Central Banking: Perspectives from Emerging Economies

By Menzie D. Chinn

University of Wisconsin and NBER

May 29, 2014

Abstract: The special challenges faced by central banks in emerging market economies in conducting monetary policy are examined. In addition to sharing the same problems confronted by their counterparts in advanced economies – including most profoundly time inconsistency and model uncertainty – they encounter more shocks emanating from the external environment, due to their relatively small economic size. In this context, the exchange rate and the management of capital flows take on a heightened importance. Overarching these concerns is the fact that most emerging markets, by definition, are characterized by less well developed financial markets that constrain and complicate the conduct of monetary policy. These points are illustrated by reference to a description of the evolution of (i) emerging market economies choices with regard to the international trilemma, (ii) the implementation of monetary policy, and (iii) the accumulation of foreign exchange reserves.

* Robert M. La Follette School of Public Affairs; and Department of Economics, University of Wisconsin, 1180 Observatory Drive, Madison, WI 53706-1393. Email: mchinn [at] lafollette.wisc.edu

"[T]o the gods we are as flies to wanton boys"

–William Shakespeare, *King Lear*

1. Introduction

In May 2013, market perceptions that the Federal Reserve would soon take steps to rein in quantitative easing measures led to sharp reversals in capital flows to emerging markets. The decision to taper – or at least the market perception of the decision -- was roundly criticized, and perhaps the most vociferous criticisms were delivered by emerging market central bank policymakers. And yet, equally vociferous complaints had been leveled, often by critics at those same institutions, at the implementation of unconventional monetary policies. Consider the recent speech by Raghuram Rajan, Governor of the Reserve Bank of India:

> "[T]he current environment is one of extreme monetary easing through
> unconventional policies. In a world where debt overhangs and the need for
> structural change constrain domestic demand, a sizeable portion of the
> effects of such policies spillover across borders, sometimes through a
> weaker exchange rate. More worryingly, it prompts a reaction. Such
> competitive easing occurs both simultaneously and sequentially, [so that]
> …[A]ggregate world demand may be weaker and more distorted than it
> should be, and financial risks higher. To ensure stable and sustainable
> growth, the international rules of the game need to be revisited." (Rajan,
> 2014)

It would be tempting to dismiss these criticisms as opportunistic attempts to lay blame for emerging market turmoil elsewhere. However, I believe it's more appropriate to view these complaints as a manifestation of the unenviable position that a typical emerging market central bank policymakers is in. Emerging market economies are typically small, in economic terms, relative to a global economy that is dominated by developments in the core advanced economies. So, while the international trilemma – the fact that a country cannot simultaneously pursue full monetary autonomy, exchange rate stability and financial openness -- constrains all economies, the degree to which the constraints bind is much more pronounced in emerging market economies.[1] For instance, a decision by the Fed to raise the policy rate drags up interest rates

---

[1] International market stress can also tighten the binds; capital flows respond strongly to the VIX.

around the globe. Corresponding decisions in a given emerging market seldom have a similar effect, except for the very largest of the emerging markets, and even then only occasionally.[2]

This asymmetry is of course not new. Consider the consequences of the decision by advanced economy central bankers to raise policy rates during the mid-1990's, after several years of negative real interest rates. At that time, similar complaints were lodged, and it's not unreasonable to at least partly trace the financial crises in Latin America and subsequently in East Asia to the cycle in core country policy interest rates.

The issue of size is not the only complication for emerging market central bankers. The other key factors includes the underdevelopment or distortion of the financial sector, along many dimensions. Historically, banks in emerging markets have subject to financial repression, government policies that regulated interest rates, or required holdings of government debt. More recently, with the advent of domestic financial liberalization in many countries, problems arising from financial repression have given way to boom-bust cycles and the accompanying cyclical costs.

Another problem more endemic to emerging market economies, at least historically, has been the inability of governments to issue sovereign debt denominated in domestic currency that is then traded internationally – i.e., "original sin" – and relatedly the pro-cyclical behavior of fiscal policy. As these characteristics recede, the task of macroeconomic stabilization may become easier; however, there is no guarantee that recent trends will continue.

Viewed against this backdrop, the perspectives of central bankers in emerging markets make sense. In this paper, I characterize emerging market central bank behavior, looking backward in time, and then focusing on the recent evolution of behavior.

The first section reviews the international trilemma (also known as the "impossible trinity") to describe the international constraints faced by emerging market central bank policy makers. Second, I describe the evolution of monetary policy over time, with specific reference to the recent adoption of inflation targeting, and examine how the different types of flexible inflation

---

[2] One exception is China. Given its large economic weight in terms of production, and its role as a source of saving flows, it's possible for its policy actions to move international asset prices. See Fratzscher and Mehl (2013), and Chinn (forthcoming).

targeting regimes actually implemented address some, but not all, of the special concerns facing emerging markets. The next section addresses the motivation for the marked accumulation of reserves over the past two decades, a special attribute of emerging market economies. I end with some conjectures regarding the future of monetary policy in emerging markets.

2. The International Trilemma

2.1 The historical context

In this examination, I focus on the set of emerging market economies as of 2014 – a set variously defined by the international financial institutions (IMF, World Bank) or other commercial organizations as encompassing about forty countries. However, it's useful to observe that the set of emerging markets has evolved over time, and the emerging markets of 1880 are in many cases the advanced economies of 2014. In other words, it would be wrong to think that the problems encountered by today's emerging market economies were not previously of importance. However, the economies of the periphery in the 1880's faced a world where the gold standard defined monetary policy. The problems posed by rigid exchange rate arrangements are still relevant for some emerging market economies, but those instances are rare, so I will defer to others on that subject.[3]

In the post-World War II era, the newly independent countries faced a world emerging from global conflict, with a newly established framework for international trade and finance. A wide variety of arrangements for monetary policy existed, but one defining characteristic, shared with advanced economies, was the essential lack of separation between the fiscal authority and the monetary authority. As a consequence, an apt characterization would be that the monetary policy largely served as a means of financing government deficits.

The breakdown of the Bretton Woods system marked a period of heightened choices for emerging market central banks. Fixed exchange rates, while still the norm, were no longer necessarily the default option, even for emerging market economies. Hence, this marks the point of departure for this analysis.

---

[3] See in particular Bordo (1981, 2005).

2.2 The choices

The international trilemma -- the thesis that a country can simultaneously choose any two, but not all, of the three goals of monetary independence, exchange rate stability, and financial integration – is illustrated in Figure 1. Each of the three sides of the triangle – representing monetary independence, exchange rate stability, and financial integration -- represents a goal. Clearly, it is not possible to be simultaneously on all three sides of the triangle. For instance, the top point, labeled "closed capital markets" is associated with monetary policy autonomy and a fixed exchange rate regime and the absence of financial integration.[4]

Countries have adopted different arrangements aimed at achieving combinations of two out of the three policy goals. The Gold Standard delivered capital mobility and exchange rate stability; the Bretton Woods system provided monetary autonomy and exchange rate stability. The fact that different economies have opted for different combinations indicates that policy authorities trade off certain goals as economic conditions evolve.[5]

Greater monetary independence allows policy makers to stabilize the economy through monetary policy without being subject to other economies' macroeconomic outcomes, thus potentially insulating the economy. However, in a world with price and wage rigidities, the resulting room for discretion means that policy makers might manipulate output movement, thus leading to increasing output and inflation volatility. On the other hand, monetary independence could permit a monetary authority to pursue an alternative nominal anchor that might simultaneously overcome the time inconsistency problem and preserve the option of pursuing countercyclical monetary policy.[6]

Alternatively, price stability could potentially be achieved through exchange rate stability; such stability could also mitigate interest rate and exchange rate uncertainty, thereby lowering the risk premium. The tradeoff is that greater levels of exchange rate stability could deprive policy makers of the option of using the exchange rate as a shock absorber. Prasad (2008) argues that

---

[4] See Obstfeld, Shambaugh, and Taylor (2005) for further discussion and references dealing with the trilemma.

[5] Aizenman et al. (2010) 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.

[6] Examination of the trilemma usually takes the constraint on monetary policy as being imposed on short run interest rates. There is some "wiggle room" associated with the fact that long term interest rates can, for a variety of reasons, be partly delinked from short rates. See Ito (2013); a contrary view, see Obstfeld (2014).

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.

The third goal, financial openness, has been, and remains, hotly debated. On the one hand, more open financial markets could lead to greater economic growth by encouraging greater efficient resource allocation, enhancing risk sharing, and supplementing domestic savings.[7] On the other hand, financial liberalization exposes economies to potentially destabilizing cross-border capital flows, and attendant boom-bust cycles (Kaminsky and Schmukler, 2002).[8]

2.3 The emerging market economies stand apart

Aizenman et al. (2010) develop a set of the trilemma indices that measure the degree to which each of the three policy choices is implemented. The monetary independence index (MI) is based on the inverse of the correlation of a country's interest rates with the base country's interest rate. The index for exchange rate stability (ERS) is the inverse of exchange rate volatility, measured as the standard deviations of the monthly rate of depreciation (based on 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).[9]

The evolution of the trilemma indices for different income-country groups is displayed in Figure 2. For the advanced economies (Figure 2.1), financial openness experienced a discrete upward shift after the beginning of the 1990s, while the extent of monetary independence declined. At the end of the 1990s, measured exchange rate stability rose significantly. These trends reflect the introduction of the euro in 1999.

---

[7] Although as Obstfeld (2013) notes in his survey, the benefits in practice of complete or near complete openness are difficult to discern, empirically.

[8] See Aizenman, et al. (2013) for a discussion of how differing combinations of exchange rate stability, monetary autonomy, and financial openness affect inflation levels, and output and inflation volatility.

[9] 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 . There is substantial disagreement regarding the extent to which de facto capital control measure the extent of actual insulation of monetary policy; see Klein (2012), and Klein and Shambaugh (2013).

The experience of the emerging market economies present a stark contrast (Figure 2.2). First, 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 resumed its ascent from 1990 onwards.[10] For the developing economies (Figure 2.3), 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 indices suggest a convergence toward the middle ground, even as discussion of the disappearing middle of intermediate exchange rate regimes rose in prominence. This pattern suggests that policymakers in these economies have been aiming for 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 coincides with the accumulation of sizable foreign exchange reserves, on the part of several key countries.

For developing economies, exchange rate stability has been the goal most aggressively pursued throughout the period. In contrast to the experience of the emerging market economies, financial openness has not been expanding for the non-emerging market developing economies, as a group.

One way to interpret the differential responses of emerging market and developing country is to consider the diverging perceptions regarding exchange rates. For advanced economies, with well-developed financial markets and the means to hedge exchange rate risk, exchange rates serve the textbook function of shock absorbers in an aggregate demand framework. For less developed countries, exchange rates are perceived as *sources* of financial and macroeconomic instability (by way of tradables prices and expected asset returns). Emerging market economies have developed over time sufficiently efficient financial markets so that the perception of exchange rates has shifted away from being a source of shocks and toward that of shock absorber. The convergence toward greater exchange rate flexibility makes sense in that context.

---

[10] In these figures, 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.

Some observations regarding Emerging Asia merit additional discussion.[11] Figure 3.1 shows that for these 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 indices diverged, but seem to have re-converged in the recent years. This characterization does not appear to be applicable to non-emerging market economies in Asia (Figure 3.2) or to non-Asia emerging market economies (Figure 3.3). 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.

One aspect not directly incorporated into the measurement of the trilemma is the accumulation of foreign exchange reserves. As long as capital openness is less than complete, there remains scope for controlled reserve accumulation/decumulation.

To the extent that external imbalances (private capital flows and current account balances) manifest in changes in official reserves, this has implications for monetary policy. Foreign exchange reserves are on the asset side of the balance sheet, so changes in reserves must result in corresponding changes in central bank liabilities (high powered money) in the absence of sterilization operations. Increases in money base will typically lead to increases in the money supply – once again in the absence of sterilization procedures such as bank reserve ratio increases.

Note sterilization is impossible if financial openness is complete. That's because infinite capital inflows or outflows would overwhelm any such attempts at sterilization. In practice, almost no country is completely open, as capital controls – or the threat of the imposition of such controls – is always present. And prudential regulations mean that the financial system usually means that there is a fair share of nontradable assets so that not all yields are equalized.[12]

Why do emerging market countries accumulate these reserves? There can be a variety of reasons, and indeed Ghosh, Ostry and Tsangarides (2012) argue that there have been a variety of

---

[11] In these figures, the sample of "Asian Emerging Market Economies" include Cambodia, China, Hong Kong, India, Indonesia, Rep. of Korea, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

[12] See Ito and Chinn (2007) for a discussion of political risk as a source of covered interest differentials. Chinn and Dooley (1997) examine the implications of nontradable assets due to banking system segmentation.

motivations over different periods; detailed discussion of this issue is reserved for Section 4. For the moment, I'll merely note that incomplete financial integration allows for controlled foreign reserve accumulation and decumulation, and thus reserves are important to track as part of an individual country's choices regarding the trilemma.

Aizenman, Chinn and Ito (2011) find that Asia, especially those economies with emerging markets, behave differently from other groups of economies; the middle-ground convergence took place earlier for this group, as opposed to all emerging market economies. In addition, the group of Asian emerging market economies stands out from the others with their sizeable and rapidly increasing amount of foreign reserve holding.

The Aizenman, Chinn and Ito measure of monetary independence describes how domestic short term interest rates depend on – or more properly fail to correlate to -- interest rates in a key foreign country. However, it doesn't specify how those interest rates are determined, so it is an incomplete description of the conduct of monetary policy. To further explain the evolution of monetary policy in emerging markets, the determinants of central bank policy rates are examined.

3. Describing Monetary Policy

3.1 Monetary autonomy, to what end?

The international trilemma defines the tradeoffs between short term monetary policy, exchange rate policy, and the degree of financial openness broadly defined, at an instant. But the existence of a tradeoff is not sufficient to define what monetary regime is actually implemented. This is an important point. Aizenman, et al. (2013) find that greater monetary independence is associated with lower output volatility, while greater exchange rate stability implies greater output volatility. Greater monetary autonomy is associated with a higher level of inflation while greater exchange rate stability and greater financial openness with a lower the inflation rate.

This characterization leaves out part of the story, because it lumps together countries that might be implementing very different monetary policy frameworks, even while enjoying some monetary autonomy. And choices regarding those different frameworks arise partly because

emerging market central banks face additional constraints in addition to those imposed by the international trilemma.

To organize concepts regarding the policy frameworks that have been applied in emerging markets, I rely on the taxonomy of Stone and Bhundia (2004). This taxonomy is based on the clarity of and transparency of the nominal anchor adopted.

- Monetary nonautonomy: the central bank does not issue its own currency
- Exchange rate peg: the central bank sets the value of the home currency relative to another, usually with the allowance for adjustments.
- Weak anchor: no nominal anchor is defined.
- Money anchor: a monetary aggregate is used as the nominal anchor.
- Full-fledged inflation targeting: the central bank aims for an explicit inflation goal.
- Implicit price stability anchor: the central bank pursues policies that target a given inflation rate, without explicit statement of that goal.
- Inflation targeting lite: the central bank pursues a broad inflation objective, but incorporates a role for the exchange rate.

The selection of one or the other of these regimes depends on the context.[13] For instance, the prevalence of a weak anchor regime – essentially one where monetary policy under discretion uses a variety of economic indicators to guide policy – seems somewhat mysterious until one considers the conditions in many emerging markets before the 1980's. Montiel (1994) sums up the situation:

> "In developing countries…the menu of assets available to private agents is very limited. Organized securities markets in which the central bank can conduct open market operations simply do not exist in many countries. By and large, individuals can hold currency as well as demand and time deposits issued by the banking system, and they can borrow from commercial banks. …[O]rganized equity markets are small or nonexistent. Capital controls and prohibitions on the holding of foreign exchange limit the extent to which foreign assets may be held by domestic residents, although parallel markets for foreign currency often emerge in response to

---

[13] Mishkin (1999) lays out a slightly different taxonomy: exchange rate targeting, monetary targeting, inflation targeting, and monetary policy with an implicit but not explicit nominal anchor.

such regulations, thereby allowing private agents to circumvent official
controls, at least in part. Finally, even in the case of those assets and
liabilities available to individuals such as demand or time deposits and
bank credit, official restrictions typically determine the interest rates paid
and charged by financial institutions."

In other words, the characteristics of emerging market financial systems – the absence of deep
equity and particularly bond markets -- meant that the monetary transmission mechanism worked
perhaps as strongly through credit as much as monetary channels.

As a consequence, monetary policy in emerging market economies, particularly before the
1990's, relied on an eclectic mix of money and/or credit stock targeting, and/or varying types of
exchange rate pegs, bands or managed floats. Monetary policy typically worked in tandem with
fiscal policy to fulfill various goals with respect to growth, inflation, external balances and
reserves accumulation, which changed over time.

In practice, monetary policy tended to be procyclical. One key reason for this outcome was the
high degree of fiscal procyclicality.[14] Kaminsky, Reinhart, and Vegh (2004) documented the
cyclicality in the monetary policy of a broad set of countries covering both emerging market and
advanced economies. When fiscal policy resulted in deficits greater than the maximum amount
of seignorage, then rapid inflation was the typical outcome; some of this phenomenon is hinted at
in Figure 4, which shows the median inflation rate in emerging market economies.

As a consequence of price instability, the search for nominal anchors gained strength during the
1980's. Entering the 1990's there was a growing recognition that nominal anchors in the absence
of central bank independence would be ineffectual. The East Asian crises of 1997 further
reinforced the belief in nominal anchor via hard pegs, given the perceived fragility crawling and
adjustable pegs.

While the advent of inflation targeting in New Zealand can be marked to the beginning of the
1990's, some form of inflation targeting only became a commonplace policy framework in
emerging market economies near the end of the decade, starting in Europe by way of Poland in

---

[14] Gavin and Perotti (1997), Talvi and Vegh (2004),

January 1998, East Asia in April of that year (Korea), and Latin America in June 1999 (Brazil).[15] The move to targets or rules based policies is closely associated with the move to autonomous or independent central banks.

In order to characterize the conduct of monetary policy since the late 1990's, it's useful to estimate reaction functions for monetary policy – essentially variants of the Taylor rules – for those countries that declared adherence to full-fledged inflation targeting, as well as those that did not.[16]

Obviously, not all central banks pursued inflation targeting, but even those that did not seemed to react to inflation and output, suggesting that they might have adhered to what Stone and Bhundia refer to as inflation targeting lite. And those that indicated that they followed inflation targeting sometimes reacted to other variables. That is, even for some inflation targeting central banks, the exchange rate and foreign exchange reserves exerted measurable effects on central bank decisions regarding the policy rate.

Aizenman, Hutchison and Noy (2010) examine the behavior of emerging market inflation targeters Brazil, Columbia, the Czech Republic, Hungary, Israel, Korea, Mexico, Peru, the Philippines, Poland and Thailand (see Figure 5 for inflation targets), and non-inflation targeters of Argentina, Indonesia, Jordan, Malaysia and Morocco, over the period from 1989-2006. They find in a panel setting that self-proclaimed inflation targeters do respond to the output and inflation gaps. Interestingly, the coefficient on the output *growth* gap (defined as HP filter deviations from trend growth) is typically small and statistically insignificant. On the other hand, the inflation rate does enter, usually with a short run coefficient of approximately 0.22-0.29.That means, given the partial adjustment mechanism assumed, a long run coefficient of between 1.4-1.7. That is a one percentage point increase in inflation induces a 1.4-1.7 percentage point increase in the policy rate.

---

[15] Israel is an early adopter, beginning in 1992. In addition, one can find earlier dates if one considers implicit inflation targets.

[16] One could imagine alternative reaction functions. Mehrota and Sanchez-Fung (2011) argue that hybrid functions incorporating nominal income targets fit better for several of the nominally inflation targeting countries.

They also find that emerging market inflation targeting central banks tend to lean against the wind when it comes to exchange rate changes; a 1 percent depreciation in the real effective exchange rate leads to a long run interest rate hike of 0.4 percentage points.[17]

The contrast with the non-inflation targeting countries is marked. In a specification including real exchange rate depreciation, the long run impact of a one percentage point inflation rate increase is 0.6. The tendency to lean against exchange rate depreciation is slightly more pronounced – each percentage point depreciation leads to a 0.5 increase in the policy rate in the long run (the short run impact does differ quantitatively and statistically, though). Another difference is that non-inflation targeters tend to react strongly to reserve accumulation. A one percent increase in foreign exchange reserves is associated with a 0.26 percentage point decrease in the policy rate.

One key distinction from advanced economy IT policies is that the output *growth* gap is not an economically or statistically significant determinant of the policy rate. In fact, the output growth gap is not important for the non-IT countries.

Commodity exporting inflation targeters behave somewhat differently than non-commodity exporters. Commodity exporters respond more strongly to inflation, as well as exchange rate changes, than do non-commodity exporters. I come back to this point in Section 3.3.

A more recent study by Ostry, Ghosh and Chamon (2012) obtains similar results through 2010, although for a slightly different specification. They find that inflation targeters respond to the extent of the real exchange rate deviation, rather than the real exchange rate depreciation.

3.2 Inflation targeting – or not – after the crisis

Do the same characterizations still apply to the inflation targeting regimes during and after the global financial crisis and its aftermath? In order to examine this question, I examine a set of countries slightly larger than Aizenman, Hutchison and Noy did, and over the slightly longer 1998-2013 period.

---

[17] Stone and Bhundia (2004) term a regime that augments inflation and output gap based reaction function with a responsiveness to exchange rates "inflation targeting lite", while Goldstein (2002) terms this "managed floating plus".

The IT emerging market countries include Brazil, Columbia, Hungary, Korea, Mexico, Peru, Philippines, Poland, and Thailand.[18] The non-IT emerging market sample is heterogeneous, and includes Argentina, Bulgaria, Chile, China, Estonia, Indonesia, India, Lithuania, Latvia, Malaysia, Russia, and Singapore.

The baseline specification is:

$$i_{it}^{policy} = \beta_0 + \beta_1 \pi_{it} + \beta_2 \hat{y}_{it} + \beta_3 \Delta q_{it} + \beta_4 \Delta res_{it} + \rho i_{it-1}^{policy}$$

Where π is 4 quarter CPI inflation, $\hat{y}$ is the output gap, q is the real exchange rate,[19] *res* is log foreign exchange reserves. $\beta_1, \beta_2 > 0$, and $\beta_3 > 0$ if the central bank leans against the wind with respect to the real exchange.[20] The lagged interest rate is included to account for the tendency of central banks to smooth the policy rate (see the data appendix for details).

Depending on the specification, β_3 or β_4 or both might be suppressed. Note that this specification imposes a constant target inflation rate (as well as equilibrium real interest rate).

The results of estimating the Taylor rule for the official inflation targeters are reported in Table 1; results for non-inflation targeters in Table 2.[21] The results in columns 1-3 in Table 1 confirm that inflation targeting countries respond to inflation; the coefficient on inflation is typically statistically significant, with the implied long run value of about 0.6. Since we have data on announced inflation targets (see Figure 5), one can also estimate:

$$i_{it}^{policy} = \delta_0 + \beta_1 \pi_{it} + \delta_1 \pi_{it}^{target} + \beta_2 \hat{y}_{it} + \beta_3 \Delta q_{it} + \beta_4 \Delta res_{it} + \rho i_{it-1}^{policy}$$

Where $\delta_1 < 0$.

The results corresponding to this specification are reported in columns 4-6. They also indicate the monetary authority responds positively to inflation, with the central bank tightening in

---

[18] No distinction is made between different levels of credibility and inflation targeting (see Carare and Stone, 2006).
[19] In principle, the deviation of the real exchange rate from a trend is more appropriate (see for instance Chinn and Dooley, 1998). However, the results using the HP deviations fail to exhibit significant coefficients in any specification.
[20] The channels by which reserves could induce a movement in the policy rate are multiple. It could be that reserves are accumulated in response to exchange rate deviations from trend (e.g., Ostry, Ghosh and Chamon, 2012), or reserves feed into money and credit stocks which then induce a tighter monetary policy. Notice that the sign on the coefficient is ambiguous.
[21] Estimates using OLS, with fixed country and time effects.

response to rising inflation, in the long run about 0.7-0.8 percentage points for each percentage point increase in inflation.

In contrast to the findings in Aizenman, Hutchison and Noy, inflation targeting central banks respond to the output gap (with a long run coefficient of about 0.5-0.7). The results differ in part because of the definition of the gap variable differs (they use *growth* gaps).[22]

Over the entire sample, inflation targeting central banks do not appear to respond to external factors, in accord with priors regarding a full-fledged inflation targeting regime (although the response to exchange rate depreciation is borderline significant (at the 17%) in column [5]). Unlike the findings of Aizenman, Hutchison and Noy, commodity exporters do not exhibit a substantially different responsiveness to exchange rate changes. Hence, at first glance, the inflation targeters appear to live up to their name.[23]

In Table 2, the results of the non-inflation targeters are reported, first for a larger sample of 14 emerging market economies (columns 1-3), and for a narrower sample of eight (columns 4-5). Monetary authorities respond fairly strongly to inflation – in the long run, as strongly as in the inflation targeting sample. Somewhat surprisingly, there is no marked response to the output gap. On the other hand, these central banks do appear to lean against the wind when it comes to the real exchange rate. In the long run, central banks raise the policy rate by one-third to one-half a percentage points in response to a 1% depreciation.

A fair characterization of emerging market central bank monetary policy is that several countries have adopted – and retained – inflation targeting. As Rose (2013) has shown, these inflation targeting regimes have proven remarkably durable, even in the face of the 2008 financial crisis and ensuing global downturn.

One caveat to this characterization is that while the framework has stayed in place where instituted, it has not necessarily stayed unchanged; Rose alludes to the fact that inflation targeting has survived exactly because it has been implemented in a flexible fashion.

---

[22] If the first difference of the output gap – approximately the same as the HP defined growth gap – is used, then the estimated output coefficient becomes statistically insignificant.

[23] These results contrast with Mohanty and Klau (2004), who examined the behavior of inflation targeters on a country by country basis.

The estimates of the parameters in the reaction functions over time confirms this point. The estimates have changed, particularly with respect to the exchange rate. Table 3 presents results for the Taylor rule, estimated over two subsamples, 1998-2007, and 2008-13.

The responsiveness to output deviations declines in economic and statistical terms. The long run impact post-crisis is about half of what was exhibited in the pre-crisis period, while the degree of interest rate smoothing increases. More interestingly, the results indicate that in the period up to 2007, inflation targeting central banks did seem to respond to exchange rates (in line with Aizenman, Hutchison and Noy, 2010). Over the 2008-13 period, central banks appear to respond to reserve accumulation by raising rates.[24]

No such correspondingly large change is apparent in the non-inflation targeting group, with respect to output gaps, inflation rates, or exchange rate changes.

3.3 Some macro factors inflation targeting doesn't address

While inflation targeting has not been adopted on a wholesale basis, a flexible inflation targeting framework does seem to characterize the monetary policy of a number of prominent emerging market economies. Moreover, even countries that have not adopted inflation targets appear to respond to inflation rates.

That being said, it is not clear that inflation targeting constitutes the most appropriate policy framework for most, let alone all, emerging markets. Some key issues include the extent and importance of exchange pass through, the prevalence of supply and terms of trade shocks, and the susceptibility to asset bubbles.[25]

Exchange rate pass through, One aspect of most emerging market economies is their relatively greater trade openness. Exports and imports, expressed as a ratio to GDP, is typically higher than in the core advanced economies such as the G-7. At the same time, because imports to emerging markets tend to be denominated in foreign currencies, and exports in foreign currency, exchange rate pass through into domestic prices is usually higher than it is in the G-7 economies.

---

[24] Instrumenting reserve changes with the US policy interest rate and lags in the rate and accumulation to account for endogeneity yields the same positive coefficient. These instruments might not be adequate to fully address reverse causality.

[25] This section draws heavily on Frankel (2011).

Consequently, exchange rate changes have proportionately larger impacts on wide swaths of a typical emerging market economy.

As noted in the previous section, inflation targeting narrowly defined, doesn't mean that the monetary authority won't respond to exchange rate changes. However, the effect is indirect, and it's only by virtue of the impact of exchange rates on aggregate prices that the exchange rate matters.

However, it's plausible that the central bank should care about the extent of exchange rate changes, not only because it potentially affects the price level, but additionally because it has ramifications for the relative price of tradables and nontradables.

Terms of trade shocks. Relatedly, when the terms of trade deteriorate for reasons other than exchange rate changes– for instance as a consequence of an oil price increase – there is a likelihood of a feed through into the price level and domestic inflation. This implies that the response of the central bank under inflation targeting will be to tighten monetary policy by raising interest rates; however, in terms of demand management, this doesn't make sense, as it makes policy more contractionary at exactly the times that one would want a more expansionary policy.

Supply shocks. This is not a problem specific to emerging markets, but is perhaps more pronounced, especially if such shocks dominate output fluctuations. Aguiar and Gopinath (2007) point out that the cycle is the trend in most emerging market economies, so supply shocks are more important. Then positive supply shocks exert downward pressure on prices, which prompt interest rate declines. In the absence of distortions in the financial system, this procyclicality might not be too problematic. However, if feedback loops associated with collateral constraints are in force, then these policies are likely to exacerbate financial boom-bust cycles.

3.4 Macroprudential issues and inflation targeting

This point regarding boom-bust cycles leads to the issue of monetary policy and the threat of asset bubbles. Since this is topic applies to advanced economies as well as emerging market economies, the issues are relatively well known. The positive feedback loops that lead to the boom-bust cycle in asset prices during the 2000's were, in retrospect, not dealt with adequately

by flexible inflation targeting focused on goods prices (see Chang, 2013, for a discussion of the challenge of financial frictions to the case for inflation targeting).

These concerns are of even greater importance in emerging markets where capital inflows are large relative to the size of the domestic financial markets, and regulatory infrastructure even less well developed. The degree of asymmetric information is likely more pronounced in these economies. The additional constraints imposed by these other international financial linkages – what Obstfeld (2014) terms the financial trilemma – are of great importance.

Currency mismatches and original sin. One of the characteristics of emerging market economies is that the government is typically constrained to borrowing in foreign currencies when accessing international markets. In addition, most domestic firms are typically only rarely able to issue debt in domestic currency terms; rather they will issue debt in foreign currency (if available). Cross border borrowing from the international banking system is often denominated in foreign currency terms because it is substantially cheaper.[26]

As a consequence, domestic firms – including banks – often build up mis-matches on their balance sheets that exhibit currency mismatches that can lead to insolvency should there be rapid and large changes in currency values. For instance, if liabilities are in US dollars, but assets in domestic currency, then a large devaluation (or depreciation) can lead to insolvencies of a breadth sufficient to pose a systemic risk. This leads to ambiguous implications for observed central bank behavior: it means a lean against the wind policy, particularly for large changes. On the other hand, it suggests that excess rigidity can lead to insufficient hedging against exchange rate risk.

3.5 Inflation targeting and prerequisites

One complicating factor is the procyclical behavior of the fiscal authority in many emerging market economies, at least traditionally. Typically, governments have raised spending when tax revenues were high and borrowing in international markets relatively easy. However, those times are exactly the times when on aggregate demand management terms one would like a restrained

---

[26] See Eichengreen, Hausmann and Panizza (2007) for an explication of the distinctions between original sin and currency mismatch (as well as debt intolerance). See Cespedes, Chang and Velasco (2004) for an examination of the importance of balance sheet effects.

fiscal policy. On the other hand, fiscal policy has tended to be relatively tight when the economy has receded, as revenues decline and international sources of lending dry up as perceived risk rises. Fiscal deficits can be run as long as the central bank has been willing to finance the deficit by way of monetization. It's exactly the presence of such conditions that elicited the skepticism by Masson et al. (1997) that inflation targeting would be implemented widely.[27]

This procyclicality of fiscal policy has been well documented (Talvi and Vegh, 2005)[28]. In a sample extending from 1960 to 1999, Frankel, Vegh and Vuletin (2011) show that almost no emerging market or less developed countries exhibited countercyclical fiscal policy.[29] However, since 2000, several emerging market countries have graduated from procyclical to countercyclical fiscal policy, as shown in Figure 6. Berman and Hutchison (2014) argue that this decline in procyclicality is partly due to the implementation of fiscal rules.

Coulibaly (2013) contends that the increasing popularity and success of inflation targeting – either in its explicit form or as one of several important goals – is partly due to the changing conditions, including less pronounced fiscal procyclicality. Lower government debt burdens and less short term external debt also count.

If the trend toward more countercyclical fiscal policy and favorable debt burdens remain in place, then two offsetting forces will be in place. On the one hand, inflation targeters will be better able to hit their targets in a benign macroeconomic environment. On the other hand, the need for a nominal anchor based on inflation becomes less pronounced. That is the optimal trade-off between inflation targeting -- that aims to overcome time consistency problems -- and alternative monetary frameworks that are motivated by minimizing cyclical fluctuations, evolves over time.

4. Reserve Accumulation and Self-Insurance

One of the central differences between the central bank policy in the advanced economies and the emerging market economies is the marked buildup of reserves, particularly since the East Asian financial crises of 1997-98. China, the world's largest holder of foreign exchange reserves,

---

[27] Relatedly, there is the concern that the level of institutional development is not sufficient to support inflation targeting; see Mishkin (2004).
[28] Originally circulated in 1998.
[29] See also Ilzetzki and Vegh (2008).

currently holds nearly \$4 trillion of reserves,[30] accounting for approximately 30% of the world's total. As of the first quarter of 2014, the top 10 reserve holders are all emerging market or developing economies, with the exceptions of Japan and Switzerland. The eight developing economies, including China, Korea, the Russian Federation, and Taiwan, hold approximately 60% of world foreign exchange reserves. These developments have contrasted sharply with those applying to the advanced economies. As illustrated in Figure 7, advanced economies – which happen to be fairly financially open – have not accumulated a lot of foreign exchange reserves relative to GDP. The relatively closed non-advanced economies (which include developing as well as emerging market economies) have accumulated lots of reserves, and that trend has continued over time.

Why have emerging market economies accumulated such large stocks of reserves? Various motivations have been forwarded, ranging from the traditional motivations – coverage of shocks to trade flows – to mercantilism, and self-insurance against capital account shocks. Ghosh, Ostry and Tsangarides (2012) attempt to decompose emerging market reserve accumulation into component parts. Their analysis yields the decomposition displayed in Figure 8.

Their analysis suggests that some of the reserve accumulation is motivated by maintaining sufficient funds to cover shocks to trade flows, and only a small (but measurable) proportion to mercantilist motives. However, an important driver of recent reserve accumulation in this group of countries is self-insurance against capital account shocks, such as those that might arise due to a sudden stop.

Even in the absence of sudden stops, the vagaries of international capital markets makes caution the preferred course. Consider the consequences of the expansionary monetary policies undertaken by the US in 2008 onward. In addition to driving the overnight rate driven to zero, the Fed undertook quantitative easing – purchases of long term Treasury securities and Agency mortgage backed securities – that were perceived to have caused large spillovers to emerging market economies.

There is merit in these perceptions. Chinn (2013) surveys studies, including those by Fratzscher, Lo Duca and Straub (2013), that indicate a substantial depreciation of the dollar, and increase in

---

[30] March 2014 data.

outflows to emerging market economies, as a consequence of unconventional monetary policies, particularly QE2. The increase in the Fed balance sheet is also shown to have ambiguous effects on exchange rates in the largest emerging market economies of Brazil, Russia, India and China.[31] The corresponding displeasure at the Fed's suggestion of a taper in the large scale asset purchases suggests that there were substantial spillover effects.[32]

It's important to recall that a similar pattern of capital flow surges occurred during a previous episode of Fed easing – namely the drop in interest rates during the 1990-91 recession, and the eventual tightening of policy in 1994. At that time, there was substantial discussion of push and pull factors in capital flows to emerging markets. Then, as now, push factors due to depressed advanced country yields was important (Calvo, et al., 1993; Fernandez-Arias, 1996; Dooley, Fernandez-Arias and Kletzer, 1996).

In this sense, the emerging market central bank view that in a world of high capital mobility, it is eminently rational to build up reserves to guard against financial crises of the sort that afflicted East Asia and Latin America during the 1990's. The consensus in the literature certainly tends to buttress the view that countries with an insufficient level of reserves experienced more serious currency and financial crises -- see for instance Flood and Marion (1999), Berg and Pattillo (1999), Reinhart and Kaminsky (1999), Gourinchas and Obstfeld (2012), Catao and Milesi-Ferretti (2013) and Obstfeld (2013).

Further confirmation comes from the most recent episode of global financial stress. It appears to be the case that the accumulation of foreign reserves protected countries from the negative shock. In particular, Bussiere, Chen, Chinn and Lisack (2014) find that the foreign reserves to short term debt variable two years prior to the global crisis is positively and significantly correlated with the real GDP growth deviation from the trend; the coefficient from the full specification with control variables is 0.73.[33] Hence, a doubling of the reserves to debt ratio is

---

[31] Other studies include Chen et al. (2012), IMF (2013a,b).

[32] For assessments of the impact of the taper, see Lim et al. (2014), Eichengreen and Gupta (2014), and Aizenman et al. (2014).

[33] The results are robust to using alternative measures of economic performance. Using the deviation from the World Economic Outlook forecast, we obtain a similar estimate of 0.62.

associated with a 0.4 to 0.5 percentage point faster growth rate. This result is robust to the exclusion of outliers and small countries.[34]

Moreover, Bussiere et al. observe that a larger depletion of reserves during the crisis is associated with a stronger rebound. This seems once again to confirm countries' increasing appetite for reserve assets as a means of self-insurance.

The pace of reserve accumulation has slowed down in the last couple of years – with the notable exception of China. There are several competing stories about the recent "flattening-out" in reserve accumulation. First, it is possible that, once a country reaches its pre-crisis level of reserves, it slows the pace of foreign reserve accumulation, since holding large reserves incurs opportunity costs and possibly large risks associated with valuation effects. Second, the deceleration of foreign reserve accumulation might reflect a change of policy priority with regard to monetary autonomy, exchange rate stability and financial openness in the wake of the 2008-2009 financial crisis. Lastly, if foreign reserve accumulation tails off, it might be because of the stabilization of the underlying macroeconomic variable – short-term debt as argued by Bussiere et al. (2014) -- that foreign reserves are accumulated to cover.[35]

5. Some Conjectures Regarding the Future

Policymakers in emerging market economies face a variety of challenges that differ from those facing their counterparts in advanced economies. These include less developed financial markets, relatedly a susceptibility to rapid reversals in capital in- and out-flows, a minimal ability to influence global markets, an inability to borrow internationally in domestic currency, and finally procyclical fiscal policies. On top of these conditions is the fact that the economies are typically relatively small in economic terms so that the international trilemma binds more strongly.[36]

---

[34] See also Dominguez, Hashimoto and Ito (2012) for similar results for a smaller set of countries.
[35] Results obtained from estimating VECM's lend support to this last interpretation. That is, with the `flattening-out' of short-term debt after the financial crisis, the demand for foreign reserves will tend to decline.
[36] Rey (2013) argues that increased financial globalization means that the trilemma has reduced in practice to a dilemma – essentially, insulation from world capital markets via capital controls is not feasible. Hence, core country monetary policies drive periphery country monetary policies, regardless of exchange rate regimes. Klein and Shambaugh (2013) provide evidence that floating regimes (and to a lesser extent) provide monetary autonomy.

After experimenting with a wide different monetary and exchange rate policies over the 1960's through the 1980's, numerous central banks have implemented various forms of inflation targeting – usually incorporating a role for exchange rates. Thus far, no country that has implemented formal inflation targeting (either by the IMF or other criterion), leading Rose (2013) to conclude that inflation targeting has proved to be a remarkably durable framework, surviving even the global financial crisis.

One way to look at this success is that for certain countries, the tradeoff between the usefulness of a nominal anchor to overcome time inconsistency problems and countercyclical stabilization has been favorable to the former. For others, it has not. For those in the latter group, the costs of failing to respond to terms of trade shocks and the need for self-protection have outweighed the time inconsistency concerns.

Other conditions have changed, also altering the calculus. The extent of original sin has declined over the past decade, particularly for certain countries. This decline is shown in Figure 9. That development suggests that the exchange rate might figure less prominently in central banks' calculations. Working in the other direction, Hausmann and Panizza (2010) argue the reduction in original sin has been modest.

Emerging-market-ness is a temporary phenomenon, and the emerging market economies of today will eventually graduate to advanced country status. At that juncture, the tradeoff will likely change. On the other hand, some developing countries will move into the emerging market category, and then confront the same choices. In other words, the emerging market economies – and their particular set of concerns – will always be with us.

References

Aguiar, Mark and Gita Gopinath, 2007, "Emerging Market Business Cycles: The Cycle Is the Trend," *Journal of Political Economy 115*: 69-102.

Aizenman, Joshua, Menzie Chinn, and Hiro Ito, 2013, "The "Impossible Trinity" Hypothesis in an Era of Global Imbalances: Measurement and Testing," *Review of International Economics 21*(3): 447-458.

Aizenman, Joshua, Menzie Chinn, and Hiro Ito, 2011, "Surfing the Waves of Globalization: Asia and Financial Globalization in the Context of the Trilemma," *Journal of the Japanese and International Economies* 25: 290-320.

Aizenman, Joshua, Menzie D. Chinn, and Ito, Hiro, 2010, "The Emerging Global Financial Architecture: Tracing and Evaluating New Patterns of the Trilemma Configuration", *Journal of International Money and Finance*, 29(4), 615-641.

Aizenman, Joshua, Michael Hutchison and Ilan Noy, 2011, ""Inflation targeting and real exchange rates in emerging markets," World Development 39(5): 712-724.

Aizenman, Joshua, Benici Mahir, and Michael Hutchison, 2014, "The Transmission of Federal Reserve Tapering News to Emerging Financial Markets", NBER Working Paper 19980.

Berg, Andrew, and Catherine Pattillo, 1999, "Are currency crises predictable? A test", *IMF Staff Papers* 46(2).

Bergman, Michael, and Michael Hutchison, 2014, "The End of the Great Moderation? Challenges to Economic Stability in Emerging Markets in the Post-Crisis Era," paper presented at JIMF-USC conference "Financial Adjustment in the Aftermath of the Global Crisis 2008-09: New Global Order?" April 18-19, 2014.

Bordo, Michael D., 2005, *The gold standard and related regimes: collected essays*. Cambridge University Press.

Bordo, Michael D., 1981, "The Classical Gold Standard: Some Lessons for Today," *Federal Reserve Bank of St. Louis Review* (May).

Bussière, Matthieu, Gong Cheng, Noëmie Lisack and Menzie Chinn, 2014, "For a Few Dollars More: Reserves and Growth in Times of Crises," *NBER Working Paper* No.19791 (January).

Calvo, Guillermo A, Leonardo Leiderman, and Carmen M. Reinhart, 1993, "Capital Inflows to Latin America: The Role of External Factors," *IMF Staff Papers* 40: 108-51.

Carare, Alina, and Mark R. Stone, 2006, "Inflation Targeting Regimes," *European Economic Review 50*(5): 1297-1315.

Catao, Luis, and Gian-Maria Milesi-Ferretti, 2013, "External Liabilities and Crises", *IMF Working Paper* 13/113 (Washington, D.C.: International Monetary Fund, May).

Cespedes, Luis, Roberto Chang and Andres Velasco, 2004, "Balance Sheets and Exchange Rate Policy," *American Economic Review* 94: 1183-1193.

Chang, Roberto, 2013, "Rethinking Monetary Policy After the Crash," paper presented at conference "Setting Up the Monetary Policy Framework: What Role for Financial Sector Considerations? " Graduate Institute of International and Development Studies, Geneva, October 2013.

Chen, Qianying, Andrew Filardo, Dong He, and Feng Zhu, 2012, "International Spillovers of Central Bank Balance Sheet Policies," in *Are Central Bank Balance Sheets in Asia Too Large?* BIS Papers No. 66 (October), pp. 230-274.

Chinn, Menzie, 2013, "Global Spillovers and Domestic Monetary Policy: The Impacts on Exchange Rates and Other Asset Prices," *BIS Working Paper* No.436 (Basel: BIS, December).

Chinn, Menzie, forthcoming, "Global Supply Chains and Macroeconomic Relationships in Asia," forthcoming in *Global Supply Chains and Trade in Value Added*, edited by Benno Ferrarini and David Hummels (Asian Development Bank).

Chinn, Menzie and Michael Dooley, 1998, "Monetary Policy in Japan, Germany and the United States: Does One Size Fit All?" in *Japanese Economic Policy Reconsidered*, edited by Craig Freedman (London: Edward Elgar, 1998): 179-217.

Chinn, Menzie and Michael Dooley, 1997, "Asia-Pacific Capital Markets: Measurement of Integration and the Implications for Economic Activity," in *Regionalism versus Multilateral Trading Arrangements*, edited by Takatoshi Ito and Anne O. Krueger (Chicago: Chicago U. Press for NBER, 1997): 169-196.

Chinn, Menzie and Hiro Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions and Interactions," *Journal of Development Economics* 61(1): 163-192.

Chinn, Menzie and Hiro Ito, 2008, "A New Measure of Financial Openness," *Journal of Comparative Policy Analysis* 10(3): 307-320.

Chinn, Menzie and Shang-Jin Wei, 2013, "A Faith-based Initiative: Do We Really Know that a Flexible Exchange Rate Regime Facilitates Current Account Adjustment?" *Review of Economics and Statistics 95*(1): 168-184.

Dominguez, Kathryn M.E., Yuko Hashimoto, and Takatoshi Ito (2012) "International reserves and the global financial crisis," *Journal of International Economics* 88(2): 388-406.

Dooley, Michael, Eduardo Fernandez-Arias, and Kenneth Kletzer, 1996, "Is the debt crisis history? Recent private capital inflows to developing countries," *The World Bank Economic Review* 10(1): 27-50.

Eichengreen, Barry, and Poonam Gupta, 2014, "Tapering Talk: The Impact of Expectations of Reduced Federal Reserve Security Purchases on Emerging Markets", *mimeo* (January).

Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza, 2007, "Currency Mismatches, Debt Intolerance, and the Original Sin: Why They Are Not the Same and Why It Matters," in *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences,* Sebastian Edwards (ed.), (Chicago: University of Chicago Press).

Fernandez-Arias, Eduardo, 1996, "The New Wave of Private Capital Inflows: Push or Pull?." Journal of Development Economics 48(2): 389-418.

Frankel, Jeffrey, 2011, "Monetary Policy in Emerging Markets: A Survey," *Handbook of Monetary Economics*, edited by Benjamin Friedman and Michael Woodford (Elsevier: Amsterdam, 2011).

Frankel, Jeffrey, Carlos Végh, and Guillermo Vuletin, 2011, "On Graduation from Procyclicality", *mimeo*, University of Maryland.

Fratzscher, Marcel, and Arnaud Mehl, 2013, "China's Dominance Hypothesis and the Emergence of a Tri-polar Global Currency System," *The Economic Journal*.

Fratzscher, Marcel, Marco Lo Duca, and Roland Straub, 2013, "On the International Spillovers of US Quantitative Easing," *Discussion Papers of DIW Berlin* 1304, (Berlin, German Institute for Economic Research).

Fry, Maxwell, 1998, "Assessing Central Bank Independence in Developing Countries: Do Actions Speak Louder than Words? *Oxford Economic Papers* 50 (3): 512-529.

Ghosh, Atish R. ; Ostry, Jonathan David ; Tsangarides, Charalambos G., 2012, Shifting Motives: Explaining the Buildup in Official Reserves in Emerging Markets since the 1980s," *IMF Working Paper* No. 12/34 (Washington, D.C: IMF, January).

Goldstein, Morris, 2002, *Managed floating plus* (Washington, D.C.: Peterson Institute).

Gourinchas, Pierre-Olivier, and Maurice Obstfeld (2012), "Stories of the Twentieth Century for the Twenty-first," *American Economic Journal: Macroeconomics* 4(1): 226–65.

Hausmann, Ricardo, and Ugo Panizza, 2010, "Redemption or Abstinence? Original Sin, Currency Mismatches and Counter-Cyclical Policies in the New Millenium," *Center for International Development Working Paper* No. 194 (Cambridge: Harvard, February).

Ilzetzki, Ethan, and Carlos A. Végh, 2008, Procyclical Fiscal Policy in Developing Countries: Truth or Fiction? *NBER Working Paper* No. 14191.

IMF, 2013a, Unconventional Monetary Policies – Recent Experience and Prospects (Washington, D.C.: IMF, April 18).

IMF, 2013b, Unconventional Monetary Policies – Recent Experience and Prospects – Background Paper (Washington, D.C.: IMF, April 18).

Ito, Hiro, 2013, "Monetary Policy in Asia and the Pacific In the Post, Post-Crisis Era," paper prepared for 36th Pacific Trade and Development (PAFTAD) Conference "Financial Development and Cooperation in Asia and the Pacific," November 19-21, 2013.

Ito, Hiro and Menzie Chinn, 2007, "Price-based Measurement of Financial Globalization: A Cross-Country Study of Interest Rate Parity," *Pacific Economic Review* 12(4): 419-444.

Kaminsky, Graciela L., Carmen M. Reinhart, and Carlos A. Végh, 2005, "When it rains, it pours: procyclical capital flows and macroeconomic policies." *NBER Macroeconomics Annual 2004*, Volume 19. (Cambridge: MIT Press): 11-82.

Kaminsky, Gracia and Sergio L. Schmukler, 2002,"Short-Run Pain, Long-Run Gain: The Effects of Financial Liberalization. *IMF Working Paper* No. 0334 (Washington, D.C.: International Monetary Fund, October).

Klein, Michael W., 2012, "Capital Controls: Gates versus Walls," *Brookings Papers on Economic Activity 2012*(2): 317-367.

Klein, Michael W., and Jay Shambaugh, 2013, "Rounding the Corners of the Policy Trilemma: Sources of Monetary Policy Autonomy," *NBER Working Paper* No. 19461.

Lim, Jamus Jerome, Sanket Mohapatra, and Marc Stocker, 2014, "Tinker, Taper, QE, Bye? The Effect of Quantitative Easing on Financial Flows to Developing Countries," *Background paper for Global Economic Prospects 2014*, Washington, DC: World Bank.

Masson, Paul R., Miguel A. Savastano, and Sunil Sharma, 1997, "The Scope for Inflation Targeting in Developing Countries," *IMF Working Paper* No. 97/130.

Mishkin, Frederic S., 1999, "International Experiences with Different Monetary Policy Regimes," *Journal of Monetary Economics* 43(3): 576-606.

Mohanty, Madhusudan, and Marc Klau, 2004, "Monetary policy rules in emerging market economies: issues and evidence," *BIS Working Paper* No. 149, Basel: Bank for International Settlements.

Montiel, Peter J., 1991, "The Transmission Mechanism for Monetary Policy in Developing Countries," *IMF Staff Papers* 38(1): 83-108

Rajan, Raghuram, 2014, "Competitive monetary easing – is it yesterday once more?" Speech at the Brookings Institution, Washington DC, 10 April 2014.

Obstfeld, Maurice, 2014, "Trilemmas and Tradeoffs: Living with Financial Globalization," *mimeo* (Berkeley, May 15).

Obstfeld, Maurice, 2013, "Never Say Never: Commentary on a Policymaker's Reflections", *mimeo*, UC Berkeley, November.

Obstfeld, Maurice, Jay C. Shambaugh, and Alan M. Taylor, 2005, "The Trilemma in History: Tradeoffs among Exchange Rates, Monetary Policies, and Capital Mobility*," Review of Economics and Statistics 87* (August): 423–438.

Ostry, Jonathan D., Atish R. Ghosh, and Marco Chamon, 2012, "Two Targets, Two Instruments: Monetary and Exchange Rate Policies in Emerging Market Economies," *IMF Staff Discussion Note* SDN/12/01 (February 29).

Prasad, Eswar S., 2008, "Monetary Policy Independence, the Currency Regime, and the Capital Account in China. In Goldstein, M. and N. R. Lardy, eds. *Debating China's Exchange Rate Policy*. Washington, D.C.: Peterson Institute for International Economics.

Reinhart, Carmen M., and Graciela L. Kaminsky, 1999, "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", *American Economic Review* 89(3), 473–500.

Rey, Helene, 2013, "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence," prepared for the 2013 Jackson Hole Meeting.

Rose, Andrew, 2013, "Surprising Similarities: Recent Monetary Regimes of Small Economies," paper presented at *JIMF*-City University HK conference, December.

Stone, Mark R., and Ashok J. Bhundia, 2004, "A New Taxonomy of Monetary Regimes," *IMF Working Paper* No. 04/191

Talvi, Ernesto, and Carlos A. Vegh, 2005, "Tax base variability and procyclical fiscal policy in developing countries," *Journal of Development Economics* 78(1): 156-190.

Data Appendix

Data for Section 2:

Monetary Independence (MI)

The extent of monetary independence is measured as the reciprocal of the *annual correlation* of the *monthly interest rates* between the home country and the base country. Money market rates are used.[37]

The index for the extent of monetary independence is defined as:

$$MI = 1 - \frac{corr(i_i, i_j) + 1}{2}$$

where *i* refers to home countries and *j* to the base country. By construction, the maximum and minimum values are 1 and 0, respectively. Higher values of the index mean more monetary policy independence. [38]

The base country is defined as the country that a home country's monetary policy is most closely linked with as in Shambaugh (2004). For the countries and years for which Shambaugh's data are available, the base countries from his work are used, and for the others, the base countries are assigned based on the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)* and the *CIA Factbook*.

Exchange Rate Stability (ERS)

To measure exchange rate stability, annual standard deviations of the monthly exchange rate between the home country and the base country are calculated and included in the following formula to normalize the index between zero and one:

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

Single year pegs are dropped because they are quite possibly not intentional ones. Higher values of this index indicate more stable movement of the exchange rate against the currency of the base country.

Financial Openness/Integration (KAOPEN)

The Chinn and Ito (2006, 2008). *KAOPEN* is based on *de jure* information regarding restrictions in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). *KAOPEN* is the first standardized principal component of the variables that indicate the presence

---

[37] The data are extracted from the IMF's *International Financial Statistics* (60B..ZF...). For the countries whose money market rates are unavailable or extremely limited, the money market data are supplemented by those from the Bloomberg terminal and also by the discount rates (60...ZF...) and the deposit rates (60L..ZF...) series from *IFS*.
[38] The index is smoothed out by applying the three-year moving averages encompassing the preceding, concurrent, and following years (*t* – *1*, *t*, *t+1*) of observations.

of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds (see Chinn and Ito, 2008).

The Chinn-Ito index is normalized between zero and one. Higher values of this index indicate that a country is more open to cross-border capital transactions.

Data for Section 3.2 drawn primarily from IMF, *International Financial Statistics*.

Interest rates are overnight call money rates. Turkey rate is from St. Louis Fed, Hungary is from ECB, and China is from Trading Economics.

Inflation is four quarter CPI growth rates, measured in log differences. Chile and China is from OECD Main Economic Indicators via St. Louis Fed.

Inflation targets are annual, and drawn (except for Chile) from a data set provided by Ilan Noy (database of Aizenman, Hutchison and Noy, 2010). Original sources are central banks.

Output gap is calculated as Hodrick-Prescott filtered log GDP, seasonally adjusted using ARIMA X-12 (if necessary). In order to mitigate the end-point problem, output is extended by forecasting out six quarters using an ARIMA(1,1,1) before applying the HP filter.

The real exchange rate is the log CPI deflated trade weighted exchange rate. Rates for Argentina, Estonia, India, Indonesia, Lithuania, Peru, Thailand, and Turkey are broad CPI deflated indices from BIS.

Reserves are international reserves excluding gold.

Table 1: Taylor Rule Regressions, Inflation Targeters, 1998Q1-2013Q4						
Dependent variable: Policy interest rate						
	[1]	[2]	[3]	[4]	[5]	[6]
Output gap	0.208***	0.201***	0.205***	0.196***	0.184***	0.196***
	(0.064)	(0.063)	(0.062)	(0.069)	(0.067)	(0.067)
Inflation	0.184**	0.195***	0.186**	0.265***	0.289***	0.265***
	(0.072)	(0.073)	(0.071)	(0.076)	(0.073)	(0.076)
Infl. target				-0.043	-0.050	-0.043
				(0.125)	(0.125)	(0.126)
Exch. depr.		0.023			0.038	
		(0.024)			(0.027)	
Res. change			-0.011			-0.001
			(0.021)			(0.019)
Lagged depvar	0.693***	0.691***	0.692***	0.634***	0.634***	0.638***
	(0.064)	(0.064)	(0.064)	(0.090)	(0.089)	(0.090)
Fixed eff.	yes	Yes	Yes	Yes	Yes	Yes
Time fix. eff	yes	Yes	Yes	Yes	Yes	yes
individuals	10	10	10	10	10	10
Adj-R sq	0.89	0.89	0.89	0.91	0.91	0.91
N	627	627	627	519	519	519

Notes: OLS estimates (robust standard errors in parentheses). *(**)[***] indicates significance at the
10%(5%)[1%]. Sample: Brazil, Chile, Colombia, Hungary, Korea, Mexico, Peru, Philippines, Poland, Thailand. For
columns 4-6, sample pertains to time period for which inflation targets are available.

Table 2: Taylor Rule Regressions, Non-Inflation Targeters, 1998Q1-2013Q4						
Dependent variable: Policy interest rate						
	[1]	[2]	[3]	[4]	[5]	[6]
Output gap	-0.037	-0.002	-0.027	0.051	0.051	0.030
	(0.076)	(0.074)	(0.075)	(0.128)	(0.127)	(0.130)
Inflation	0.192***	0.215***	0.200***	0.250***	0.263***	0.273***
	(0.050)	(0.051)	(0.049)	(0.072)	(0.071)	(0.070)
Exch. depr.		0.154***			0.114*	
		(0.047)			(0.066)	
Res. change			-0.051***			-0.130
			(0.019)			(0.095)
Lagged depvar	0.699***	0.681***	0.693***	0685***	0.676***	0.672***
	(0.062)	(0.062)	(0.062)	(0.090)	(0.090)	(0.089)
Fixed eff.	yes	Yes	Yes	Yes	Yes	yes
Time fix. eff	yes	Yes	Yes	Yes	Yes	yes
individuals	13	13	13	8	8	8
Adj-R sq	0.79	0.79	0.79	0.80	0.80	0.80
N	779	779	779	477	477	477

Notes: OLS estimates (robust standard errors in parentheses). *(**)[***] indicates significance at the 10%(5%)[1%]. Broad sample: Argentina, Bulgaria, China, Estonia, Indonesia, India, Lithuania, Latvia, Malaysia, Russia, Singapore, Turkey, and South Africa. Narrow sample: China, Indonesia, India, Malaysia, Russia, Singapore, Turkey, and South Africa.

Table 3: Taylor Rule Regressions, Inflation Targeters, over Time						
Dependent variable: Policy interest rate						
	1998-2007			2008-2013		
	[1]	[2]	[3]	[4]	[5]	[6]
Output gap	0.359***	0.342***	0.362***	0.051***	0.048**	0.046**
	(0.130)	(0.127)	(0.127)	(0.020)	(0.020)	(0.019)
Inflation	0.332**	0.385***	0.333***	0.046	0.048	0.044
	(0.099)	(0.097)	(0.100)	(0.031)	(0.031)	(0.031)
Infl. target	-0.028	-0.032	-0.029	-0.107	-0.105	-0.083
	(0.170)	(0.169)	(0.169)	(0.250)	(0.250)	(0.246)
Exch. depr.		0.072*			0.005	
		(0.044)			(0.009)	
Res. change			0.004			0.015*
			(0.025)			(0.008)
Lagged depvar	0.533***	0.524***	0.533***	0.870***	0.870***	0.876***
	(0.113)	(0.111)	(0.113)	(0.046)	(0.046)	(0.045)
Fixed eff.	yes	Yes	Yes	Yes	Yes	Yes
Time fix. eff	yes	Yes	Yes	Yes	Yes	yes
individuals	9	9	9	9	9	9
Adj-R sq	0.89	0.89	0.89	0.96	0.96	0.96
N	295	295	295	221	221	221

Notes: OLS estimates (robust standard errors in parentheses). *(**)[***] indicates significance at the 10%(5%)[1%]. Sample: Brazil, Chile, Colombia, Hungary, Korea, Mexico, Peru, Poland, Thailand.
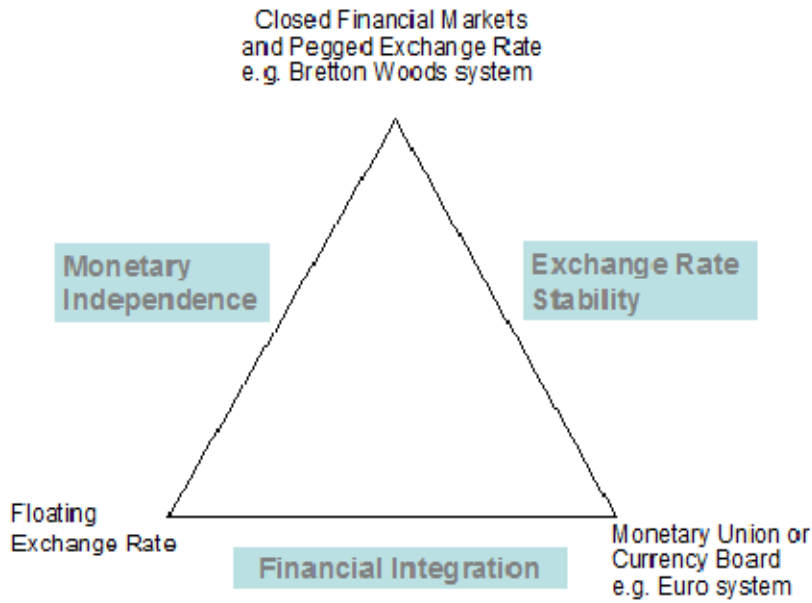
Figure 1: The Trilemma of International Finance
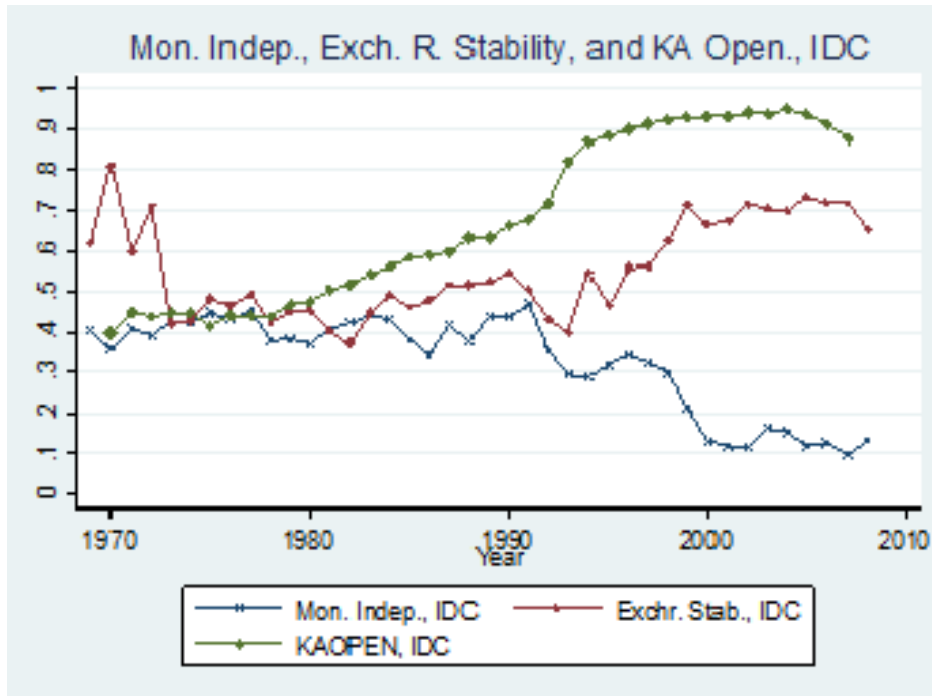
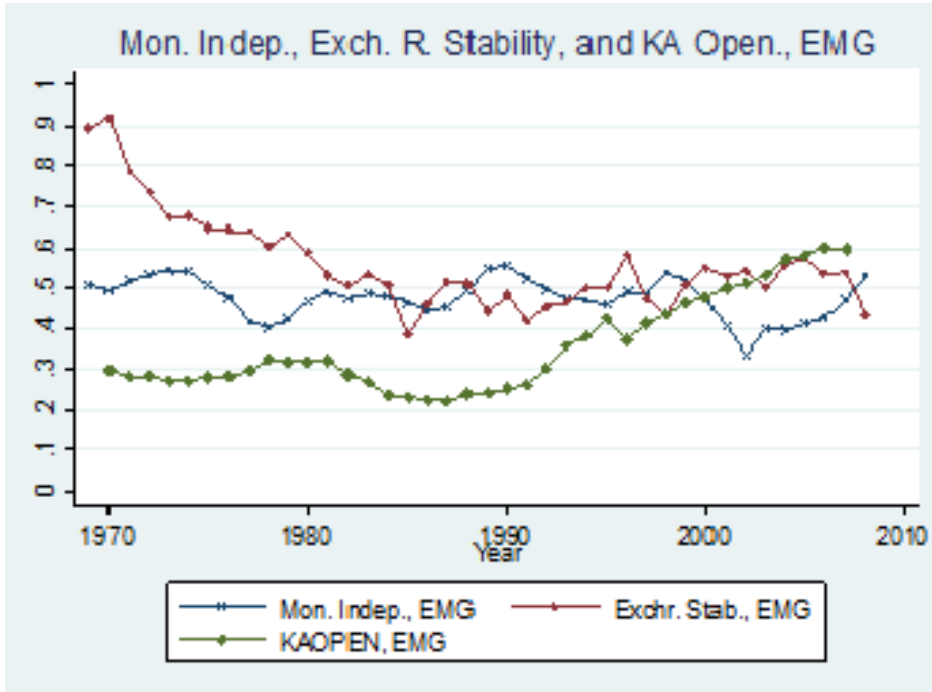Figure 2.1: Trilemma Indices for Industrial Countries

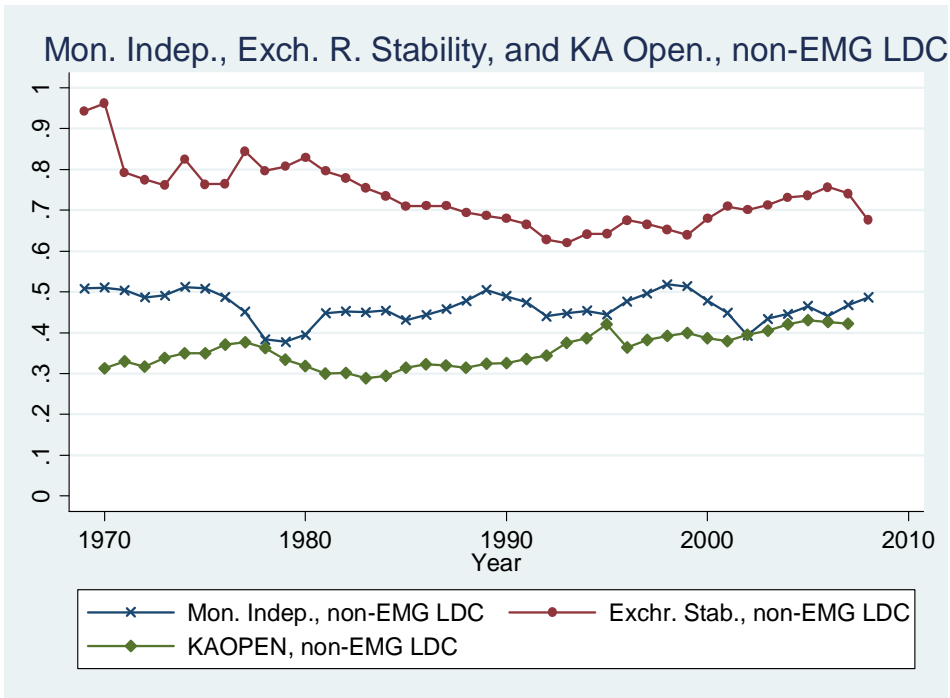Figure 2.2: Trilemma Indices for Emerging Market Economies

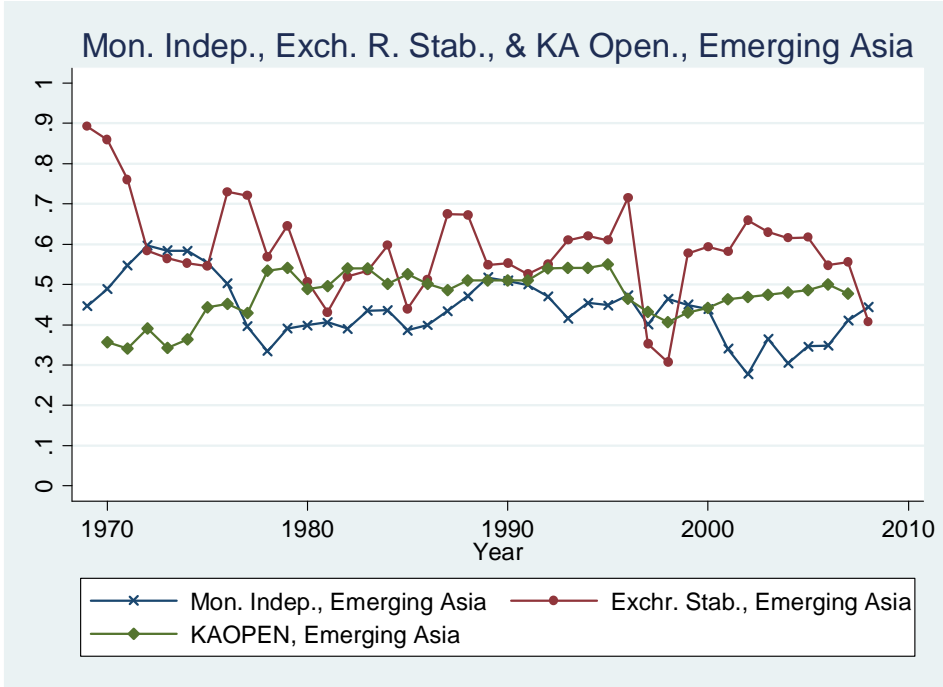Figure 2.3: Trilemma Indices for Less Developed Countries
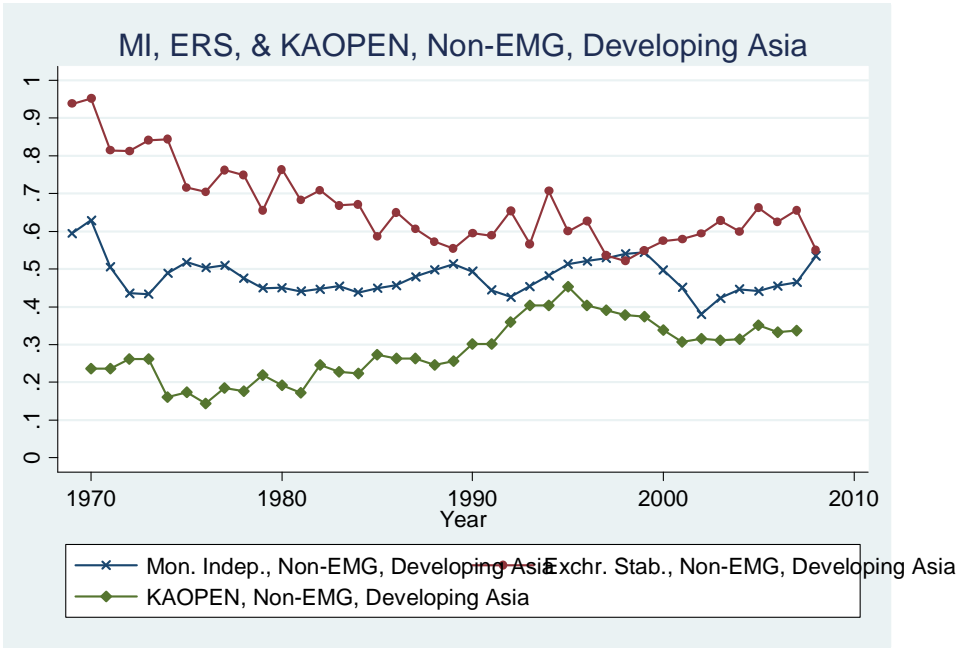
Figure 3.1: Trilemma Indices for Emerging Asia

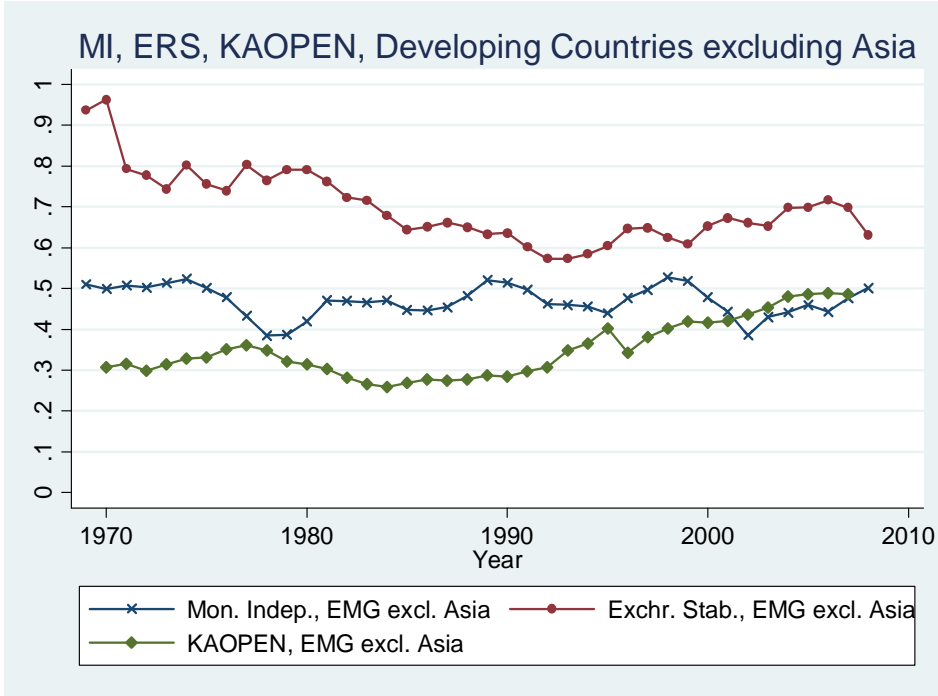Figure 3.2: Trilemma Indices for Developing Asia

MI, ERS, KAOPEN, Developing Countries excluding Asia

Legend:
- —×— Mon. Indep., EMG excl. Asia
- —●— Exchr. Stab., EMG excl. Asia
- —◆— KAOPEN, EMG excl. Asia

Figure 3.3: Trilemma Indices for Non-Asia Emerging Market Economies

Figure 1: Median Inflation in Emerging Market Economies

Source: World Development Indicators, International Financial Statistics and author's calculations.
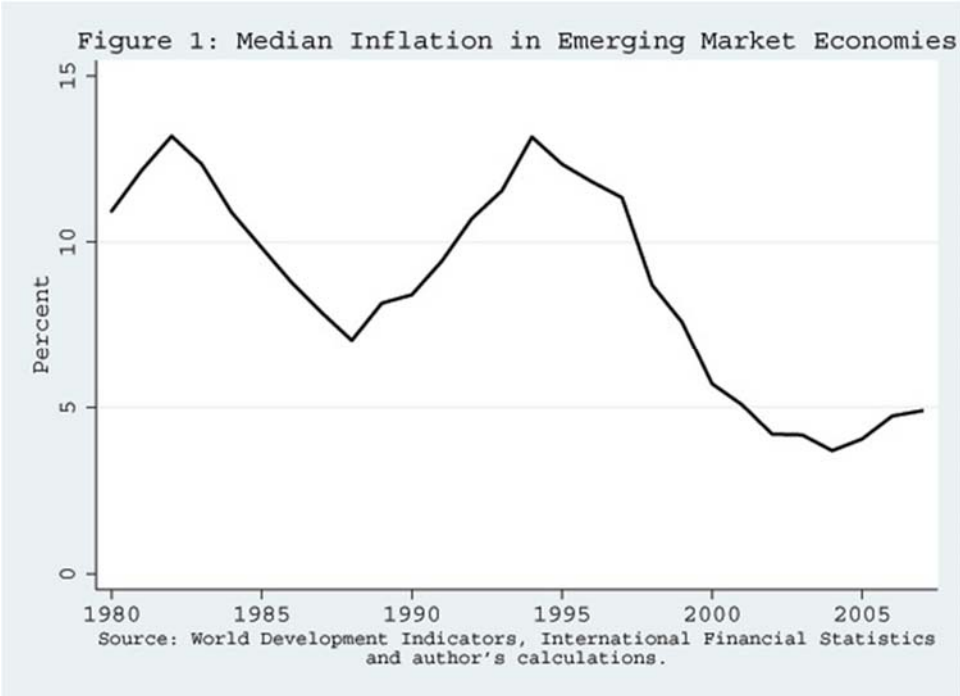
Figure 4. Source: Coulibaly (2013).
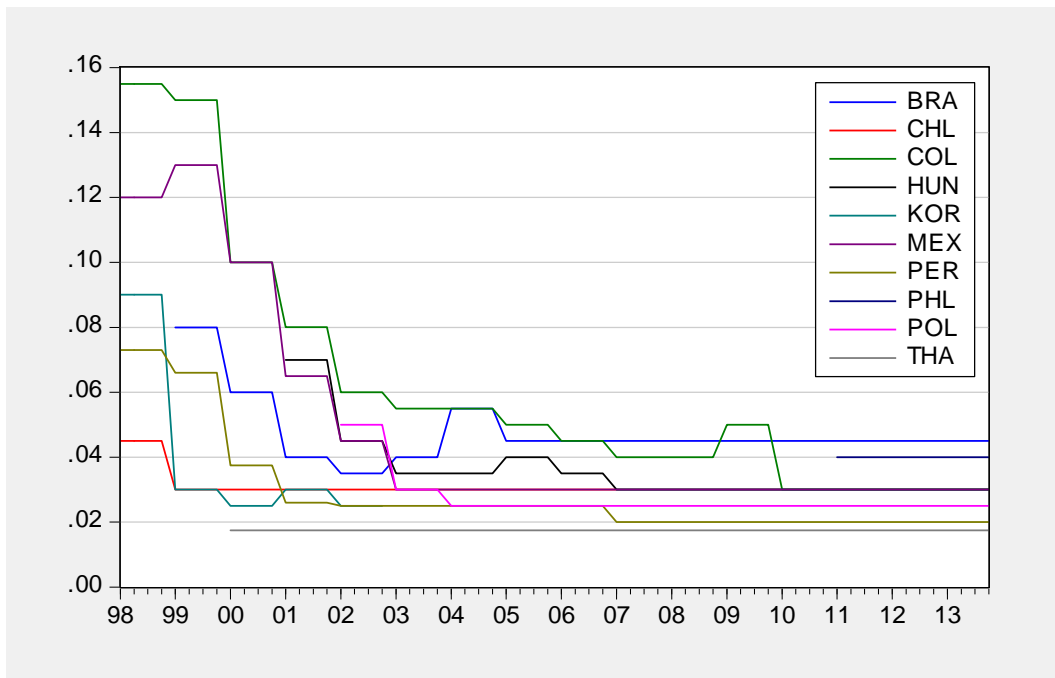
Figure 5: Inflation Targets in Selected Countries
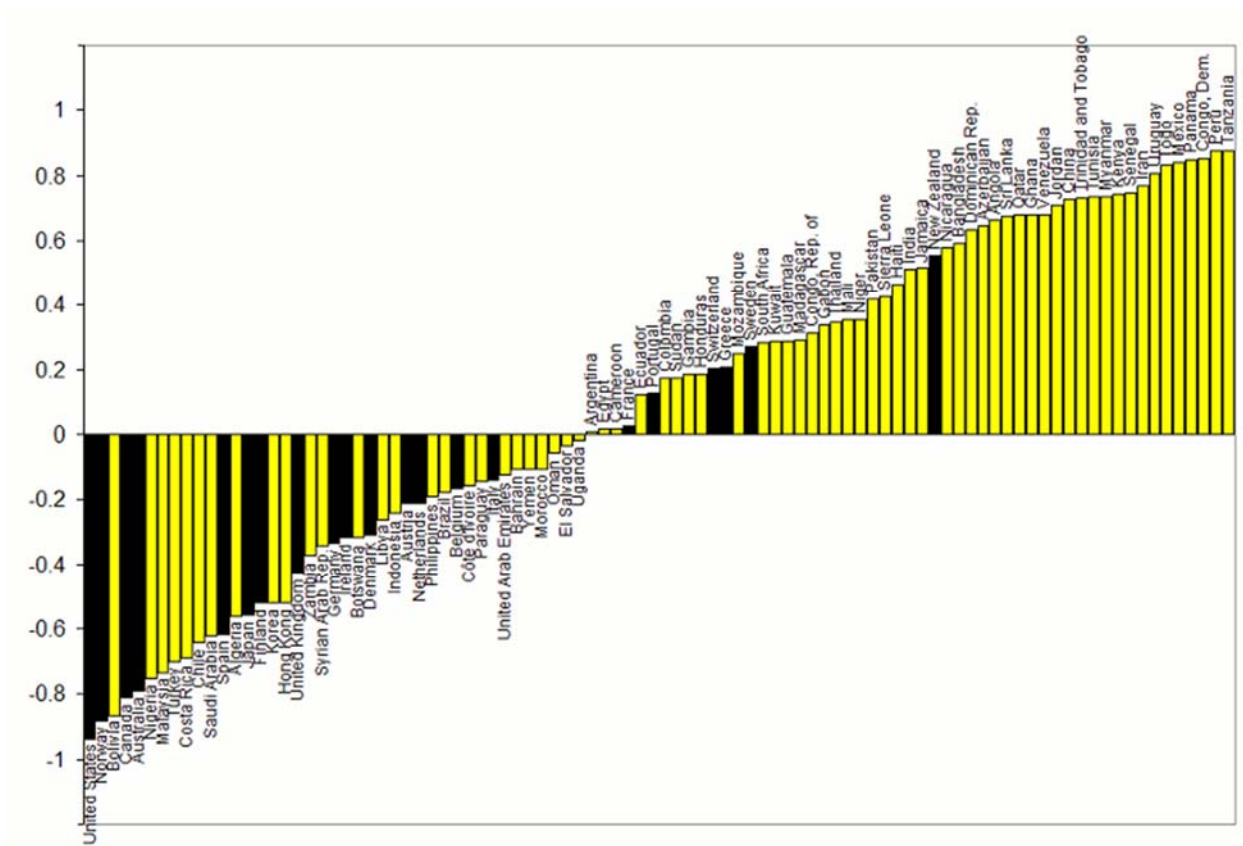
Figure 6: Fiscal procyclicality, 2000-2009. Source: Frankel, Vegh and Vuletin (2011).
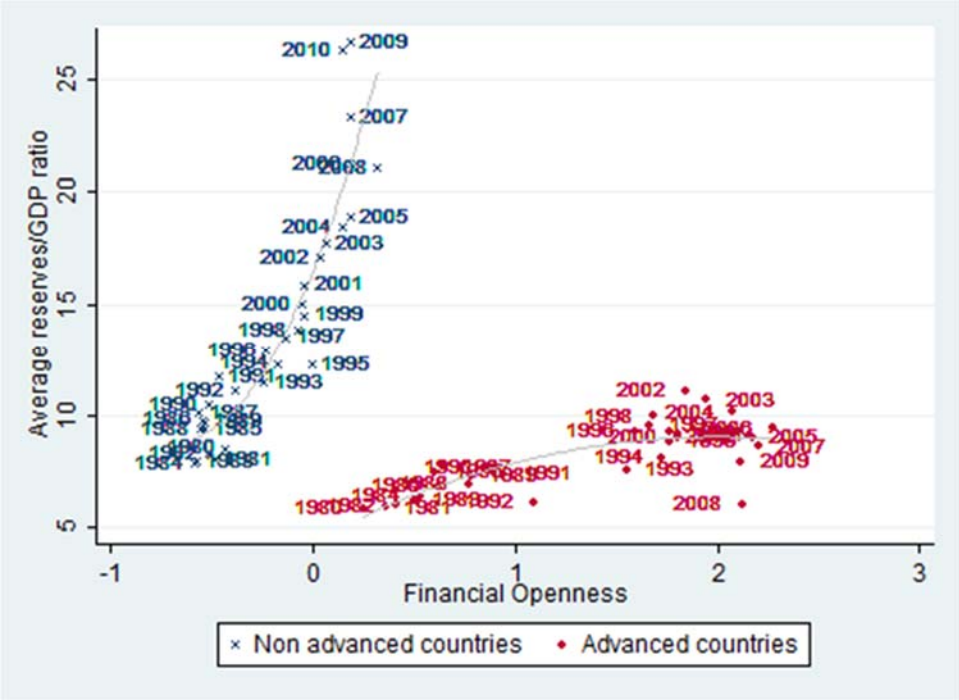
Figure 7: Average reserves/GDP for advanced and non-advanced countries. Source: Bussiere, Chen, Chinn and Lisack (2014).
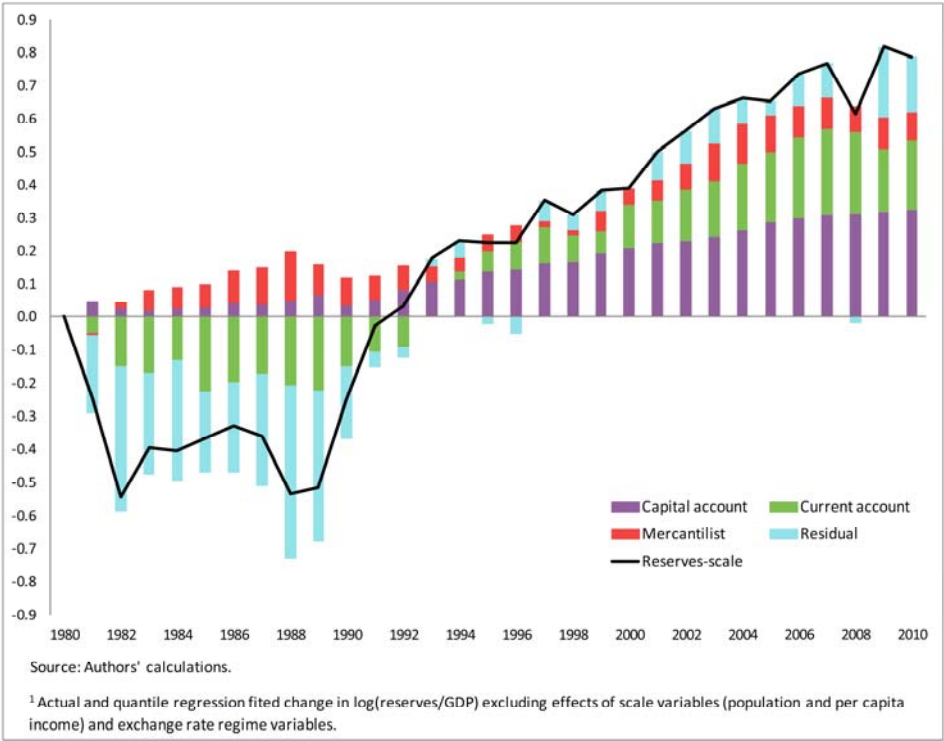

Figure 8: Fitted Changes in Reserves, and Components. Source: Ostry, Ghosh and Tsangarides (2012).

5. Reliance on Hard Currencies for Emerging Market Government and Nongovernment Bonds Issued in International Capital Markets² (Simple average across countries)
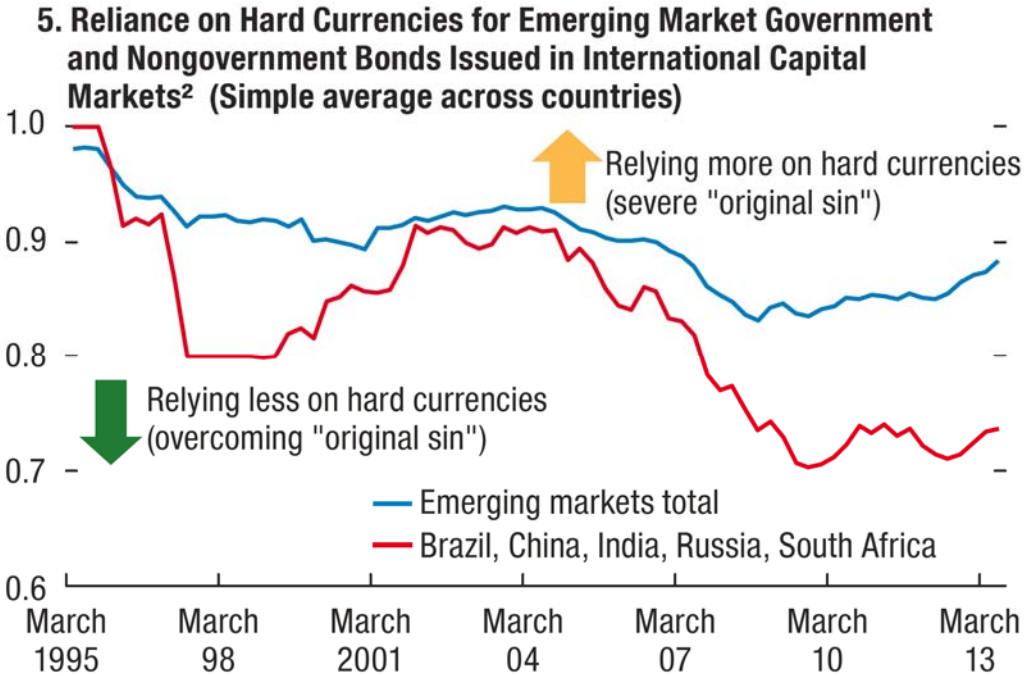
Figure 9. Source: IMF, *Global Financial Stability Report* (April 2014), Figure 2.3.5, p. 73.