some if the concept of monetary independence is taken synonymously to central bank independence because many authors, most typically Alesina and Summers (1993), have found more independent central banks would have no or at most, little impact on output variability. However, in this literature, the extent of central bank independence is usually measured by the legal definition of the central bankers and/or the turnover ratios of bank governors, which can bring about different inferences compared to our measure of monetary independence.

[18] The link is not always theoretically predicted to be negative. When monetary authorities react to negative supply shocks, that can amplify the shocks and exacerbate output volatility. Cechetti and Ehrmann (1999) find the positive association between adoption of inflation targeting and output volatility.

[19] In Model (3) of Table 1-1, $\hat{\alpha}_1 TLM_{it} + \hat{\alpha}_3 (TLM_{it} \times IR_{it})$ for ERS is found to be $0.009 ERS_{it} - 0.067 (ERS_{it} \times IR_{it})$ or $(0.009 - 0.067 IR_{it}) ERS_{it}$. In order for ERS to have a negative impact, $0.009 - 0.067 IR_{it} < 0$, and therefore, it must be that $IR_{it} > 0.009 / 0.067 = 0.13$.

[20] See Moreno and Spiegel (1997) for an earlier study of trilemma configurations in Singapore.

be 12.6% of GDP in model (3) for developing economies and 18–19% for emerging market economies.

Economies with more open capital account tend to experience lower output volatility according to Table 2-1. However, those with IR holding higher than 23% of GDP can experience higher volatility by pursuing more financial openness, which is somewhat counterintuitive.[21]

Among the external finance variables, an increase in the "other" capital inflows, i.e., banking lending or more net portfolio inflows, received by an economy, increases the likelihood that the economy might experience higher output volatility. This reflects the fact that economies that experience macroeconomic turmoil often witness an increase in inflows of bank-lending or "hot money" such as portfolio investment. Total debt service is found to be a positive contributor to output volatility while short-term debt does not seem to have an effect. These results contrast with the conventional wisdom regarding short-term external debt.[22,23]

3.1.2 Inflation Volatility

The regression models for inflation volatility do not turn out to be as significant as those for output volatility including the performance of the trilemma indexes. We do not report the results in the table. While the findings on the macro variables are generally consistent with the literature, the performance of the trilemma indexes appears to be the weakest for this group of estimations. However, exchange rate stability is now a volatility-increasing factor, which is contrary to what has been found in the literature (such as Ghosh, et al., 1997) and somewhat

[21] The result of model (2) in Table 2-1 is consistent with those of models (1) and (3). That is, model (2) predicts that if a country increases its level of monetary independence and financial openness concurrently, it could reduce output volatility. As long as the concept of the trilemma holds true, i.e., the three policy goals are linearly related, as Aizenman et al. (2008) empirically proved, the efforts of increasing both *MI* and *KAOPEN* is essentially the same as lowering the level of exchange rate stability. Models (1) and (3) predict that lower ERS leads to lower output volatility. But these models also predict that if the country holds IR more than thresholds, it would have to face higher output volatility, which is found in model (2).

[22] One might suspect that this result can be driven by multicollinearity between the short-term debt variable and the variables for the various net inflows. However, even when the three net inflow variables are removed from the models, still the total debt service continues to be a positive factor while the short-term debt variable continues to be an insignificant one.

[23] In this sort of exercise, the issue of endogeneity can be raised and make it suspicious that the estimated coefficients are biased and with low efficiency. The GMM estimation, either in difference form (Arellano and Bond, 1991) or as a system (Blundell and Bond, 1998; Blundell, et al., 2000), are often suggested to deal with this issue. However, in our context, because our estimation is not based on a dynamic model and also because our use of five-year panels (instead of annual data) helps avoid serial correlation, the GMM estimation is not appropriate. A two-stage estimation with instruments for the variables of our focus can be suggested, but finding appropriate instruments would be extremely difficult. As one attempt to deal with endogeneity, we sampled all the explanatory variables from the initial year of each five-year panel, and obtained qualitatively similar results.

counterintuitive, because economies with more stability in their exchange rates should experience lower inflation and thereby lower inflation volatility. One possible explanation is that economies with fixed exchange rates tend to lack fiscal discipline and eventually experience devaluation as argued by Tornell and Velasco (2000).[24] When we include the interaction term between the crisis dummy and the ERS variable to isolate the effect of exchange rate stability for the crisis economies, the estimated coefficient on ERS still remains with the same magnitude and statistical significance.[25]

3.1.3 Medium-Run Level of Inflation

The models for the medium-run level of inflation fit as well as those for output volatility. Higher inflation volatility, higher M2 growth, and oil price shocks are associated with higher inflation. Also, when the world economy experiences a boom, developing economies tend to experience higher inflation, which presumably reflects strong demand for goods produced and exported by developing economies.

Greater exchange rate stability leads to lower inflation for both developing and emerging market economies, a result consistent with the literature (such as Ghosh et al., 1997). This finding and the previously found positive association between exchange rate stability and output volatility are in line with the theoretical prediction that establishing stable exchange rates is a trade-off issue for policy makers. It will help the country to achieve lower inflation by showing a higher level of credibility and commitment on part of the monetary authorities, but at the same time, efforts of maintaining stable exchange rates will rid policy makers of an important adjustment mechanism through fluctuating exchange rates.

The estimations for both subsamples show that the more financially open a developing country is, the lower the inflation it will experience. Interestingly, the more open to trade a country is, the more likely it is to experience lower inflation for the LDC regressions.

The negative association between "openness" and inflation has been the subject of debate as globalization has proceeded. Rogoff (2003) argues that globalization contributes to dwindling

[24] Tornell and Velasco argue that while economies with flexible exchange rates face the cost of having lax fiscal policy immediately, economies with fixed exchange rates tend to lack fiscal discipline because "under fixed rates bad behavior today leads to punishment tomorrow."

[25] Even when the model incorporates external finances, the estimation results remain to be weak, except for FDI inflows and total debt service. While FDI inflows are found to be inflation stabilizers, total debt service can be destabilizing inflation, both consistent with the literature.

mark-ups, and therefore, disinflation. Romer (1993), extending the Barro-Gordon (1983) model, verified that the more open to trade a country becomes, the less motivated its monetary authorities are to inflate, suggesting a negative link between trade openness and inflation. Razin and Binyamini (2007) predicted that both trade and financial liberalization will flatten the Phillips curve, so that policy makers will become less responsive to output gaps and more aggressive in fighting inflation. Here, across different subsamples of developing economies, we present evidence consistent with the negative openness-inflation relationship.

The extended versions of the regressions that incorporate external finances retain the same characteristics in general. However, for emerging market economies, the interaction term between ERS and IR holding is found to have a positive impact on the rate of inflation. Models (8) and (9) in Table 2-2 show that if the ratio of reserves holding to GDP is greater than about 24%, the efforts of pursuing exchange rate stability can help *increase* the level of inflation. This means that economies with excess levels of reserves holding will eventually face the limit in the efforts of fully sterilizing foreign exchange intervention to maintain exchange rate stability—thereby experiencing higher inflation. In the LDC sample (Table 2-1), we can find the same kind of threshold as in models (8) and (9). Financial openness can lead to lower inflation, but only for the case when IR hold is below 21–22% as a ratio to GDP. Given that it is only in a financially open economy that monetary authorities face the need for foreign exchange interventions, the threshold of IR holding for financial openness can be interpreted in the same way as that for exchange rate stability. This implies that there are limits to sterilized interventions, and that it is more binding for financially open economies. Aizenman and Glick (2008) and Glick and Hutchison (2008) show that China has started facing more inflationary pressure in 2007 when allegedly intervening in the foreign exchange market to sustain exchange rate stability. This finding indicates that sterilized interventions would eventually lead to a rise in expected inflation if they are conducted as an effort to maintain monetary independence and exchange rate stability while having somewhat open financial markets. The rise in the inflationary pressure provides evidence that policy makers cannot evade the constraint of the trilemma.

Lastly, among the external finances variables, FDI is found to be an inflation reducer. One possible explanation is that economies tend to stabilize inflation in order to attract FDI. Lastly, and unsurprisingly, higher levels of total debt services are found to increase inflation for the LDC sample.

3.2 Implications for Asia

The estimation results on the determinants of output volatility provide some interesting insights on Asian economic development. The finding that economies can reverse the volatility-increasing effect of greater exchange rate stability by holding higher levels of IR than some threshold (about 13–18% of GDP) may explain the reason why many Asian emerging economies hold higher levels of IR. Let us shed further light on how IR holding and the exchange rate regime interact with each other.

Figure 6 shows the marginal interactive effects between ERS and IR based on the estimates from Column 3 of Table 1-2. For presentation purposes, the EMG group of economies is divided into three subgroups: (i) an Asian group, (ii) a Latin American group, and (iii) all other EMG economies. In all the panels of figures, the contours are drawn to present different levels of the effect of ERS on output volatility conditional on the level of IR. The solid horizontal line refers to the threshold of IR at 18% of GDP, above which higher levels of ERS has a negative impact on output volatility.[26] For example, the solid contour line above the threshold shows the combinations of ERS and IR that lead to a one percentage point reduction in output volatility. In the figure, the further toward the northeast corner in the panel, i.e., the higher level of ERS *and* IR a country pursues, the more negative the impact on output volatility is. Below the threshold, however, it is true that the further one moves toward the southeast corner, (i.e., higher level of ERS *and* lower level of IR holding), the more *positive* the impact on output volatility. In each of the panels, the scatter diagrams of ERS and IR are superimposed. The black circles indicate ERS and IR for 2002–2006 and the red "x's" for 1992–1996.[27]

These diagrams highlight several interesting observations. First, from the 1992 to 1996 and 2002 to 2006 periods, periods that encompass several episodes of global crises that

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[26] In Model (3) in Table 1-2, $\hat{\alpha}_1 TLM_{it} + \hat{\alpha}_3 (TLM_{it} \times IR_{it})$ for ERS is found to be $0.012 ERS_{it} - 0.066 (ERS_{it} \times IR_{it})$. If the marginal effect is –1%, it must be that $-0.01 = 0.012 ERS_{it} - 0.066 (ERS_{it} \times IR_{it})$. If we solve this for *IR*, then we obtain $IR_{it} = \frac{0.012}{0.066} - \frac{-0.01}{0.066 ERS_{it}}$. We repeat this calculation for the –2% impact, –3% impact, etc. so as to create the other contours.

[27] The estimated coefficient on IR (level) is significantly positive in Column (1) of Table 1-2, which indicates the volatility-enhancing effect of IR itself. Hence, it is essentially a trade-off between holding more IR and pursuing greater exchange rate stability once the level of IR surpasses the threshold level. The analysis presented in Figure 6 focuses on the marginal effect of ERS and how it changes depending on the level of IR while keeping in mind that higher levels of IR is volatility-increasing.

originated in Asia, the figure shows that many economies, especially those in East Asia and Eastern Europe, increased their IR holding above the threshold. Second, the movement is not necessarily toward the northeast direction. Rather, it is around the threshold level where the effect of ERS is neutral (i.e., zero percentage point impact), unless they move much higher toward output volatility-reducing territory (such as Bulgaria and China). Last, only a handful of economies have achieved combinations of ERS and IR that significantly reduce output volatility. Such economies include Botswana, China, Hong Kong, Malaysia, Jordan, and Singapore. However, the fact that three Asian economies are among the economies with large IR holding and great ERS may explain why Asian economies are often perceived to be currency manipulators although they are more of exceptions than the rule.

Interestingly, in addition to the interactive effect of IR holding with ERS, Table 3-2 shows that if a country holds a level of IR greater than 24% of GDP, it would nullify the negative effect of pursuing greater exchange rate stability on inflation, which indicates that foreign exchange interventions can be inflationary. The fact that many Asian emerging market economies hold a greater amount of IR than the 24% threshold as shown in Figure 6, means that these economies need to perceive the double-edged sword aspect of the policy of pursuing both greater exchange rate stability and more IR. As we have previously discussed, these economies include China.

4. Further Investigation into Output Volatility and Trilemma Choices

4.1 Channels to Output Volatility

Given the resilience of the Asian economies during the global financial crisis of 2008-09, one cannot help but focus on the estimation results for output volatility. One natural question that arises is, through what channels do these factors contribute to output volatility? To answer this question, we estimate similar models for output volatility but replace the dependent variable with real exchange rate stability, through which net exports can be affected, and the volatility of investment. This exercise should help us examine whether and to what extent policy choices can differ depending on the extent of economic openness.

4.1.1 Results on Investment Volatility and Real Exchange Rate Volatility

The results shown in columns (1) through (3) of Table 3 correspond to investment volatility and columns (4) through (6) of Table 3 correspond to real exchange rate stability specifications. However, for the estimation of the real exchange rate stability, some of the explanatory variables have been changed. In particular, change in the U.S. real interest rate, fiscal procyclicality, and financial development (measured by private credit creation as a ratio to GDP) are dropped from the estimation, and replaced with inflation volatility, and differentials in inflation volatility between the home and base economies.[28]

By comparing the results of these specifications with different dependent variables, we can make some interesting observations. First, we can also observe the negative effect of monetary independence on the investment volatility estimation as we did in that on output volatility. However, if the level of IR holding is above 15–20% of GDP, higher monetary independence could lead to higher volatility in investment. This may be because higher levels of IR could lead to higher levels of liquidity, and thus to more volatile movement in the cost of capital. Second, while a higher degree of exchange rate stability could (unsurprisingly) induce greater real exchange rate stability, it could also lead to more volatile investment. But as was the case with output volatility, if the level of IR holding exceeds a given threshold, greater exchange rate stability reduces investment volatility.[29] Third, financial openness has a negative impact on both real exchange rate stability and investment volatility. Hence, we can conclude that financial liberalization could help reduce output volatility by making both real exchange rate and investment more stable. Last, the investment volatility regressions show that net portfolio and bank lending inflows can be volatility-increasing, although bank lending inflows can reduce real exchange rate volatility.

4.1.2. Results on Other Aspects of Macroeconomic Performance

In addition, we repeat the same exercise for variables pertaining to other aspects of macroeconomic performance, namely, the volatility of final consumption—the sum of private consumption and government expenditure, the volatility of GNI (gross national income), and the ratio of the two variables. The motivation for these estimations is twofold. First, we need to

[28] We also tested interest rate differentials, but they did not turn out to be significant. Therefore, they are not included in the estimation.

[29] The threshold levels of IR holding are 18% of GDP in model (1) and 28% of GDP in model (3) in Table 3-1. In Table 3-2, they are 14% in model (1) and 26% in model (3).

ensure if there are channels other than investment and net exports through which the trilemma policy configurations can affect output volatility. Second, the ratio of the volatility of GNI to that of final consumption is essentially a proxy to the measure of risk sharing. In other words, a higher value of the ratio means a lower volatility of final consumption compared to that of GNI, which can arise when economic agents successfully diversify risk and smooth consumption. Hence, if trilemma policy choices are found to reduce the ratio, that can be interpreted as evidence for successful international risk sharing.[30]

The regression results for final consumption volatility are not robust in terms of not only the macroeconomic control variables, but also of the trilemma variables (not reported). Although the weak estimation results may indicate a possibility of misspecification in these regressions, at the very least this finding suggests that the channel of final consumption can be ruled out. It is either investment or net exports through which trilemma configurations affect output volatility.

While the estimation results for GNI are found to be quite similar to the estimation of output volatility, the estimation involving the ratio of GNI volatility to final consumption volatility do not perform well at all. Considering that home bias is much more pervasive in developing economies, the insignificant results are not surprising. Developing economies are not reaping the benefits of international risk sharing, though that could also mean that there is room for these economies to reap the benefit from financial liberalization.

4.2 A Closer Look at the Transmission Channels and Policy Implications for Asia

In the previous exercise, we found different dynamics between the models for investment volatility and that for real exchange rate volatility. This difference should suggest that the effect of international macroeconomic policy configurations differ depending upon how much weight policy makers place between these two policy goals. For example, if policy makers put greater weight on real exchange rate stability, it is better to pursue more exchange rate stability and greater financial openness (which implies lower levels of monetary independence), which could have a volatility-enhancing impact on investment and output, though the answer depends on the level of IR holding. More concretely, the results from model (1) in Table 3-2 show that greater

[30] However, plotting the time series of the ratio of final consumption volatility to GNI volatility is not promising. While the ratio appears to be trending up moderately among industrialized economies, i.e., they are reaping the benefits of diversifying risk and smoothing consumption, there is no discernable trend for the group of developing economies.

(weaker) monetary independence increases (decreases) real exchange rate volatility. The estimation results also indicate that the IR threshold (as a ratio to GDP) necessary for greater (weaker) monetary independence to have a positive (negative) effect on investment volatility, is 15% of GDP whereas that for greater (weaker) exchange rate stability to have a negative (positive) effect is 16%. Hence, if an emerging market country holds a level of IR higher than 16% and tries to pursue a higher level of exchange rate stability and a *lower* level monetary independence (i.e., a combination of greater exchange rate stability and greater financial openness), that country could achieve lower levels of not only real exchange rate stability, but also investment. This result may explain why many emerging market economies, especially those that are more open to international trade such as Asian emerging market economies, tend to prefer exchange rate stability and holding a massive amount of IR while also pursuing financial liberalization.

This finding has a significant relevance to Asian economies. Panel (a) in Figure 7 shows the average ratio of trade openness (the sum of exports and imports as a ratio to GDP) to investment (as a ratio to GDP) from 1990 to 2006 for different groups of developing economies. While the ratio for the group of non-emerging market Asian developing economies is below the average for the entire group of developing economies, the ratio for the Asian emerging market economies (EMG) is the highest among the regional subgroups. This means that the results shown in columns (4) through (6) of Tables 3-1 and 3-2 are more relevant to this group of economies than any other groups. Our estimation results indicate that more open economies could reduce volatility in both investment and real exchange rate by pursuing more stable exchange rate as long as they hold higher levels of IR. Panels (b) through (d) show the period averages of IR holding (% of GDP), ERS, and MI, respectively. In Panel (b), the level of IR holding for the Asian EMG is much greater than the threshold of 15–16% we just discussed above, though both ERS and MI are around the group averages of developing economies. These panels of figures indicate that Asian emerging market economies may have pursued international macroeconomic policies that help reduce the level of volatility in both investment and the real exchange rates, or at least the latter if not both. In fact, according to Figure 8, Asian EMGs have achieved lower levels of volatilities in both investment and the real exchange rate than any other group of developing economies (naturally, except for the 1990s because of the Asian crisis), and their levels are comparable to that of industrialized economies.

Figure 9 illustrates the estimated effects of the three trilemma variables on the volatilities of investment volatility and the real exchange rate calculated using the estimation results shown in Table 3-1.[31] The panels of Figure 9 allow us to make several interesting observations for the Asian economies. First, across different groups of developing economies, exchange rate stability and its interaction with IR holding have contributed significantly to lowering the real exchange rate volatility over years. Second, between the group of Asian developing economies and that of non-Asian economies, the role of monetary independence is different.[32] For the Asian economies, it has been a volatility enhancing factor for investment with its impact rising rapidly over the last period (2002-2006). The rapid increase in the volatility-increasing impact for this group of economies can be explained by the rapid increase in the level of IR holding in this period. For non-Asian economies, on the other hand, monetary independence has been a volatility reducer, especially for Latin American economies though its impact dwindled in the last period. Third, exchange rate stability and its interaction with IR holding, contribute to lowering investment volatility among the Asian economies but only during the 2002–2006 period, while it has been a volatility-increasing factor throughout the period for the other groups.

Fourth, although we have found in the previous estimation that a country with a greater level of IR holding than the threshold of 15-16% of GDP should lessen the volatilities in both investment and the real exchange rate by pursuing weaker monetary independence and greater exchange rate stability, the Asian economies on average do not appear to be following that sort of policy combinations. In the last five-year period, although they have succeeded in making exchange rate stability contribute to lowering investment volatility and the real exchange rate stability, their monetary independence levels are not low enough to contribute to reducing investment volatility with the high level of IR holding. Fifth, financial openness does not play a role in affecting the volatilities of investment and the real exchange rate, which reflects the ambivalent impact of financial liberalization as we discussed previously. This also suggests that the motivation for financial liberalization may not be relevant to policy makers' intention of

[31] That is, the bars in the panels of figures refer to $\hat{\alpha}_1 TLM_{it} + \hat{\alpha}_3 (TLM_{it} \times IR_{it})$ for each of the trilemma indexes and its interaction with IR holding. The estimated effects are calculated using the estimated coefficients and actual values for the trilemma indexes and the IR ratio. However, because only two out of the three trilemma variables are included in the estimations, the estimation results from two types of regressions: one with *MI* and *ERS* included in TLM_{it} and the other with *ERS* and *KAOPEN*, are used to calculate the estimated effects for all the three indexes. The estimated effect of ERS is, however, based on the average of the estimated coefficients for the two regressions.

[32] Most of the "Asian developing economies" are emerging market economies due to data availability.

alleviating macroeconomic volatilities through more open financial markets. Last, for all groups, the three policies on net, have contributed negatively to the real exchange rate volatility, but positively to investment volatility over years, though the net impact of the trilemma policies seems to be nil for the group of Latin American economies. Having the trilemma policy combinations as volatility-increasing factors for investment may not be such a big concern for Asian emerging market economies which are quite open to international trade (Figure 7(a)).

The top row of Figure 10 displays the actual levels of volatilities in output, investment, and the real exchange rate (blue bars) along with the estimated impacts of the trilemma configurations (orange bars) for the period of 2002-2006, using the estimated coefficients from and the actual data for model (1) in Table 2-1 (for output volatility) and models (1) and (4) in Table 3-1 (for investment volatility and real exchange rate volatility, respectively). The bottom row presents the diamond charts for each of the country groups. Also, the figures in parentheses beside the name of the country groups report the average ratios of trade openness to the investment rates for the period of 2002-2006 to indicate how open the economies are.

For the group of Asian emerging market economies, the trilemma policy combination contributes to lowering the volatilities of output and the real exchange rate, but to raising the volatility of investment. However, given that these economies are quite open (the ratio of relative trade openness to the investment rate (x) is 4.83), the volatility-reducing impact of the trilemma policy combination on the real exchange rate volatility should outweigh the volatility-increasing impact on the investment volatility, thus contributing to lowering output volatility. Latin American EMGs are on average less of open economies (x = 2.37). As an aggregate, we can see that the impact of trilemma policy combinations of these economies is nil though the level of investment volatility is high.[33] This may imply that these economies design their trilemma policies in a way that does not exacerbate the volatilities of investment or output.

Based on what we have found so far, economies should be able to alleviate volatilities in both investment and the real exchange rate by implementing certain trilemma combinations. It may be important, especially for relatively closed economies, to pursue investment stability. Hence, for relatively closed economies which hold high levels of IR (higher than the threshold of 15-16% of GDP), policy makers may choose to pursue weaker monetary independence and greater exchange rate stability so that they can achieve higher stabilities in both investment and

[33] Note that the scale for the volatility level is different for this group of economies than the other groups.

real exchange rates. However, in those economies which hold low levels of IR, policy makers may choose to pursue greater monetary independence and lower exchange rate stability although they could not minimize the volatility of the real exchange rate with greater monetary independence and lower ERS.[34] Table 5 presents the summary of these points.

Those economies that are highly open may focus on pursuing real exchange rate stability. For these open economies, the volatility of investment becomes less important, but that makes holding high levels of IR more important. It is important to pursue greater exchange rate stability to achieve more stable real exchange rate movement, but to alleviate the volatility-increasing impact of greater exchange rate stability, a country needs to hold higher levels of IR. Because monetary independence is a volatility-increasing factor for the real exchange rate, and because it can be a volatility-reducer for a country with high IR, monetary independence must be at low levels. But given that we found the effect of monetary independence is minimal for the real exchange rate stability, monetary independence can be at middle levels depending upon how open the economy is. The more open the economy, the more it can afford to have slightly higher levels of monetary independence because it can then neglect the volatility-increasing impact of greater monetary independence on investment (Table 5). This may explain the reason why emerging market economies, many of which are very open economies, as a group appear to have a well-balance combination of the three trilemma policies.

Panels (b) through (d) of Figure 10 again present the contributions of the trilemma policies to the volatilities of output, investment, and the real exchange rates and the diamond charts for individual economies ((b) Asian economies, (c) Latin American economies, and (d) others). Although the predictions summarized in Table 5 do not necessarily fit well with the actual experiences of individual economies, we can find some cases that are consistent with the above discussions. Brazil and Mexico may be considered good examples of scenario (b) shown in Table 5- closed economies in terms of low trade-investment ratios, with low IR, high MI, lower ERS, and higher KAOPEN. Egypt can be representative of scenario (a). Malaysia, the Philippines, and Thailand are somewhat consistent with scenarios (c) and (d) though the high IR holdings allow the latter two economies to have lower levels of ERS. For these economies, it is clear that the trilemma policies contribute to lowering output volatility by stabilizing the real

[34] As we have discussed, the level of financial openness is irrelevant in terms of its impact on these volatilities. But because monetary independence and exchange rate stability is a trade-off issue, whether it holds a high or low level of IR, it can pursue greater financial openness.

exchange rate movement. Jordan is a good example of scenario (c) while Gabon is of scenario (d). One interesting outlier is China; its level of monetary independence is so high that it contributes positively to higher investment volatility despite having a combination of very high IR and ERS. Despite the high volatility-increasing impact of the trilemma configuration on investment, the volatility-reducing effect on the real exchange rate seems to be outweighing the former and contributing to lower output volatility although relatively it is not such an open economy. Overall, the trilemma policy configuration seems to be effective in reducing the volatility of the real exchange rate for the Asian economies. For this group of economies, it is the trade channel through which the trilemma policies seem to be affecting the volatility of output.

5. Concluding Remarks

Asia has impressed the world with the strength of its recovery from the global financial crisis of 2008-09, thus appropriately attracting attention from both the academic and policy communities. In this paper we assessed how the region has dealt with the process of financial globalization, in terms of varying its international macroeconomic policies, through the lens of the "trilemma".

The "trilemma indexes" developed by Aizenman et al. (2008) allow us to trace the changing patterns of the trilemma configurations among economies and bring to light striking differences between the policy choices adopted by industrialized and developing economies during the period 1970–2007. The recent trend suggests that industrialized economies have been experiencing divergence of the three dimensions of the trilemma, and have moved towards a combination of high exchange rate stability and financial openness and low monetary independence- a trend most distinctively exemplified by the experience of the euro economies. Emerging market economies, on the other hand, appear to be converging towards a "middle ground" with managed exchange rate flexibility, while maintaining medium levels of monetary independence and financial integration. Interestingly, for Asian emerging market economies, convergence is not a recent phenomenon. As early as the 1980s, the three indexes have been clustered around the middle range, though exchange rate stability has been the most pervasive policy choice. Another, more recent development involves the high level of international reserves (IR) holding –a feature that we incorporate into our analysis.

Our finding that economies' policy configurations have evolved over years must imply that combinations of the three policies have their own respective strengths and weaknesses in terms of macroeconomic performance, in terms of output volatility, inflation volatility, and medium-term rate of inflation. To reveal the special attributes of the Asian experience along both in time series and cross sectional dimensions, we applied a panel data analysis.

We obtained a series of interesting findings. First, we found that some of the policy choices significantly affect output volatility and inflation rate. Specifically, higher levels of monetary independence seem to be associated with lower output volatility. Economies with higher levels of exchange rate stability tend to experience higher output volatility, though this effect can be mitigated by holding a level of IR higher than the threshold of about 20% of GDP. This result is consistent with the phenomenon of many emerging market economies accumulating massive IR.

We also found that economies with greater monetary independence tend to experience higher inflation while economies with higher exchange rate stability tend to experience lower inflation. Furthermore, financial openness is associated with lower inflation. However, we found some evidence that if economies pursue greater exchange rate stability and financial openness while holding a sizeable amount of IR, they can experience a rise in the level of inflation. This finding suggests that economies with excess levels of reserve holding may eventually face a limit in foreign exchange sterilization.

We further find that greater monetary independence helps reduce investment volatility. However, if the level of IR holding exceeds 15–20% of GDP, greater monetary independence may become volatility-*enhancing* for investment by providing too much liquidity and thereby making the cost of capital volatile. However, the volatility-enhancing effect of exchange rate stability on investment can be mitigated by holding higher levels of IR. We also find that greater financial openness helps reduce real exchange rate volatility. Our results indicate that policy makers in a relatively more open economy may prefer pursuing greater exchange rate stability and greater financial openness while holding a massive amount of IR because this policy combination would help them stabilize both investment and real exchange rate.

Overall, we find that Asian economies, especially the emerging market economies, are equipped with macroeconomic policy configurations that dampen the volatility of the real exchange rate. These economies' sizeable amount of IR holding appears enhance the stabilizing

effect of the trilemma policy choices while allowing them to achieve middle-ground policy arrangements. This finding provides a motivation for the recent phenomenal buildup of international reserve holdings in the region.

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Table 1-1: The Macroeconomic Impact of the Trilemma Configurations: Less Developed Countries (LDC)

	Output volatility			Level of Inflation		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Income	-0.059	-0.056	-0.064	-0.125	-0.068	-0.096
	[0.019]***	[0.019]***	[0.019]***	[0.046]***	[0.049]	[0.047]**
Relative Income, sq.	0.094	0.094	0.112	0.207	0.123	0.167
	[0.022]***	[0.024]***	[0.024]***	[0.055]***	[0.060]**	[0.058]***
Change in US real interest rate	0.126	0.126	0.132			
	[0.041]***	[0.042]***	[0.041]***			
Volatility of TOT*OPN	0.03	0.03	0.027	0	-0.001	-0.002
	[0.007]***	[0.007]***	[0.007]***	[0.016]	[0.017]	[0.016]
Inflation volatility	0.026	0.024	0.027	0.336	0.317	0.328
	[0.006]***	[0.006]***	[0.006]***	[0.014]***	[0.014]***	[0.014]***
Fiscal Procyclicality	0.004	0.004	0.004	0.002	0.005	0.002
	[0.002]**	[0.002]**	[0.002]**	[0.004]	[0.004]	[0.004]
Relative oil price shocks				0.029	0.023	0.026
				[0.005]***	[0.005]***	[0.005]***
World Output Gap				0.641	0.396	0.601
				[0.273]**	[0.282]	[0.267]**
Trade openness				-0.012	-0.016	-0.011
				[0.007]*	[0.007]**	[0.007]*
M2 growth				0.381	0.419	0.373
				[0.019]***	[0.019]***	[0.019]***
Private credit creation	-0.002	-0.004	-0.001	-0.008	-0.004	-0.011
	[0.005]	[0.005]	[0.005]	[0.012]	[0.012]	[0.012]
Total Reserve (as % of GDP)	0.059	0.015	0.067	-0.085	-0.08	-0.142
	[0.038]	[0.032]	[0.024]***	[0.091]	[0.079]	[0.055]***
Monetary Independence (MI)	-0.013	-0.019		0.012	0.017	
	[0.011]	[0.011]*		[0.027]	[0.027]	
MI x reserves	-0.026	0.012		-0.019	-0.027	
	[0.063]	[0.060]		[0.148]	[0.146]	
Exchange Rate Stability (ERS)	0.006		0.009	-0.058		-0.06
	[0.005]		[0.005]*	[0.013]***		[0.012]***
ERS x reserves	-0.06		-0.067	0.074		0.083
	[0.031]**		[0.029]**	[0.072]		[0.067]
KA Openness		-0.003	0		-0.048	-0.045
		[0.005]	[0.005]		[0.013]***	[0.012]***
KAOPEN x reserves		-0.008	-0.027		0.126	0.1
		[0.025]	[0.024]		[0.062]**	[0.058]*
Observations	417	417	417	417	417	417
Adjusted R-squared	0.26	0.25	0.26	0.84	0.83	0.84

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The regional dummies are included in the regressions for output and inflation, so is the dummy for oil exporters in the output volatility regression. But the estimated coefficients of these dummies are not reported to conserve space.

Table 1-2: The Macroeconomic Impact of the Trilemma Configurations: Emerging market economies (EMG)

	Output volatility			Level of Inflation		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Income	-0.043	-0.031	-0.043	-0.074	-0.022	-0.044
	[0.024]*	[0.025]	[0.025]*	[0.084]	[0.080]	[0.084]
Relative Income, sq.	0.058	0.041	0.058	0.12	0.078	0.096
	[0.030]*	[0.033]	[0.034]*	[0.104]	[0.102]	[0.108]
Change in US real interest rate	0.157	0.145	0.155			
	[0.049]***	[0.050]***	[0.049]***			
Volatility of TOT*OPN	0.021	0.025	0.02	0.063	0.034	0.047
	[0.013]	[0.013]*	[0.013]	[0.040]	[0.037]	[0.037]
Inflation volatility	0.038	0.036	0.037	0.348	0.387	0.38
	[0.007]***	[0.007]***	[0.007]***	[0.022]***	[0.021]***	[0.021]***
Fiscal Procyclicality	0.003	0.003	0.003	-0.003	-0.003	-0.004
	[0.002]	[0.002]	[0.002]	[0.007]	[0.006]	[0.006]
Relative oil price shocks				0.01	0.003	0.006
				[0.008]	[0.007]	[0.007]
World Output Gap				0.911	0.778	0.855
				[0.412]**	[0.380]**	[0.385]**
Trade openness				0	0.002	0.002
				[0.010]	[0.010]	[0.010]
M2 volatility				0.455	0.424	0.415
				[0.028]***	[0.027]***	[0.027]***
Private credit creation	-0.002	-0.005	-0.002	-0.02	-0.026	-0.026
	[0.005]	[0.005]	[0.005]	[0.018]	[0.016]	[0.017]
Total Reserve (as % of GDP)	0.085	0.024	0.059	-0.164	-0.087	-0.106
	[0.036]**	[0.035]	[0.023]**	[0.111]	[0.096]	[0.068]
Monetary Independence (MI)	-0.008	-0.016		-0.022	-0.028	
	[0.013]	[0.014]		[0.040]	[0.038]	
MI x reserves	-0.048	-0.007		0.099	0.039	
	[0.060]	[0.059]		[0.179]	[0.165]	
Exchange Rate Stability (ERS)	0.011		0.012	-0.053		-0.04
	[0.007]*		[0.007]*	[0.021]**		[0.020]**
ERS x reserves	-0.073		-0.066	0.12		0.096
	[0.032]**		[0.030]**	[0.095]		[0.087]
KA Openness		-0.005	-0.002		-0.047	-0.043
		[0.006]	[0.006]		[0.017]***	[0.017]**
KAOPEN x reserves		0.013	0.004		0.037	0.025
		[0.026]	[0.025]		[0.077]	[0.077]
Observations	196	196	196	196	196	196
Adjusted R-squared	0.3	0.27	0.29	0.87	0.89	0.89

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The regional dummies are included in the regressions for output and inflation, so is the dummy for oil exporters in the output volatility regression. But the estimated coefficients of these dummies are not reported to conserve space.

Table 2-1: The Impact of the Trilemma Configurations and External Financing: Less Developed Countries (LDC)

	Output volatility			Level of Inflation		
	(1)	(2)	(3)	(4)	(5)	(6)
Currency Crisis	0.005	0.005	0.005	0.031	0.032	0.029
	[0.003]*	[0.003]*	[0.003]*	[0.006]***	[0.007]***	[0.006]***
Private credit creation	-0.003	-0.008	-0.005	-0.018	-0.014	-0.019
	[0.006]	[0.006]	[0.007]	[0.017]	[0.017]	[0.016]
Total Reserve (as % of GDP)	0.072	-0.055	0.065	-0.053	-0.182	-0.198
	[0.052]	[0.052]	[0.034]*	[0.122]	[0.123]	[0.076]***
Monetary Independence (MI)	-0.019	-0.035		-0.002	-0.017	
	[0.014]	[0.014]**		[0.033]	[0.034]	
MI x reserves	0.005	0.112		-0.04	0.055	
	[0.085]	[0.089]		[0.199]	[0.208]	
Exchange Rate Stability (ERS)	0.008		0.012	-0.04		-0.04
	[0.007]		[0.006]*	[0.016]**		[0.015]***
ERS x reserves	-0.086		-0.095	0.074		0.071
	[0.044]*		[0.044]**	[0.104]		[0.098]
KA Openness		-0.02	-0.014		-0.055	-0.055
		[0.008]**	[0.008]*		[0.019]***	[0.018]***
KAOPEN x reserves		0.086	0.048		0.261	0.254
		[0.045]*	[0.042]		[0.107]**	[0.097]***
Net FDI inflows/GDP	0.047	0.092	0.109	-0.477	-0.442	-0.441
	[0.068]	[0.071]	[0.070]	[0.177]***	[0.184]**	[0.173]**
Net portfolio inflows/GDP	0.241	0.289	0.286	0.064	0.297	0.228
	[0.122]**	[0.129]**	[0.127]**	[0.286]	[0.302]	[0.287]
Net 'other' inflows/GDP	0.069	0.063	0.071	0.037	0.09	0.045
	[0.029]**	[0.029]**	[0.029]**	[0.069]	[0.070]	[0.068]
Short-term Debt	-0.009	-0.008	-0.007	-0.007	-0.003	0.012
(as % of total external debt)	[0.016]	[0.016]	[0.016]	[0.037]	[0.038]	[0.036]
Total debt service	0.063	0.081	0.078	0.176	0.184	0.154
(as % of GNI)	[0.035]*	[0.035]**	[0.035]**	[0.088]**	[0.088]**	[0.086]*
Observations	311	311	311	311	310	310
Adjusted R-squared	0.37	0.39	0.4	0.86	0.86	0.86

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The dummy for Sub-Saharan economies is included in the regressions for output and inflation volatility, so are the dummies for Latin America and Caribbean and East Europe and Central Asia in the regression for the level of inflation. “Trade openness” that is insignificant is omitted from presentation to conserve space.

Table 2-2: The Impact of the Trilemma Configurations and External Financing: Emerging market economies (EMG)

	Output volatility			Level of Inflation		
	(1)	(2)	(3)	(4)	(5)	(6)
Currency Crisis	0.004	0.007	0.004	0.024	0.017	0.02
	[0.003]	[0.003]**	[0.004]	[0.010]**	[0.009]*	[0.010]**
Private credit creation	0	-0.005	0.001	-0.037	-0.027	-0.043
	[0.007]	[0.007]	[0.007]	[0.026]	[0.022]	[0.025]*
Total Reserve (as % of GDP)	0.087	-0.043	0.096	-0.18	-0.242	-0.176
	[0.055]	[0.056]	[0.035]***	[0.162]	[0.153]	[0.098]*
Monetary Independence (MI)	-0.018	-0.038		-0.037	-0.051	
	[0.017]	[0.018]**		[0.051]	[0.048]	
MI x reserves	0.008	0.096		0.063	0.14	
	[0.088]	[0.094]		[0.257]	[0.249]	
Exchange Rate Stability (ERS)	0.023		0.028	-0.06		-0.053
	[0.009]**		[0.009]***	[0.028]**		[0.026]**
ERS x reserves	-0.125		-0.15	0.25		0.225
	[0.052]**		[0.051]***	[0.151]**		[0.140][11%]
KA Openness		-0.01	-0.002		-0.065	-0.045
		[0.009]	[0.009]		[0.024]***	[0.024]*
KAOPEN x reserves		0.062	0.016		0.252	0.11
		[0.047]	[0.042]		[0.126]**	[0.121]
Net FDI inflows/GDP	-0.121	-0.105	-0.155	-0.847	-0.598	-0.678
	[0.107]	[0.112]	[0.113]	[0.345]**	[0.324]*	[0.347]*
Net portfolio inflows/GDP	-0.113	-0.048	-0.081	-0.34	-0.06	-0.159
	[0.140]	[0.145]	[0.147]	[0.411]	[0.383]	[0.412]
Net 'other' inflows/GDP	0.025	0.017	0.022	0.016	0.059	0.018
	[0.037]	[0.037]	[0.037]	[0.121]	[0.107]	[0.116]
Short-term Debt	-0.013	-0.008	-0.011	0.047	0.041	0.069
(as % of total external debt)	[0.019]	[0.019]	[0.019]	[0.058]	[0.052]	[0.057]
Total debt service	0.008	0.037	0.011	0.197	0.07	0.206
(as % of GNI)	[0.044]	[0.044]	[0.044]	[0.164]	[0.147]	[0.159]
Observations	154	154	154	151	151	151
Adjusted R-squared	0.45	0.29	0.46	0.88	0.91	0.89

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The dummy for Sub-Saharan economies is included in the regressions for output and inflation volatility, so are the dummies for Latin America and Caribbean and East Europe and Central Asia in the regression for the level of inflation.

Table 3-1: Determinants of Volatilities of Investment and Real Exchange Rates: Less Developed Countries (LDC)

	Investment volatility			Real exchange rate volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Income	-0.1	-0.15	-0.125	-0.016	0.027	-0.015
	[0.143]	[0.142]	[0.139]	[0.020]	[0.031]	[0.020]
Relative Income, sq.	0.121	0.239	0.211	0.017	-0.041	0.019
	[0.264]	[0.265]	[0.258]	[0.037]	[0.057]	[0.038]
Change in US real interest rate	0.39	0.306	0.259			
	[0.199]*	[0.198]	[0.194]			
Volatility of TOT*OPN	0.095	0.121	0.103	0.008	0.011	0.008
	[0.036]***	[0.036]***	[0.035]***	[0.005]	[0.008]	[0.005]
Inflation volatility	0.134	0.133	0.131	0.038	0.031	0.038
(Infl. vol. differentials in (4)-(6))	[0.025]***	[0.025]***	[0.025]***	[0.003]***	[0.005]***	[0.004]***
Fiscal Procyclicality	-0.001	0.003	0.004			
	[0.009]	[0.009]	[0.009]			
Trade openness				-0.005	-0.011	-0.005
				[0.003]*	[0.004]***	[0.003]*
Currency Crisis	0.01	0.002	0.007	0.009	0.013	0.009
	[0.011]	[0.011]	[0.011]	[0.002]***	[0.002]***	[0.002]***
Private credit creation	-0.011	-0.012	-0.001			
	[0.026]	[0.026]	[0.025]			
Total Reserve (as % of GDP)	-0.229	-0.393	0.158	0.022	0.038	-0.013
	[0.210]	[0.205]*	[0.132]	[0.030]	[0.045]	[0.019]
Monetary Independence (MI)	-0.181	-0.159		0.004	0.024	
	[0.056]***	[0.057]***		[0.008]	[0.012]**	
MI x reserves	1.193	0.785		-0.049	-0.086	
	[0.342]***	[0.351]**		[0.048]	[0.076]	
Exchange Rate Stability (ERS)	0.077		0.07	-0.037		-0.038
	[0.026]***		[0.025]***	[0.004]***		[0.004]***
ERS x reserves	-0.413		-0.254	-0.007		0.001
	[0.179]**		[0.170]	[0.025]		[0.024]
KA Openness		-0.042	-0.012		-0.008	-0.004
		[0.032]	[0.030]		[0.007]	[0.004]
KAOPEN x reserves		0.223	0.051		0.029	0.019
		[0.178]	[0.165]		[0.038]	[0.024]
Net FDI inflows/GDP	0.327	0.347	0.25	-0.041	-0.088	-0.033
	[0.274]	[0.280]	[0.272]	[0.041]	[0.064]	[0.042]
Net portfolio inflows/GDP	1.48	1.414	1.364	0.052	0.046	0.054
	[0.493]***	[0.508]***	[0.494]***	[0.069]	[0.108]	[0.071]
Net 'other' inflows/GDP	0.376	0.38	0.418	-0.028	-0.014	-0.028
	[0.116]***	[0.116]***	[0.112]***	[0.016]*	[0.025]	[0.016]*
Short-term Debt	-0.042	-0.042	-0.042	0.006	0.004	0.007
(as % of total external debt)	[0.063]	[0.063]	[0.062]	[0.008]	[0.013]	[0.008]
Total debt service	0.264	0.232	0.213	0.02	0.081	0.02
(as % of GNI)	[0.140]*	[0.138]*	[0.136]	[0.020]	[0.031]***	[0.021]
Observations	309	309	309	310	310	310
Adjusted R-squared	0.31	0.26	0.25	0.63	0.29	0.63

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The dummy for Sub-Saharan economies is included in the regressions for output and inflation volatility, so are the dummies for Latin America and Caribbean and East Europe and Central Asia in the regression for the level of inflation.

Table 3-2: Determinants of Volatilities of Investment and Real Exchange Rates: Emerging market economies (EMG)

	Investment volatility			Real exchange rate volatility		
	(1)	(2)	(3)	(4)	(5)	(6)
Relative Income	0.237	0.119	0.193	-0.045	0.072	-0.073
	[0.254]	[0.272]	[0.255]	[0.054]	[0.074]	[0.050]
Relative Income, sq.	-0.625	-0.36	-0.452	0.099	-0.108	0.176
	[0.557]	[0.604]	[0.561]	[0.118]	[0.166]	[0.112]
Change in US real interest rate	-0.1	-0.07	-0.134			
	[0.218]	[0.232]	[0.212]			
Volatility of TOT*OPN	-0.098	-0.022	-0.09	0.021	0.002	0.019
	[0.056]*	[0.059]	[0.055]	[0.011]*	[0.016]	[0.010]*
Inflation volatility	0.143	0.151	0.142	0.05	0.038	0.051
(Infl. vol. differentials in (4)-(6))	[0.028]***	[0.029]***	[0.027]***	[0.006]***	[0.008]***	[0.005]***
Fiscal Procyclicality	0.017	0.014	0.02			
	[0.010]	[0.011]	[0.010]*			
Trade openness				-0.004	-0.004	-0.006
				[0.005]	[0.006]	[0.004]
Currency Crisis	0.038	0.033	0.034	0.011	0.013	0.009
	[0.012]***	[0.013]**	[0.012]***	[0.003]***	[0.003]***	[0.002]***
Private credit creation	0.025	0.004	0.033			
	[0.024]	[0.025]	[0.024]			
Total Reserve (as % of GDP)	-0.374	-1.045	0.368	0.035	0.052	0.001
	[0.192]*	[0.211]***	[0.118]***	[0.040]	[0.058]	[0.023]
Monetary Independence (MI)	-0.286	-0.365		0.027	0.042	
	[0.060]***	[0.066]***		[0.013]**	[0.018]**	
MI x reserves	1.867	2.095		-0.068	-0.123	
	[0.306]***	[0.353]***		[0.064]	[0.096]	
Exchange Rate Stability (ERS)	0.127		0.121	-0.039		-0.037
	[0.032]***		[0.030]***	[0.007]***		[0.006]***
ERS x reserves	-0.818		-0.583	-0.012		-0.006
	[0.183]***		[0.173]***	[0.037]		[0.033]
KA Openness		-0.065	0.026		-0.001	-0.009
		[0.034]*	[0.029]		[0.009]	[0.006]
KAOPEN x reserves		0.414	-0.138		-0.013	0.011
		[0.175]**	[0.144]		[0.047]	[0.028]
Net FDI inflows/GDP	-0.216	0.237	-0.433	-0.054	-0.114	0.024
	[0.373]	[0.422]	[0.384]	[0.081]	[0.117]	[0.077]
Net portfolio inflows/GDP	0.76	1.34	0.736	-0.043	-0.149	-0.018
	[0.488]	[0.543]**	[0.497]	[0.102]	[0.147]	[0.097]
Net 'other' inflows/GDP	0.586	0.637	0.6	-0.078	-0.08	-0.056
	[0.131]***	[0.139]***	[0.127]***	[0.027]***	[0.038]**	[0.025]**
Short-term Debt (as % of total external debt)	-0.102	-0.07	-0.113	0.014	-0.002	0.009
	[0.067]	[0.072]	[0.066]*	[0.013]	[0.017]	[0.011]
Total debt service (as % of GNI)	0.172	0.277	0.182	0.027	0.034	0.032
	[0.155]	[0.165]*	[0.151]	[0.038]	[0.052]	[0.035]
Observations	149	149	149	151	151	151
Adjusted R-squared	0.62	0.49	0.49	0.68	0.39	0.69

Robust regressions are implemented. * significant at 10%; ** significant at 5%; *** significant at 1%. The dummy for Sub-Saharan economies is included in the regressions for output and inflation volatility, so are the dummies for Latin America and Caribbean and East Europe and Central Asia in the regression for the level of inflation.

Table 5: Policy Combinations and Implications on Volatilities of Investment (var(I)) and the Real Exchange Rate (var(q))

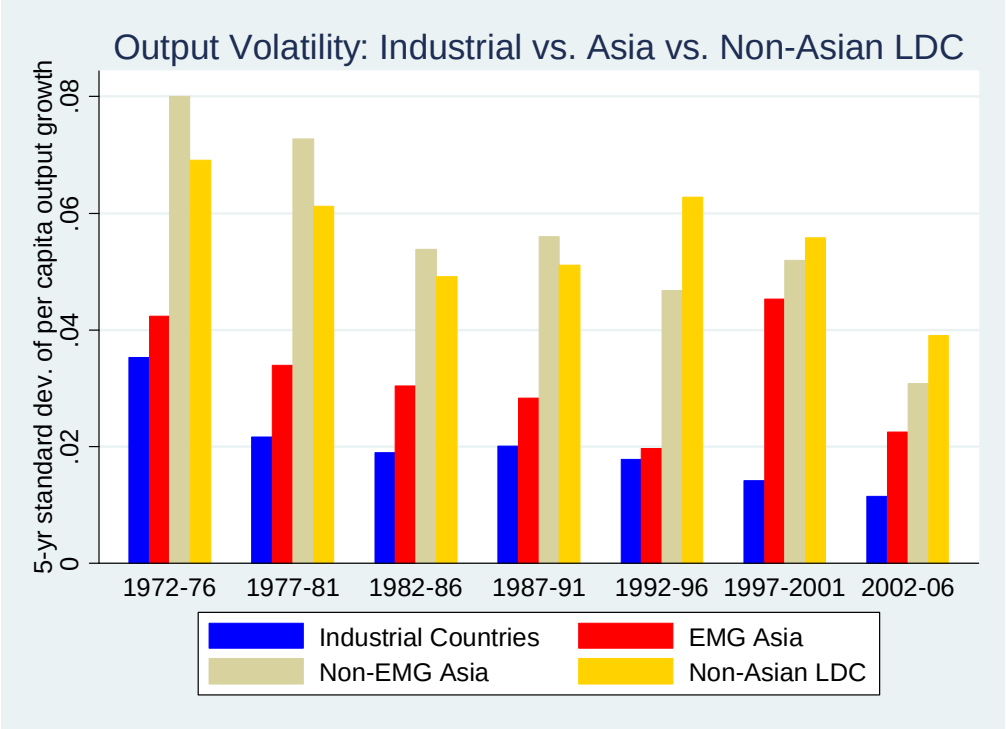
Closed Economy

Policy Goals	(a) Lower var(I) and Lower var(q)	(b) Lower var(I) and Not too high var(q)
	High IR Lower MI Higher ERS (Middle ERS if IR is very high) (Higher KAOPEN or middle if IR is very high)	Low IR Higher MI Lower ERS (Higher KAOPEN)

Open Economy

Policy Goals	(c) Lower var(I) and Lower var(q)	(d) Not too high var(I) and Lower var (q)
	High IR Lower MI Higher ERS (Higher KAOPEN)	High IR Middle MI Higher ERS (Middle KAOPEN)

Figure 1: Output Volatility, 1972 – 2006



Notes: Output volatility is measured by five-year standard deviations of the growth rate of per capita output. The data for per capita output are extracted from the PWT database.

Figure 2: The Trilemma

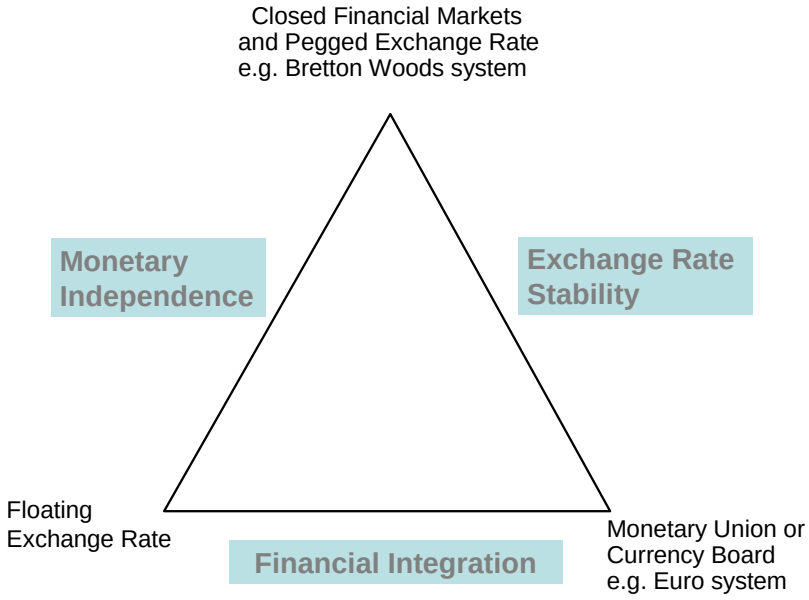
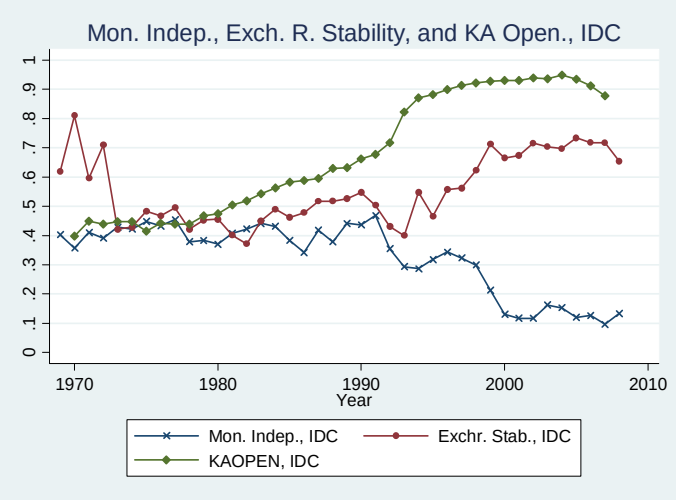
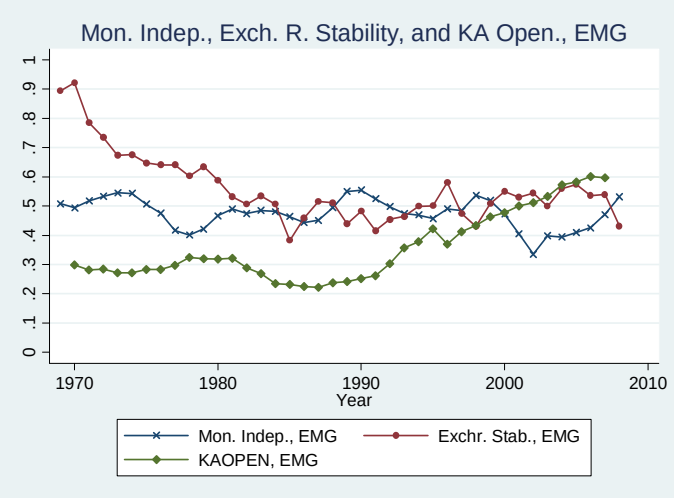


Figure 3: Development of the Trilemma Configurations Over Time

(a) Industrialized Countries



(b) Emerging market economies



(c) Non-Emerging Market Developing Countries

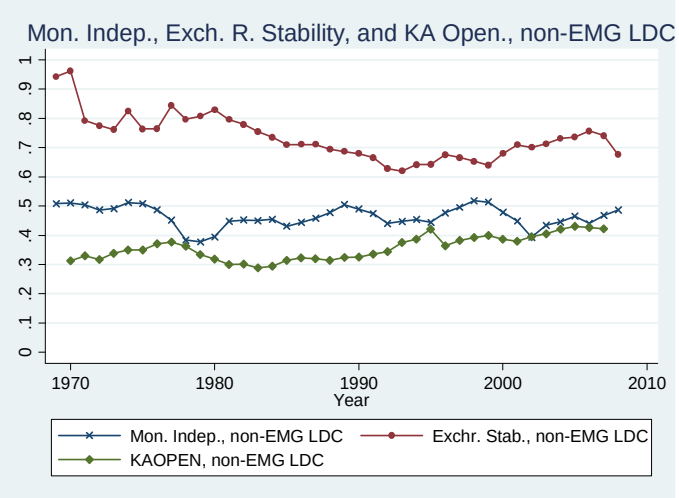
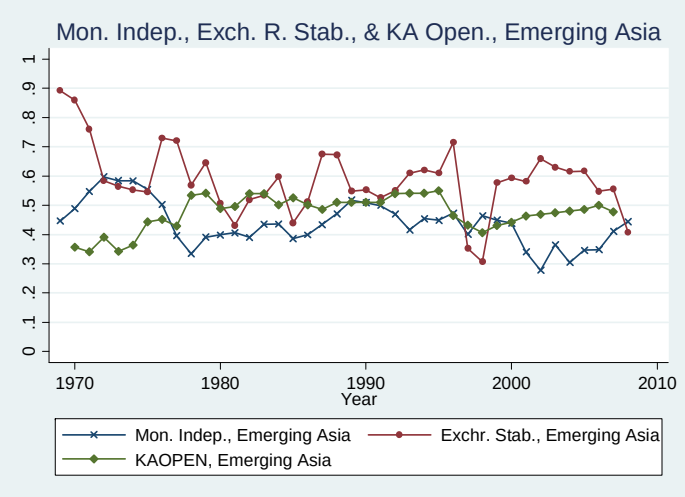
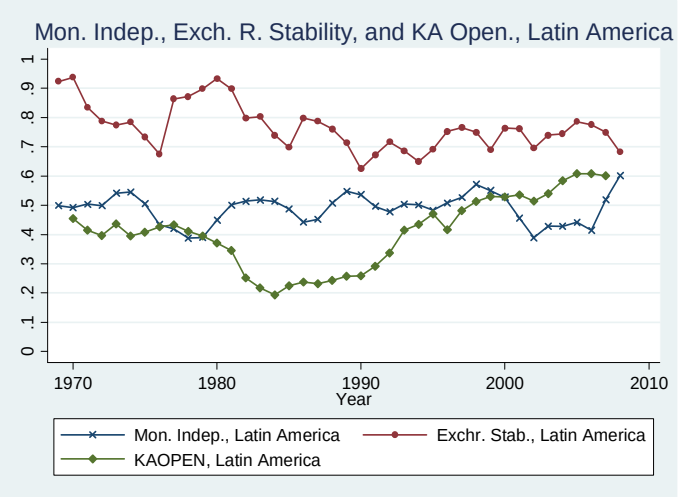


Figure 4: Regional Comparison of the Development of the Trilemma Configurations

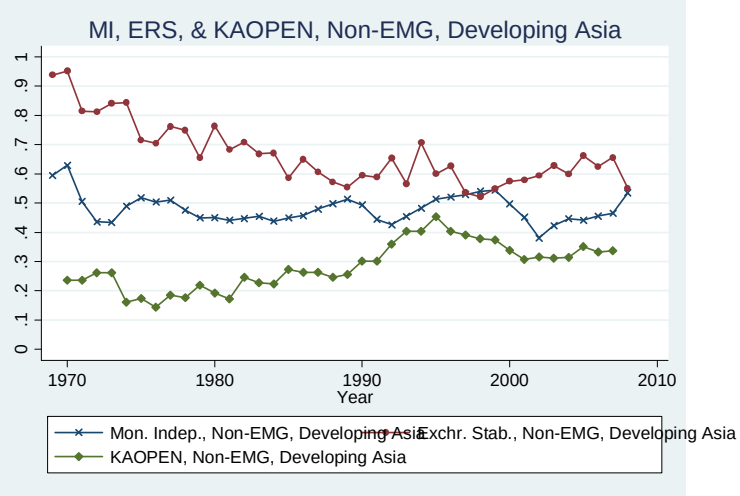
(a) Emerging Market Economies (EMG) in Asia



(c) Latin American Countries



(b) Non-EMG, Developing Asia



(d) Less Developed Countries (LDC) excluding Asia

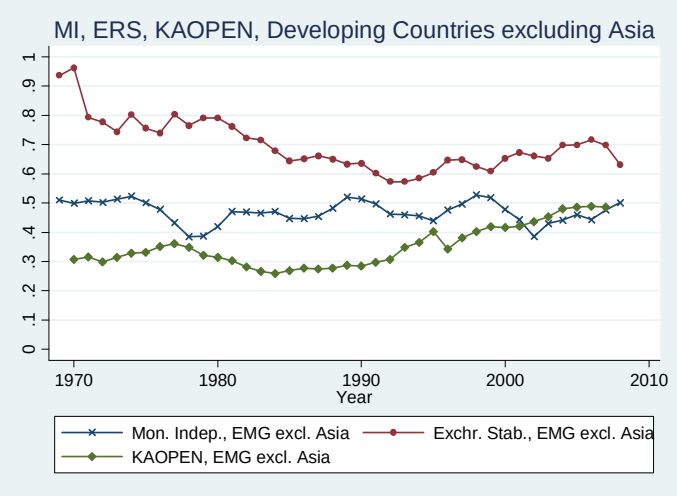


Figure 5: The "Diamond Charts": Variation of the Trilemma and IR Configurations Across Different Country Groups

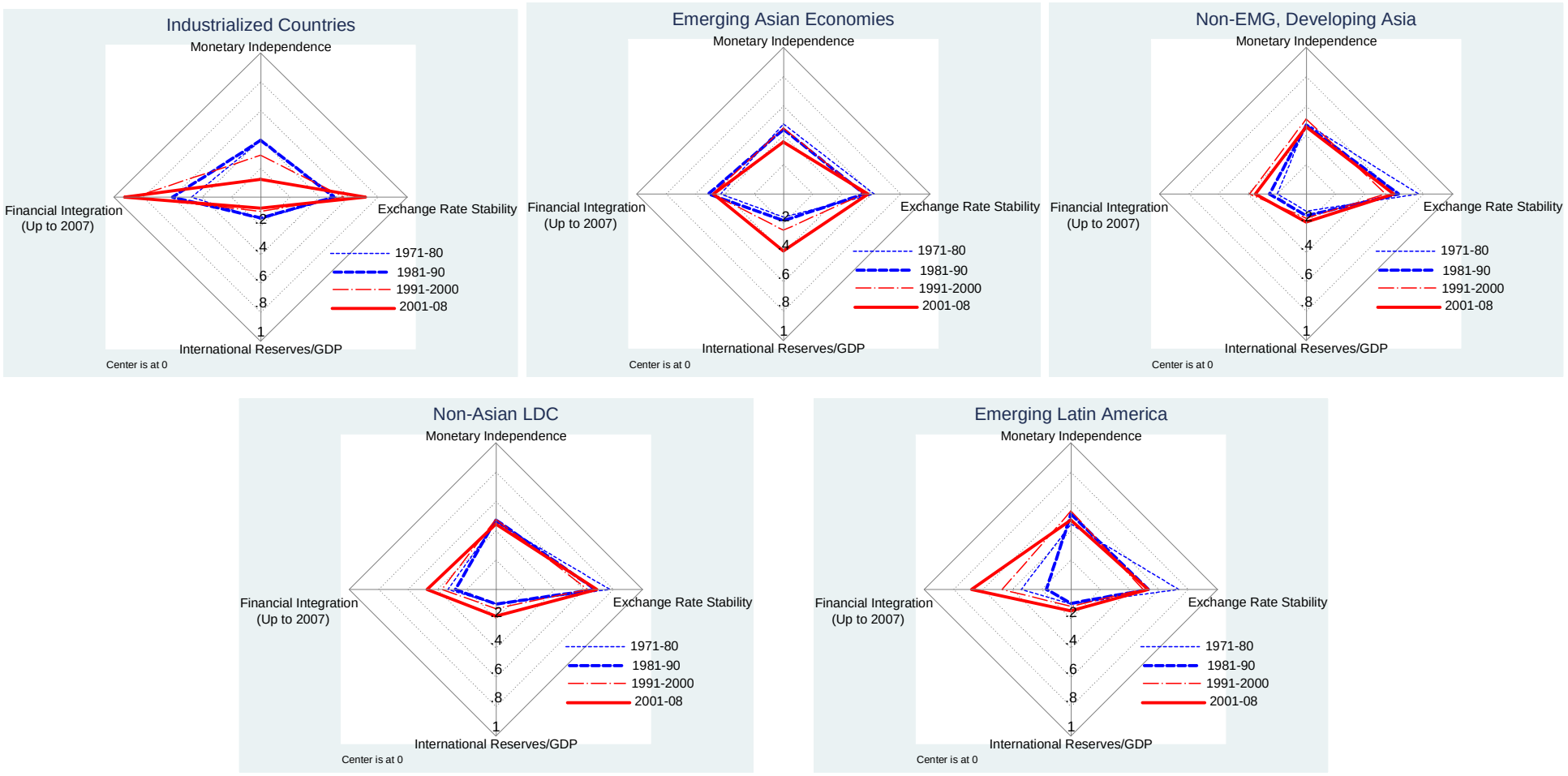
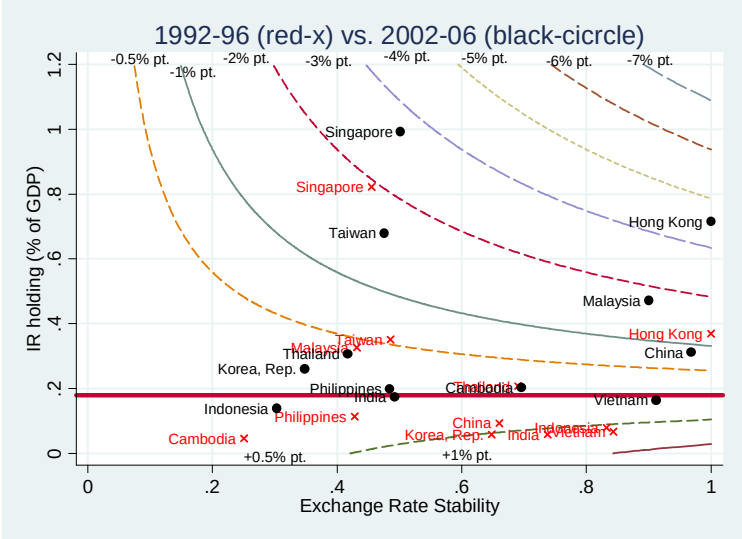
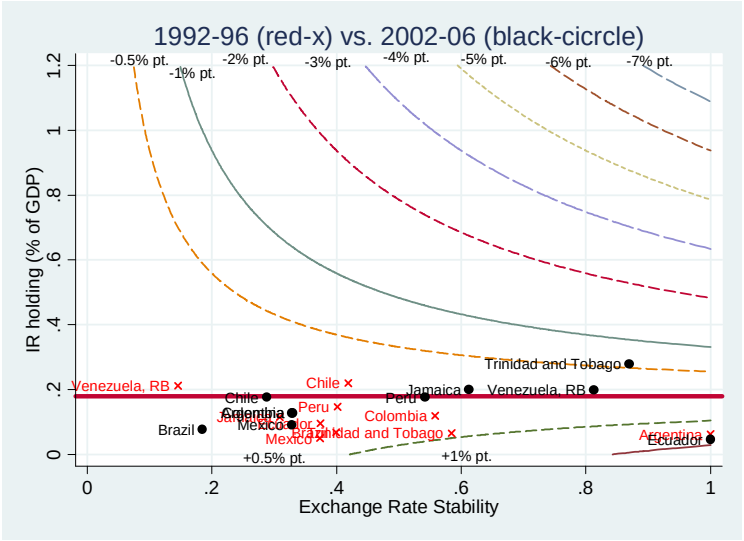


Figure 6: Interactive Effects of Exchange Rate Stability and IR Holding

(a) Asian EMGs



(b) Latin American EMGs



(c) Other EMGs

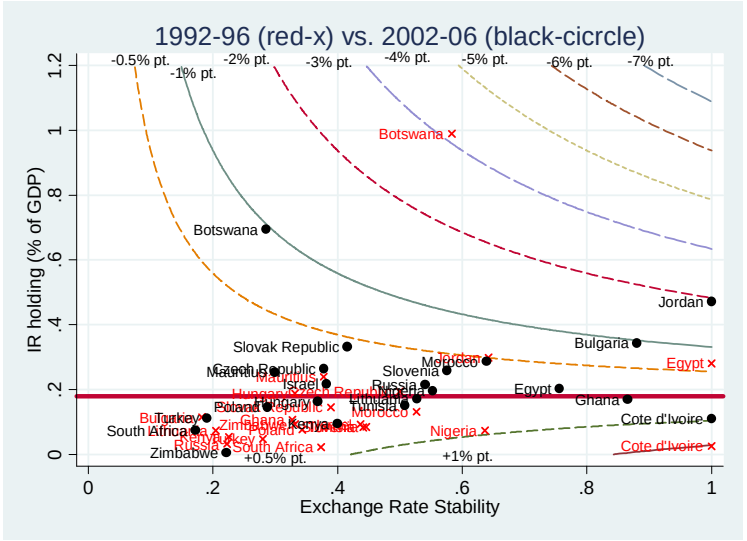
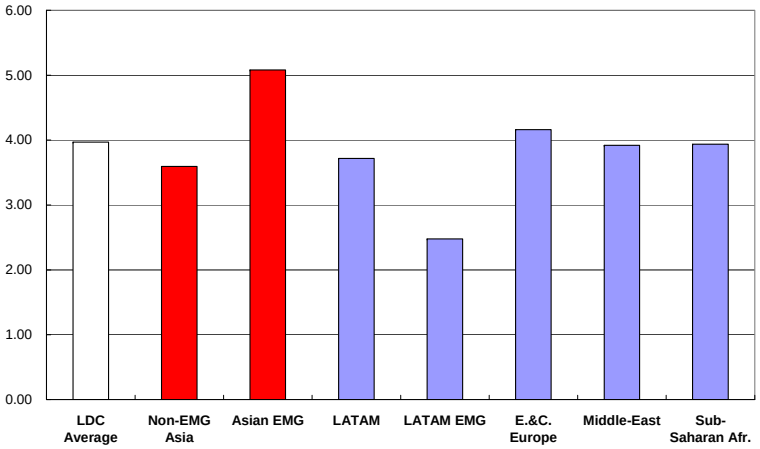
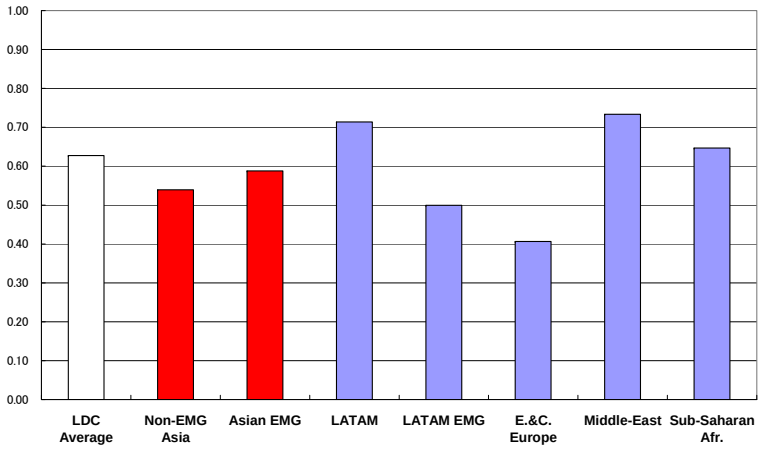


Figure 7: Regional Comparison of Trade Openness and Exchange Rate Stability

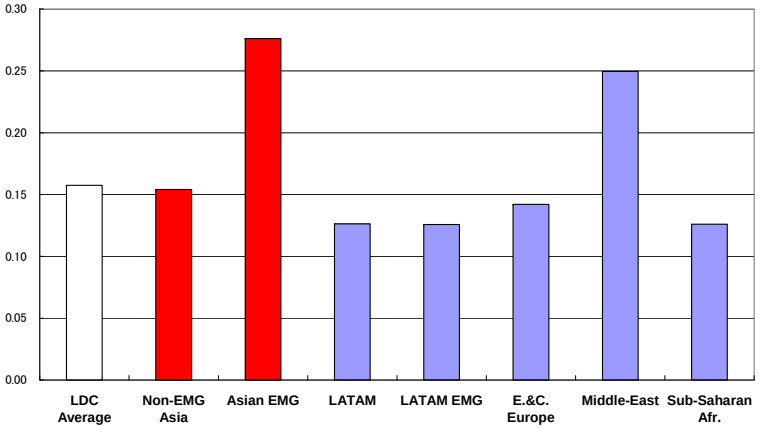
(a) Ratio of Trade Openness ((EX+IM)/Y) to Investment Rate (% of GDP): 1990 - 2006



(c) Exchange Rate Stability (ERS) 1990 - 2006



(b) Int'l Reserves as % of GDP 1990 - 2006



(d) Monetary Independence (MI) 1990 - 2006

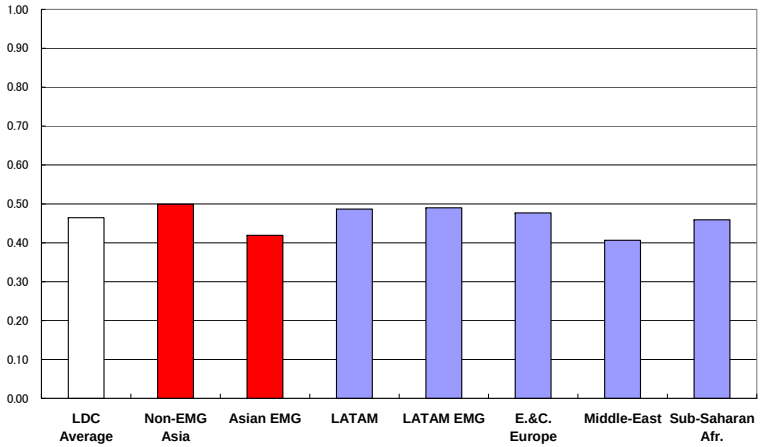
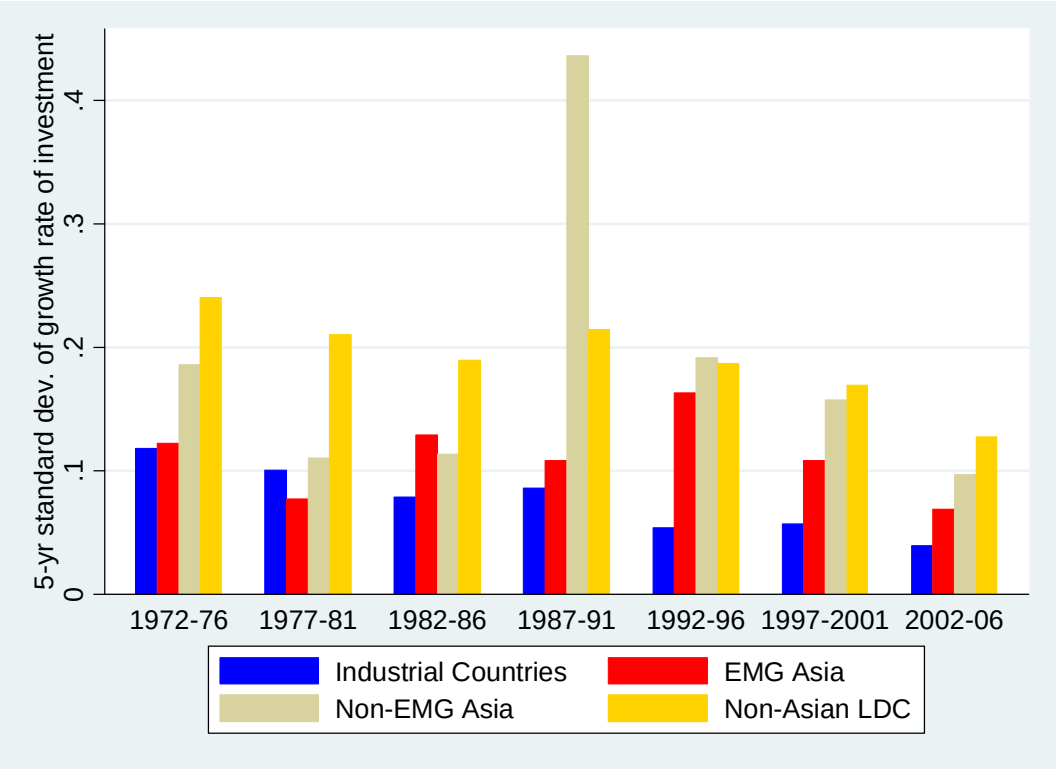


Figure 8: Regional Comparison of Investment Volatility and Real Exchange Rate Volatility

(a) Investment Volatility



(b) Real Exchange Rate Volatility

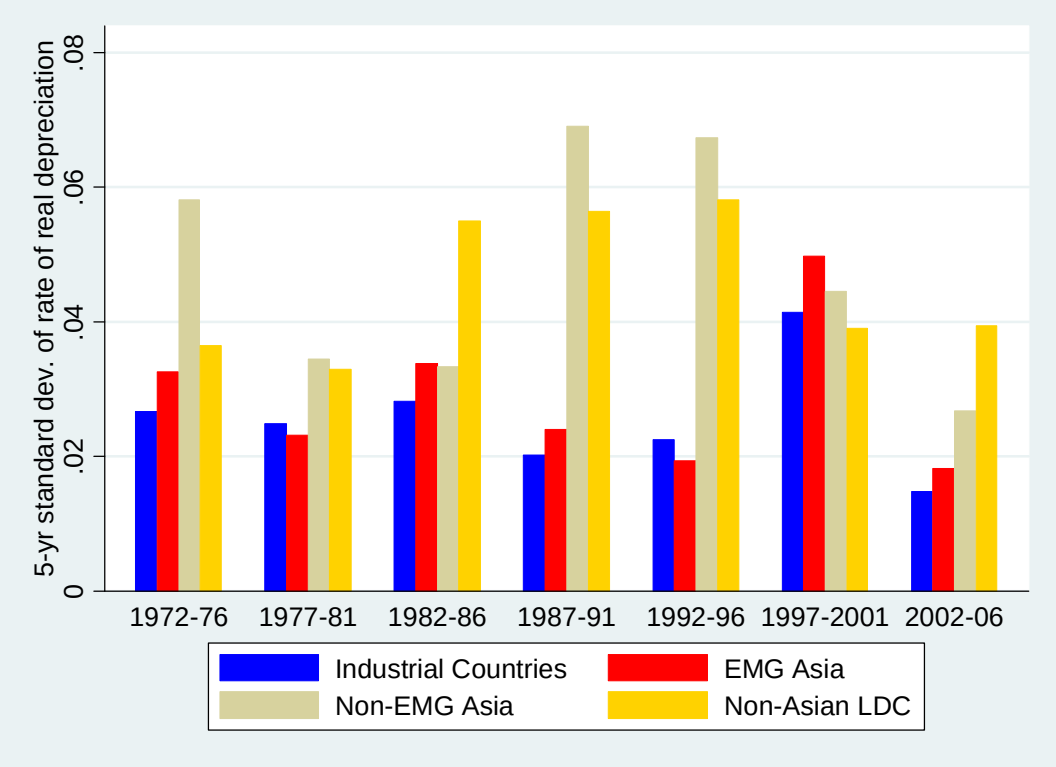
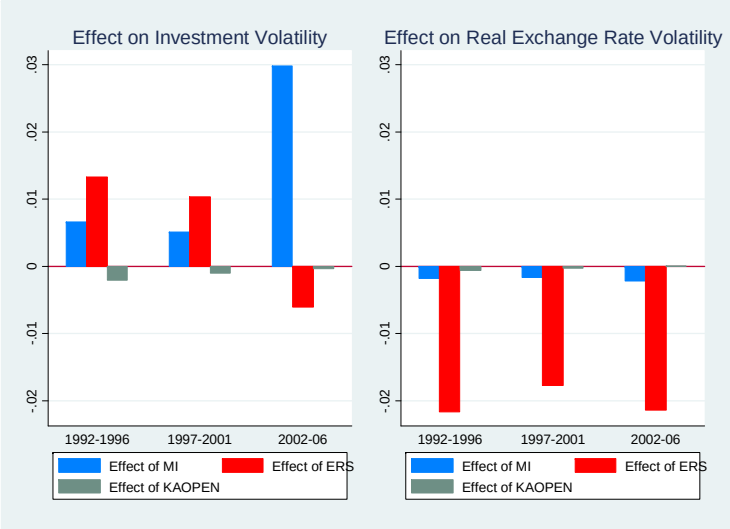
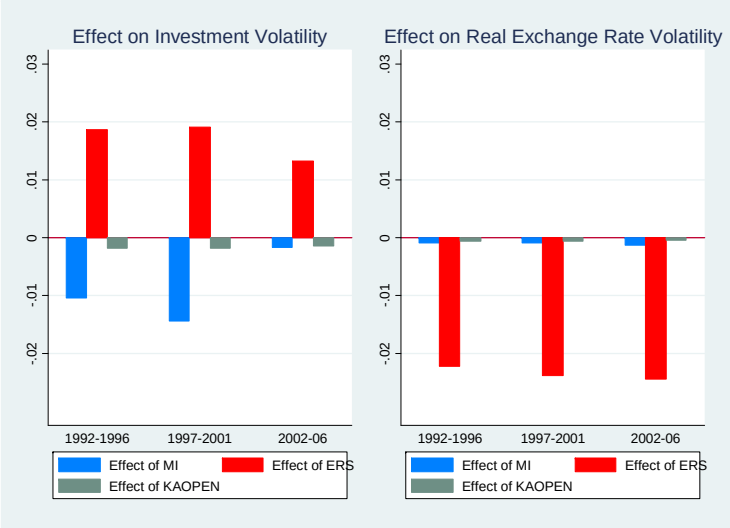


Figure 9: The Impacts of the Trilemma Configurations on Investment Volatility and Real Exchange Rate Volatility

(a) Developing Asia



(b) Non-Asian Developing Economies



(c) Latin American Countries

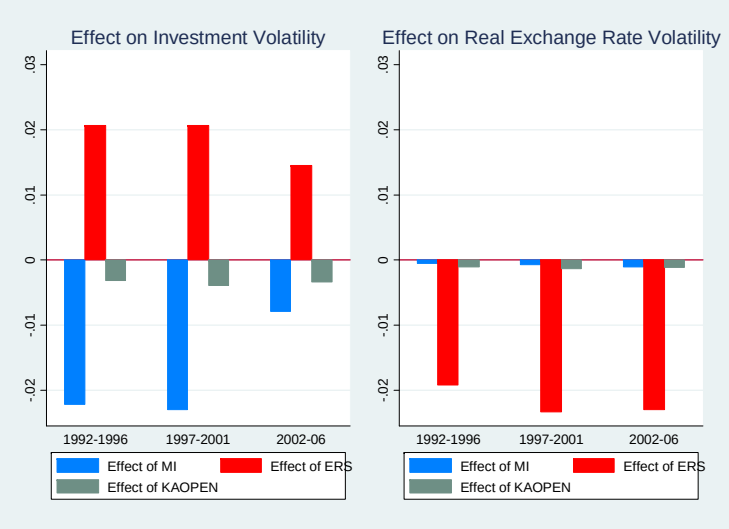


Figure 10:Contributions of Trilemma Policies to the Volatilities of Output, Investment, and the Real Exchange Rates

(a) Country groups (x = the average ratio of trade openness to the investment rate as of 2002-2006)

Emerging Market Economies in Asia (4.83) Non-Asian Developing Countries (3.50) EMG Coutries in Latin America (2.37)

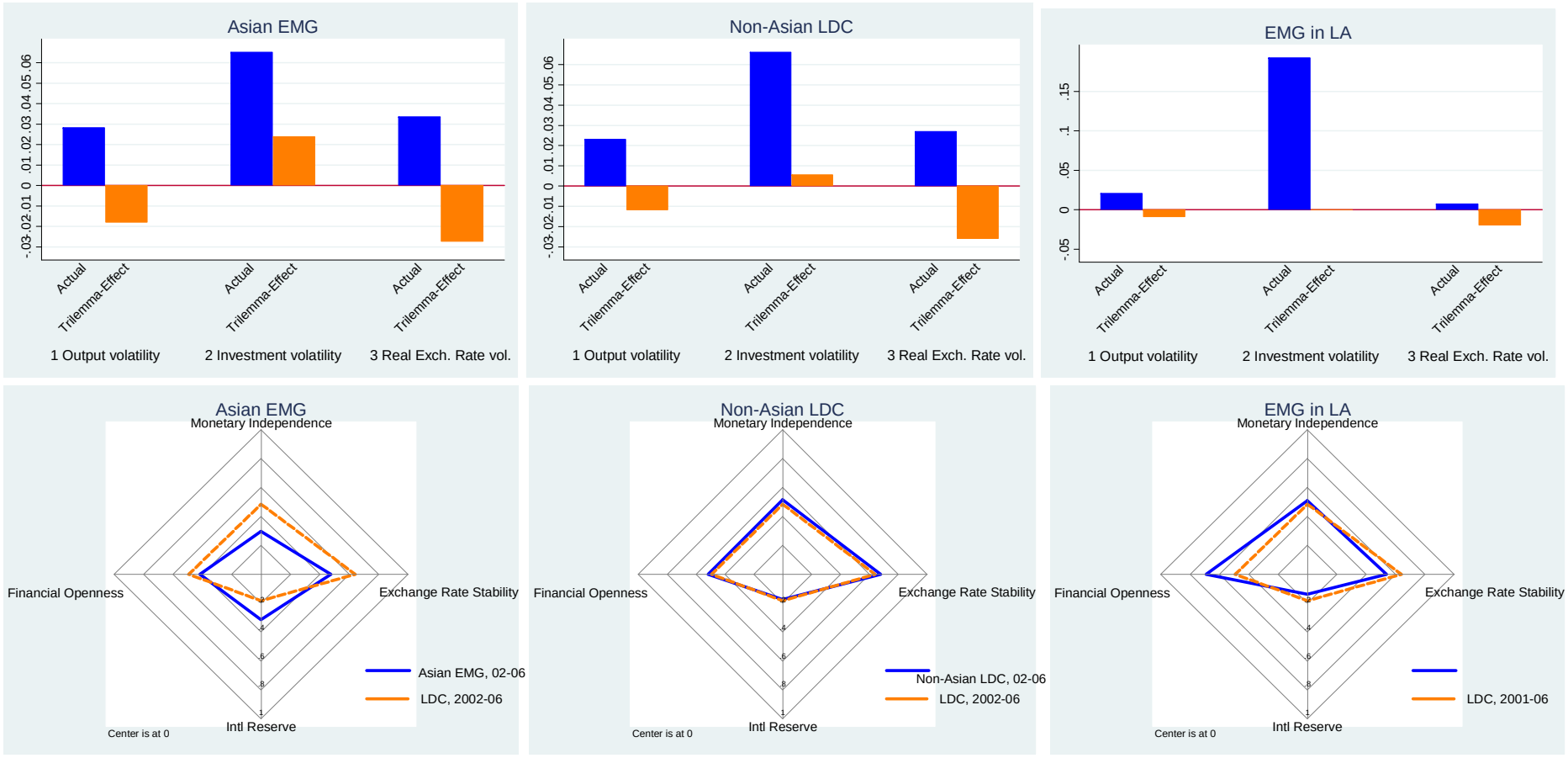
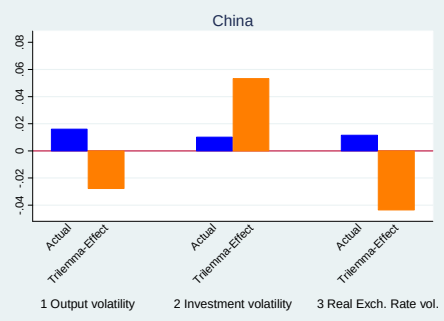
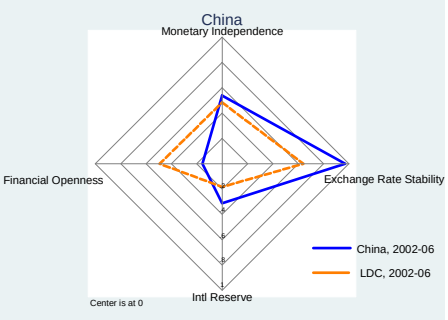


Figure 10: continued

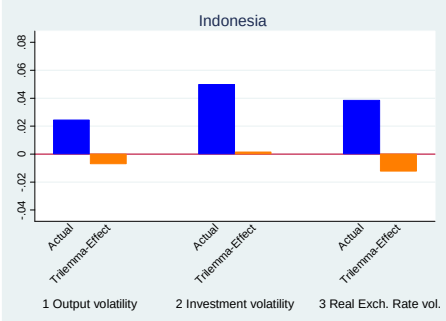
(b) Asian countries (x = the average ratio of trade openness to the investment rate as of 2002-2006)

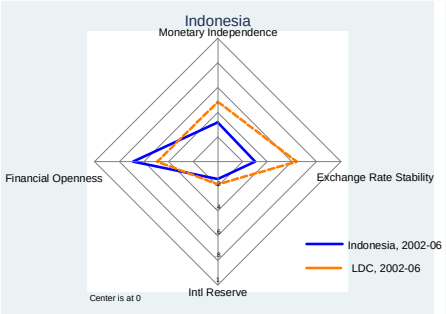
China (1.54)



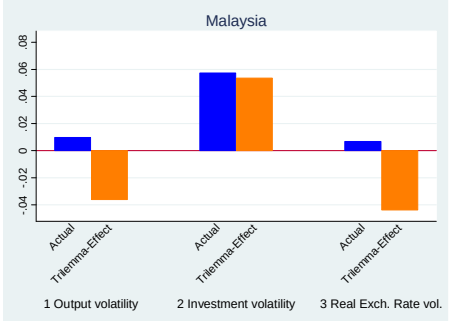


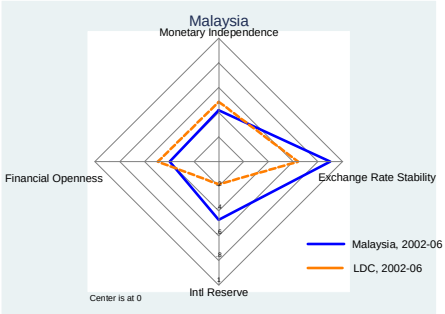
Indonesia (2.56)



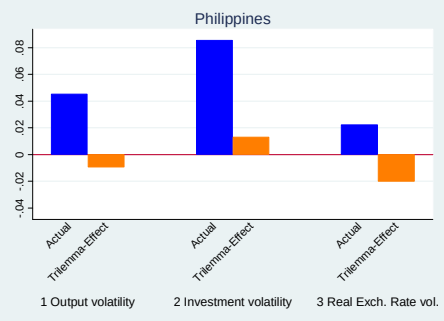


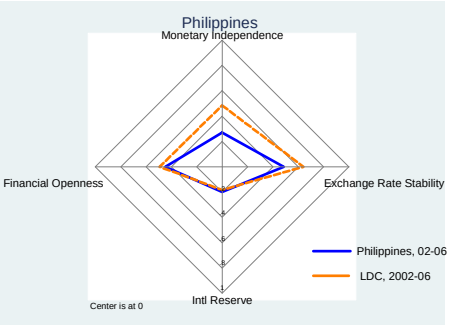
Malaysia (8.93)



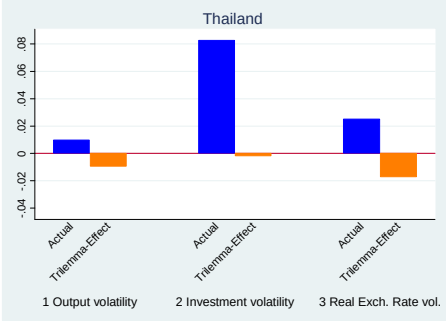


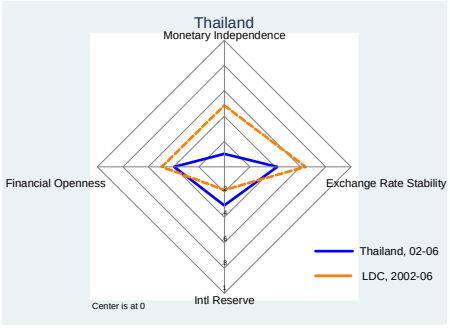
Philippines (5.27)



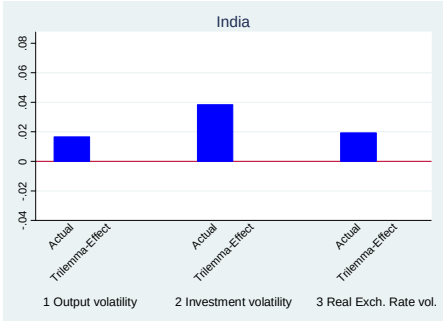


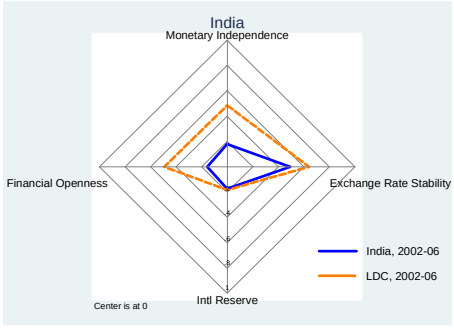
Thailand (5.84)





India (1.32)[35]



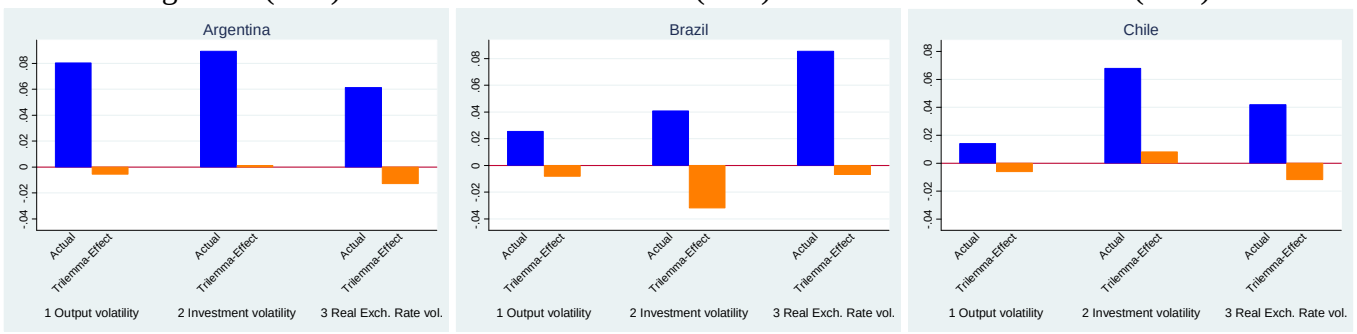


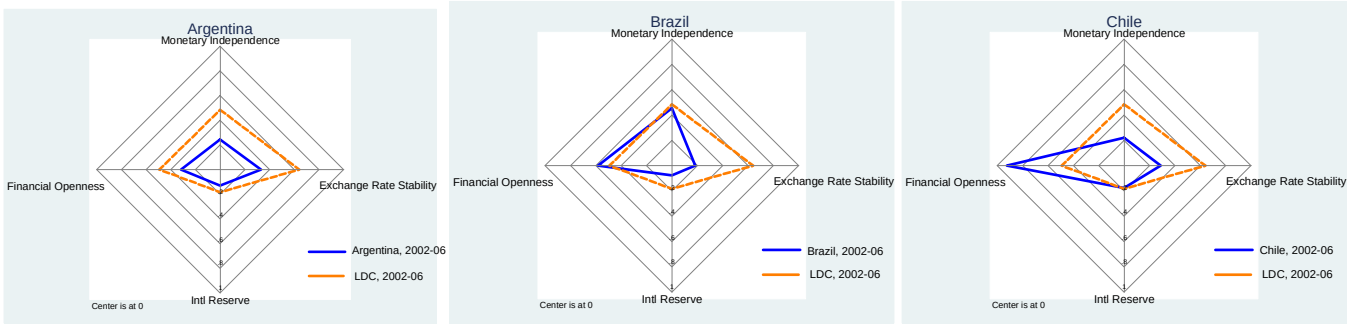
[35] India's data for 2002-06 was not available at the time of this study, thus the top figure showing the estimated trilemma effect for 2002-06 in India is not reported.

Figure 10: continued

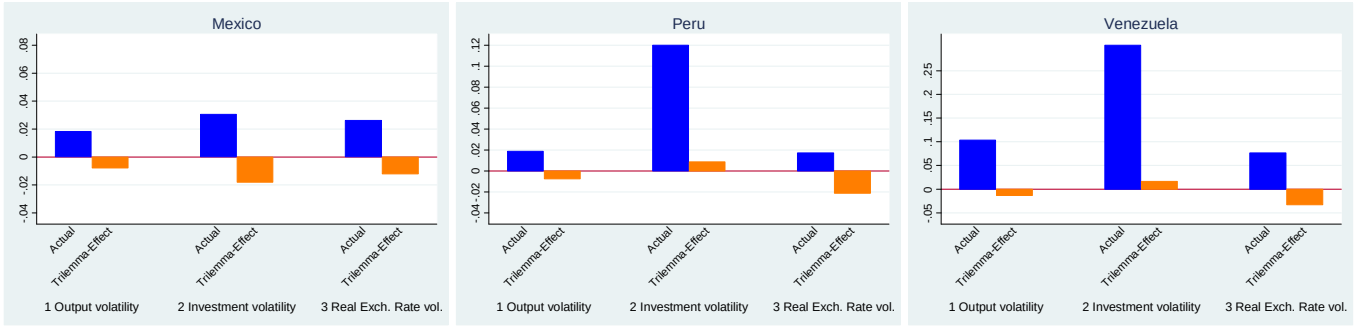
(b) Latin American countries (x = the average ratio of trade openness to the investment rate as of 2002-2006)

Argentina (2.49) | Brazil (1.79) | Chile (3.15)





Mexico (2.41) | Peru (2.14) | Venezuela (2.10)



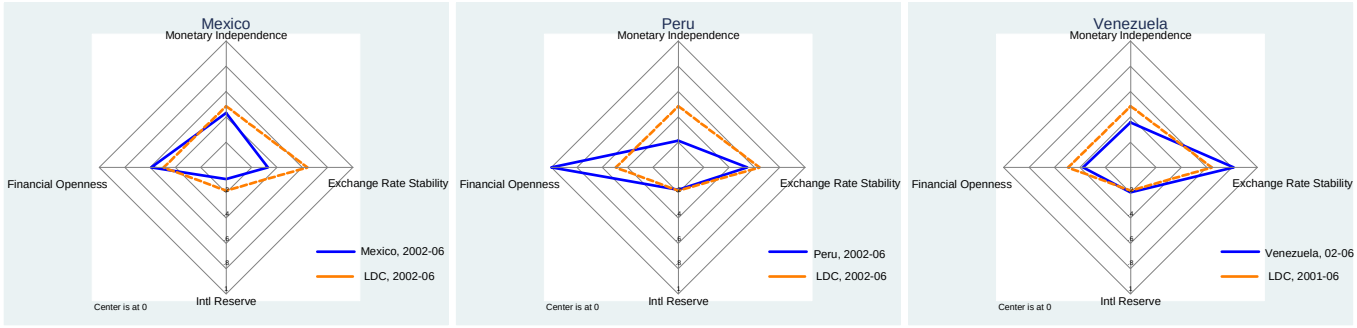


Figure 10: continued

(c) Other developing economies