EXCHANGE RATE POLICY: LIMITS TO FLEXIBILITY, CAPITAL CONTROLS, AND RESERVE MANAGEMENT

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EXCHANGE RATE POLICY: LIMITS TO FLEXIBILITY, CAPITAL CONTROLS, AND RESERVE MANAGEMENT

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No. 3

The views expressed by the authors of the following papers do not necessarily represent those of the institutions to which they are affiliated.

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1. Foreword



CÉDRIC TILLE Graduate Institute of International and Development Studies, BCC programme director, and Centre for Economic Policy Research (CEPR)

Tille, C., "Foreword", in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 7–9.

I am pleased to introduce this volume of proceedings from the third annual conference held by the Bilateral Assistance and Capacity Building for Central Banks programme (BCC),¹ which – this year – took as its theme *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management*. The conference took place in Geneva on October 29–30, 2015. The choice of topic was motivated by the fact that the relative merits of fixed and flexible exchange rates are still being debated. In addition, this debate has recently taken on a new dimension as economists have begun to examine the growing role of a global financial cycle, in addition to that of the standard business cycle on which earlier work had focused. An exchange between policymakers and academics on the pros and cons of the various regimes and on the lessons learned from practical experience was thus timely.

The BCC programme is jointly funded by the Swiss State Secretariat for Economic Affairs (SECO) and the Graduate Institute of International and Development Studies (the Graduate Institute Geneva). It aims to support partner central banks in emerging and developing countries in building the analytical and technical expertise required for the efficient conduct of monetary policy, and builds on long-standing expertise developed at the Graduate Institute Geneva in providing technical assistance through missions in partner countries tailored to those countries' specific needs.

¹ http://graduateinstitute.ch/bcc.

The conference brought together representatives from the central banks of the eight countries in the programme,² and prominent academics and representatives from policy institutions, with the purpose of sharing recent research and policy experiences. In total 55 people took part in the conference.

The conference was structured around two pillars. The first day hosted a research workshop where researchers from the central banks had the opportunity to present their work, and benefit from active discussions with conference participants. The day ended with a presentation by Dr Ayan Kose on the theme of exchange rate regimes. On the second day, Dr Monica Rubiolo from the SECO welcomed the participants to a series of policy panel discussions allowing countries to share their experiences pertaining to financial sector development. A keynote presentation by Prof. Menzie Chinn laid out the main elements and was followed by three panels that led to active discussions between senior policymakers, prominent economists, and members of the audience.

The first panel discussed the impact of the exchange rate regime on the sensitivity of growth to various shocks. The panellists pointed out that the relative merits of flexible and fixed exchange rates depend on the specific nature of the shocks and crises affecting the economy. The exchange rate exposure of firms and financial intermediaries also plays a central role. When liabilities are in foreign currencies, a depreciation leads to financial distress, which offsets the benefits of international competitiveness. The panel also pointed out that the choice of the most appropriate exchange rate regime depends on the stage of economic and financial development. In addition, assessing the extent to which the exchange rate is in line with fundamentals remains an uncertain exercise, and communication with the market plays a major role for the credibility of the exchange rate regime.

The second panel considered the extent to which the growing role of the global financial cycle impacts the ability of central banks to implement an independent policy. This question was the object of active debate. Some argue that the financial cycle cannot be managed by some marginal adjustment to the policy framework, but needs to be considered as a separate source of shocks. The spillovers of policy in the world's major economies also warrant specific attention. The panel debated whether central banks need to rely on the interest rate to counter the financial cycle, or whether this can be handled using other tools, such as macroprudential measures and capital controls. Such measures have been found to impact the volumes and composition of credit, but need to be precisely tailored. Other panellists argued that while the financial cycle matters, it does not make the exchange rate regime a moot question, as that regime affects a country's sensitivity to the cycle.

The final panel focused on the issue of exchange rate intervention and foreign exchange reserves accumulation. While exchange rate intervention can be justified as a response to certain shocks, the optimal level of intervention and accumulation of foreign reserves is highly uncertain as there is no clear, unique criterion to rely on. Assessing the impact of

² These countries are Albania, Azerbaijan, Bosnia and Herzegovina, Colombia, Ghana, Peru, Tunisia, and Vietnam.

intervention is a complex task, but there is evidence for some effect, at least in the short term. This impact is sensitive to several elements, and a clear communication of the objective of such intervention is needed. The panel argued that the impact of intervention is temporary and that relying on it to manage the path of the exchange rate over longer periods is of limited effectiveness. Still, the issue attracted renewed attention during the crisis, as central banks undertook policies on a scale that had been hard to imagine before. This has led policymakers to experiment with additional tools, and put more emphasis on the issue of the management of large holdings of foreign exchange reserves.

The conference led to active and fruitful exchanges of views among the representatives of the various central banks, and between academics and representatives of other policy institutions. The event thereby significantly contributed towards the BCC goal of building a network of practitioners among the central banks involved in the programme, and strengthened the momentum initiated during the first two annual conferences in Geneva, and the regional conferences held at the Central Reserve Bank of Peru and the Central Bank of Albania, respectively.

This monograph offers a focused exposition of the points addressed in the conference. The article by Prof. Chinn provides an overview of the state of research on exchange rate regimes and the related trade-offs. The lecture was followed by presentations and active discussion in the policy panel sessions, and we present the main points that arose during those panels. The presentation by Dr Kose offers a view of the challenges at the current juncture. The monograph also includes a concise presentation of the papers presented in the workshop, and of the ensuing discussions.

I am very grateful to all the participants for making this conference such an interactive and productive event, with particular thanks going to the senior representatives of the partner central banks, Dr Rubiolo of the SECO, Prof. Chinn, and Dr Kose for their contributions. I would also like to express my gratitude to the staff of the BCC programme for their involvement in making the conference possible, as well as in the broader programme through the year.

Geneva, 10 December 2015

2. Welcome Address



MONICA RUBIOLO Head of Section at the Swiss State Secretariat for Economic Affairs (SECO)

Rubiolo, M., "Welcome Address", in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 11–13.

Distinguished guests and participants in this year's BCC conference,

I would like to welcome you here in Geneva for the annual conference of the BCC programme, in the name of the organizers of the conference – the Graduate Institute of International and Development Studies and the Swiss State Secretariat for Economic Affairs (SECO).

This is the third time the BCC annual conference has taken place. And as with previous events, the idea of this conference is to bring together the different stakeholders of the BCC programme and to provide a platform for exchange and discussions on a topic of current interest.

This year's conference is dedicated to the topic of exchange rate regimes and their impacts. The impact of different exchange rate regimes on economic growth is a source of continuous discussion in the macroeconomic literature and amongst practitioners. Despite a long history of research work on this topic, opinions remain diverse. All exchange rate regimes have their particularities, advantages, and disadvantages. To determine the most appropriate exchange rate regime for a given country is not a simple task as much will be at stake.

For a long time, standard macroeconomic theory has taught us that there is a trade-off between international capital mobility, the choice of the exchange rate regime, and the autonomy of monetary policy. Many empirical studies have confirmed this classic "trilemma" and the fact that financial openness and independent monetary policies are feasible only with floating exchange rates.

However, this view has been challenged by recent developments. Global financial integration and the increase in capital mobility in the past two decades have triggered a lively debate as to whether exchange rate flexibility continues to be a sufficient condition for the autonomy of monetary policy.

The global financial crisis has emphasized the role of global financial cycles in interest rates, asset prices, capital flows and bank leverage. Most recent evidence suggests that domestic financial conditions are increasingly affected by developments in the rest of the world.

In particular, it seems that conditions in the world's foremost financial centres spill over to other economies, regardless of the exchange rate regime. The question now is thus whether or not the classical trilemma is reduced to a dilemma, where independent monetary policies are only possible if the capital account is managed.

This debate on financial integration and spill-over effects between regions and currency areas has been particularly heated in emerging market economies, but it also concerns advanced economies. Indeed, in the course of this year, several central banks – including the Swiss National Bank – have intervened in the foreign exchange market, reacting to changes in the global economic environment.

Against this backdrop we have decided to dedicate this year's BCC conference to this controversial and topical question. These two days in Geneva should provide an opportunity for BCC partner countries to share research results and experiences with peers and with distinguished international academics and experts.

Yesterday, researchers from BCC partner central banks presented and discussed some of their most recent research. Today's programme will focus on the impact of exchange rate regimes on growth and inflation, the effects of global financial integration on monetary policy, and the tools available for limiting exchange rate volatility.

The Geneva conference together with the regional conference is the main platform for facilitating peer exchange under the BCC programme. Learning from one's peers is – in our view – a powerful tool for strengthening capacities, and should thus be at the heart of the BCC programme.

The BCC programme was established by the SECO to support central banks in building the relevant capacities to ensure sound and independent macroeconomic management. Tailored technical assistance and applied research on key monetary issues are the other two key components of this programme.

The BCC programme is the SECO's most important pillar for providing support to central banks. The development of stable and efficient financial sectors is one of the SECO's main interests in the area of macroeconomic support. A stable and well-developed financial sector is crucial to ensuring a macroeconomic framework that supports competitiveness and sustainable growth. Central banks play a key role in ensuring macroeconomic stability and creating sound macroeconomic framework conditions.

Since the financing for this programme comes from Swiss taxpayers we have a responsibility to account for the programme's results. It is in this spirit that the SECO has decided to conduct an external, mid-term evaluation, which is currently ongoing. The results of the evaluation shall allow the SECO to adapt the programme, where necessary, to improve the performance of BCC.

Field visits to two beneficiary countries (Vietnam and Tunisia) have already taken place and I have been told by my staff that they were very useful. The evaluators will soon send an online survey to all partner central banks. We count on the participation of your institutions in this survey in order to present us with a meaningful assessment. The results of this evaluation are expected at the end of this year and will be shared with all participants.

Now, I would like to invite you, dear guests, to actively participate in the panel discussions. I'm sure you have very different and valuable experiences that will stimulate the debate. I hope you can also benefit from the experts present today to gain new insights. We are particularly honoured to have Prof. Menzie Chinn with us today as keynote speaker, and we are looking forward to his presentation. Our thanks also go to the other speakers and panellists who will contribute to today's programme; as well as to the researchers who made yesterday's exchanges possible.

I would also like to thank the Graduate Institute of International and Development Studies, Geneva, and in particular Prof. Cédric Tille and his team – for the excellent organization of this event – and Ms Irene Frei, Programme Manager for BCC. They have put a lot of effort and energy into preparing such an interesting and diverse programme.

I hope you enjoy today's discussions and that the conference will bring some "fresh air" from the Alps into your daily work.

Thank you.

3. Keynote Lecture

NAVIGATING THE TRILEMMA IN A FINANCIALLY INTEGRATED WORLD: CHALLENGES FOR CENTRAL BANK POLICYMAKERS



MENZIE D. CHINN University of Wisconsin and National Bureau of Economic Research (NBER)

Chinn, M.D., "Keynote Lecture – Navigating the Trilemma in a Financially Integrated World: Challenges for Central Bank Policymakers", in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 15–49.

Introduction

In recent years, exchange rate policy – never a settled issue – has become a topic of particularly heightened interest. In 2010, as the US embarked upon a new round of quantitative easing, Brazil's finance minister, Guido Mantega, levelled charges that the United States was waging a "currency war". In 2013, as Fed Chairman Ben Bernanke observed that quantitative easing (Ω E) would have to end eventually, currency markets once again went into convulsions in what was eventually coined the taper tantrum.

The frustration with the vagaries of financial centres' monetary policies was summarized 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 needs for structural change constrain domestic demand, a sizeable portion of the effects of such policies spill over 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)

The spillover effects of the US and other financial centres' monetary policies on other economies highlight the challenges that emerging market policymakers face with regard to exchange rate policy, revolving around the degree of flexibility, the management of financial openness, and foreign exchange reserve management, while at the same time attempting to retain some monetary autonomy.

These complaints are a manifestation of the conditions that a typical non-core country's central bank policymakers face. Emerging market economies are typically small, in economic terms, relative to a global economy, and yet financially integrated; developing countries are typically less financially integrated, but face other constraints on policy. 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 non-centre economies. For instance, a decision by the Fed to raise the policy rate drags up interest rates 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.¹

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

The issue of size is not the only complication for emerging markets' central bankers. The other key factors include the underdevelopment or distortion of the financial sector, along many dimensions. Historically, banks in emerging markets have been subject to financial repression, government policies that regulated interest rates, or required holdings in 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.

One exception is China. Given its large economic weight in terms of production, and its role as a source of saving flows, it is possible for its policy actions to move international asset prices. However, even then, empirical work by Aizenman, Chinn and Ito (forthcoming) fails to find a significant effect in financial markets.

The first section of this paper reviews the international trilemma (also known as the "impossible trinity"), describing the international constraints faced by emerging markets' and developing countries' central bank policymakers. In the next sections, two issues omitted from the trilemma are examined: the accumulation of reserves, and balance sheet effects. Finally, I end with an examination of how the choice of exchange rate regimes and financial openness determine the extent to which financial shocks in the financial centres are propagated to asset prices in emerging markets and developing countries' economies.

The International Trilemma

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 represents one of these three aforementioned goals. Clearly, it is not possible to occupy a position simultaneously on all three sides of the triangle. For instance, the top point, labelled "closed capital markets", is associated with monetary policy autonomy and with a fixed exchange rate regime and the absence of financial integration.²

Countries have adopted different arrangements aimed at achieving combinations of two of these 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.³

Greater monetary independence allows policymakers to stabilize the economy through monetary policy without being subject to other economies' macroeconomic outcomes, thus potentially insulating those policymakers' economies. However, in a world with price and wage rigidities, the resulting room for discretion means that policymakers 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.⁴

 $^{^{\}mathbf{2}}$ See Obstfeld, Shambaugh and Taylor (2005) for further discussion and references dealing with the trilemma.

³ The exchange rate as a nominal anchor takes on a heightened importance when credibility issues are to the fore. See Chinn (forthcoming) for a discussion in the context of inflation targeting.

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-term rates. See Ito (2013); for a contrary view, see Obstfeld (2014).

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 trade-off is that greater levels of exchange rate stability could deprive policymakers of the option of using the exchange rate as a shock absorber. Prasad (2008) argues that exchange rate rigidities would prevent policymakers from implementing appropriate policies consistent with macroeconomic reality, implying that they would be prone to causing asset booms and busts by overheating the economy. Hence, the rigidity caused by exchange rate stability could not only enhance output volatility; it could 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 more efficient resource allocation, enhancing risk sharing, and supplementing domestic savings.⁵ On the other hand, financial liberalization exposes economies to potentially destabilizing cross-border capital flows, and attendant boom-bust cycles (Kaminsky and Schmukler, 2002).⁶

The Emerging Market and Developing Economies Stand Apart

Aizenman et al. (2010) develop a set of 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).⁷

The evolution of the trilemma indices for different income-country groups is displayed in Figures 2 through 5. For the advanced economies (Figure 2), financial openness experienced a discrete upwards 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.

The experience of the emerging market economies, however, presents a stark contrast (Figure 3). First, exchange rate stability declined rapidly from the 1970s through the mid-1980s. After some retrenchment around the early 1980s (in the wake of the debt crisis),

⁵ Although, as Obstfeld (2013) notes in his survey, the benefits in practice of complete or near complete openness are difficult to discern, empirically.

⁶ 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.

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 measures the extent of actual insulation of monetary policy; see Klein (2012) and Klein and Shambaugh (2013).

financial openness resumed its ascent from 1990 onwards.⁸ For the developing economies (Figure 4), exchange rate stability declined less rapidly, and financial openness trended upwards more slowly. In both cases though, monetary independence remained more or less trendless.

Interestingly, for the emerging market economies, the indices suggest a convergence towards 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 markets and developing countries 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 developing countries, exchange rates are perceived as *sources* of financial and macroeconomic instability (by way of tradable prices and expected asset returns). Emerging market economies have developed, over time, financial markets that are sufficiently efficient for the perception of exchange rates to shift away from being a source of shocks and towards that of being a shock absorber. The convergence towards greater exchange rate flexibility makes sense in that context.

Some observations regarding "Emerging Asia" merit additional discussion.⁹ Figure 5 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 of the first years of the new millennium, the indices diverged; but they seem to have re-converged in the recent years. This characterization does not appear to be applicable to non-emerging market economies in Asia or to non-Asian emerging market economies, convergence in the trilemma configurations seems to be the case in the last decade.

In these figures, the emerging market economies are defined as those economies classified as either emerging or frontier in the years 1980–1997 by the International Financial Corporation. For Asia, emerging market economies are the "Emerging East Asia-14" – as defined by the Asian Development Bank – plus India.

⁹ In these figures, the sample of "Asian Emerging Market Economies" includes Cambodia, China, Hong Kong, India, Indonesia, the Rep. of Korea, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

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 themselves in changes to 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 the 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 that sterilization is impossible if financial openness is complete. That is 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 threats of the imposition of such controls – are always present. And prudential regulations mean that the financial system usually ensures that there is a fair share of non-tradable assets so that not all yields are equalized.¹⁰

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 motivations over different periods; detailed discussion of this issue is reserved for the next section. For the moment, 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, behaves differently from other groups of economies; the middle-ground convergence took place earlier for this group, when compared 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 holdings.

This evolution is illustrated in the revised trilemma diagrams, which incorporate reserve holdings, thereby changing the triangle of Figure 1 into a diamond (Figures 6 and 7), with the lower vertex defined by reserves to GDP. As shown in Figure 6, in the aggregate for emerging Asian economies (including China), there has been a move towards greater reserve holdings and monetary autonomy as exchange rate stability has declined. However, the averages mask heterogeneity, with China in particular refraining from capital account liberalization while choosing higher exchange rate stability (Figure 7).

¹⁰ 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 non-tradable assets due to banking system segmentation.

Reserve Accumulation and Self-Insurance

One of the central differences between central bank policies in the advanced economies and those in the emerging market economies is the latter's marked build-up of reserves, particularly since the East Asian financial crises of 1997–98. China, the world's largest holder of foreign exchange reserves, holds nearly USD 3.5 trillion of reserves as of mid-2015, accounting for approximately 30 per cent of the world's total reserve holdings. In the first quarter of 2014, the top ten 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 per cent of world's foreign exchange reserves between them. These developments have contrasted sharply with the actions of the advanced economies. As illustrated in Figure 8, 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 – 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 its component parts. Their analysis suggests that some of such reserve accumulation is motivated by maintaining sufficient funds to cover shocks to trade flows, and only a small (but measurable) proportion by 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 make caution the preferred course. Consider the consequences of the expansionary monetary policies undertaken by the US from 2008 onwards. In addition to driving the overnight rate to zero, the Fed undertook quantitative easing – purchases of long term Treasury securities and Agency mortgage-backed securities – that was 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 an increase in outflows to emerging market economies, to be a consequence of unconventional monetary policies, particularly of QE2. The increase in the Fed balance sheet is also shown to have had ambiguous effects on exchange rates in the largest emerging market economies of Brazil, Russia, India, and China.¹¹ The corresponding displeasure at

¹¹ Other studies include Chen et al. (2012) and the IMF (2013a,b).

the Fed's suggestion of a taper in large-scale asset purchases suggests that there were substantial spillover effects. $^{\rm 12}$

It is 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 were important (Calvo et al., 1993; Fernandez-Arias, 1996; Dooley, Fernandez-Arias and Kletzer, 1996).

In this sense, the emerging market central bank view is 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 1990s. 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 certain countries from the negative shock. In particular, Bussière, Chen, Chinn and Lisack (forthcoming) 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 0.73.¹³ Hence, a doubling of the reserves to debt ratio is 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.¹⁴

Moreover, Bussière 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. Reserve accumulation seems to be a more effective means of self-insurance when capital controls are higher. This is shown in Figure 9, where the average marginal impact of reserves is higher the more stringent capital controls are, as measured using the Chinn-Ito index.

Balance Sheet Effects

The trilemma is an interpretation of the Mundell-Fleming model. One critical factor omitted from that framework is the impact of balance sheet effects. Balance sheet effects have become more important because of the drastically increased cross-border holdings of assets and liabilities. With this development, the net international investment position – the

¹² For assessments of the impact of the taper, see Lim et al. (2014), Eichengreen and Gupta (2014), and Aizenman et al. (2014).

¹³ 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.

¹⁴ See also Dominguez, Hashimoto and Ito (2012) for similar results for a smaller set of countries.

difference between assets and liabilities – does not convey fully the exposure of a country to changes in the international environment.

The composition of the gross asset and liability positions is key; in particular, when the composition of assets and liabilities differ substantially and changes in the economic environment that affect assets and liabilities differently can have big effects on the state of the economy.¹⁵

Compositions can differ along several dimensions: terms of maturity, currency of denomination, and capital structure. For instance, a country might have borrowed extensively short term, and loaned long term. Should foreign lending sources decide not to roll over short-term debt, the mismatch in assets and liabilities can come to the fore; in essence, a "run" occurs on the country. Capital structure mismatch – say the liabilities are in the form of debt, while assets are in equity – can mean that when economic conditions deteriorate, a default might be forced on the country.

The most salient of concerns is currency mismatch. Suppose liabilities are mostly denominated in a foreign currency, while assets are in the domestic currency. Then a depreciation of the domestic currency might not yield a net positive impact on the economy, as implied by the Mundell-Fleming model. Rather, the depreciation will exert a contractionary impact on the economy by increasing the value of the liabilities (defined in terms of the domestic currency) while leaving the value of assets unchanged. If the mismatch applies to the government, then the government's net liabilities increase. If it applies to the private sector (firms and households), then private sector elements will see their net liabilities increase, perhaps forcing some firms into insolvency. The closure of firms reduces aggregate supply. Even if firms do not go bankrupt, their reduced net worth makes them a higher credit risks (at least from the banks' perspective), thereby reducing their ability to borrow and invest in plant and equipment. This effect further depresses the economy.

Recent financial crises were characterized by currency mismatches, either in government debt (Mexico, Brazil, Turkey, Argentina, and Russia), in the banking sector (Korea, Thailand, Indonesia, Turkey, Russia, and Brazil), or in the nonfinancial corporate sector (Korea, Thailand, Indonesia, Turkey, Argentina, and Brazil).

What drove the development of these currency mismatches? One contributing factor appears to have been the presence of pegged or highly managed exchange rate regimes. Fixed exchange rate regimes reduced the uncertainty associated with foreign currency denominated debt, and thus encouraged the accumulation of debt in foreign currencies. In some cases, the real depreciation associated with the pegs provided additional impetus for accumulation.

Mismatches in the private sector can have spillover effects on the government sector. If, for instance, the government has to bail out the banking system, then private firm insolvency due to currency mismatches can be transferred to the public sector. The fact that private sector liabilities sometimes become public sector liabilities, thereby triggering a deeper crisis, is one manifestation of the phenomenon of "contingent liabilities", which underpins

¹⁵ See expositions in Chang and Velasco (2001), Cespedes et al. (2004) and Allen et al. (2002).

the "third generation" models of currency crises.¹⁶ In the midst of a crisis, the government cannot credibly commit to not bailing out key players (such as the banking system) in the economy. These liabilities are "contingent" upon the state of the economy (say, an economic downturn, or a currency devaluation). But by bailing out the banks, the government endangers its own state of solvency.

The policy implications are relatively straightforward, albeit difficult to implement. For instance, the aforementioned facts imply that currency mismatches in debt, either in the public or the private sector, should be avoided. Achieving this objective is difficult; governments are often unable to borrow on international markets in their own currency – this phenomenon is referred to as "original sin" by Eichengreen, Hausmann and Panizza (2007).

Finally, the importance of balance sheet effects introduces a new set of trade-offs during crises. Consider the case in which a country has both a currency mismatch on public sector debts (borrowing in dollars; tax revenues in the local currency) and private sector debts with a maturity mismatch (short-term borrowing; long term lending). An interest rate defence of the currency will mitigate a deterioration in the government's position while exacerbating interest rate risk (short-term interest rates will typically rise relative to long-term rates). This tension in policy effects is layered on top of the obviously counterproductive effect higher interest rates have on aggregate demand. Hence, the presence of balance sheet mismatches limits the degree to which countries can opt for greater exchange rate flexibility.

Spillover Effects of Core Country Monetary Policies

In this section, the effects of core country (the US, the euro area, and Japan) monetary policies on emerging market and developing country asset prices – including exchange rates – are examined based upon findings in Aizenman, Chinn and Ito (forthcoming). While there are numerous studies devoted to examining the sensitivity of non-core country asset prices to core country monetary policies, Aizenman et al. are the first to examine the implications of combinations of trilemma policies.¹⁷

In their empirical exploration, the authors employ an estimation process that is similar to that employed by Forbes and Chinn (2004) and is composed of two steps of estimations. First, they investigate the degree of sensitivity of several important financial variables to global, cross-country, and domestic factors. Second, treating the estimated sensitivity as a dependent variable, they examine their determinants among a number of country-specific variables. In so doing, they disentangle the roles of countries' macroeconomic conditions or policies, real or financial linkages with the centre economy, and the level of institutional development of the countries concerned.

¹⁶ See Krugman (1998) and Corsetti, Pesenti and Roubini (1998). Dooley (2000) provides a related model, which interprets the build-up of contingent liabilities as endogenous to the insurance provided by international agencies.

¹⁷ See, for instance, Fratzscher (2011), Fratzscher et al. (2013), Forbes and Warnock (2012), Ahmed and Zlate (2013), Eichengreen and Gupta (2014), and Lim et al. (2014).

Methodology

In the first step, a correlation between a specific financial variable of country *i* and each of the centre economies is estimated, while controlling for global and domestic factors. The estimated coefficient of our focus is $\hat{\gamma}_{Fi}^{C}$. A significantly positive $\hat{\gamma}_{Fi}^{C}$ indicates a closer linkage between country *i* and economic core country *C*, as shown in (1):

$$R_{ii}^{F} = \alpha_{Fii} + \sum_{g=1}^{G} \beta_{Fii}^{G} Z_{ii}^{G} + \sum_{c=1}^{C} \gamma_{Fii}^{C} X_{ii}^{C} + \phi_{Fii} Y_{ii} + \varepsilon_{ii}$$
(1)

where Z_i^G is a vector of global factors, X_i^C is a vector of cross-country factors, and Y_{it} is a control variable for domestic factors. C represents the centre economies: the US, the euro area, and Japan. $\hat{\gamma}_{it}^G$, the estimate of our focus, represents the extent of sensitivity of a financial variable (R_{it}^e) to cross-country factors, or – more specifically – linkages to the four major economies. The financial variables examined include the short-term policy interest rate and the rate of change in the real effective exchange rate (REER).¹⁸

The global factors (Z_i^G) include global interest rates (the first principal component of Federal Reserve, ECB, and Bank of Japan's policy interest rates), the principal component of oil prices, and commodity prices,¹⁹ as well as the VIX index and the "Ted spread," (spread between the three-month LIBOR and US Treasury Bill yield).

The vector of cross-country linkage factors (X^c) corresponds to the dependent variable. For example, if the short-term interest rate for country *i* is the dependent variable, X_i^c includes the short-term interest rates of the four centre economies.²⁰ To control for domestic economic conditions, the year-on-year growth rate of the industrial production index is included. Regressions are conducted for three year non-overlapping panels, so that $\hat{\gamma}_{Fit}^c$ is time-varying.²¹ The sample is monthly – 1986 through 2012 – and encompasses about

100 countries including both advanced economies (IDC) and less developed countries (LDC).²² The estimates of key interest are sensitivities of $\hat{\gamma}_{Fit}^{C}$ to country-specific variables.

$$\hat{\gamma}_{Fit}^{C} = \theta_0 + \theta_1 OMP_{Fit} + \theta_2 MC_{Fit} + \theta_3 LINK_{Fit} + \theta_4 INST_{Fit} + \theta_5 CRISIS_{Fit} + u_{Fit} \quad (2)$$

There are four groups of explanatory variables. The first is a set of open macroeconomic policy choices (OMP,), including the indexes for exchange rate stability (ERS) and financial

¹⁸ Policy rates are used for interest rates, and shadow rates when the policy rates hit the zero lower bound, drawn from Wu and Xia (2014) and Christensen and Rudebusch (2014). The REERs are tradeweighted rates drawn from *International Financial Statistics*.

¹⁹ When estimating the policy interest rate correlation, the first component of US FRB, ECB, and Bank of Japan's interest rates are not included as part of the global factor vector because it would overlap with χ^c .

²⁰ For the euro area's variables before the introduction of the euro in 1999, the GDP-weighted average of the variable of concern for the original 12 euro countries is calculated and included in the estimation.

²¹ Aizenman et al. also estimate a model with China as a core economy; the results are not substantially different.

²² In this study, the emerging market countries (EMC) are defined as those countries classified as either emerging or frontier during the period 1980–1997 by the International Financial Corporation, plus Hong Kong and Singapore.

openness (*KAOPEN*) from the trilemma indexes by Aizenman et al. (2013).²³ A country that has a fixed exchange rate arrangement with a major country, or the base country, is more subject to financial shocks occurring in the base country if it has more open financial markets.

The group MC_i includes macroeconomic conditions such as inflation volatility, current account balance, and public finance conditions, measured either using gross national debt or general budget balance shares. Linkage with the core countries (*LINK*) is measured by the following variables:

- Trade linkage, measured as $TR_LINK_{ip} = IMP_{ip}^{C}/GDP_{ip}$, where IMP_{i}^{C} is total imports into the centre economy C from country i, which are normalized by country i's GDP.
- Financial linkage, *FIN_LINK_{ip}*, measured as the ratio of the total stock of foreign direct investment from country *C* in country *i* as a share of country *i*'s GDP (*FDINV^C_i*).²⁴
- Trade competition (*Trade_Comp*) measures the importance to country *i* of export competition in third markets between country *i* and major country *C*.

The fourth group is composed of the variables that characterize the nature of institutional development (*INST*) – namely, variables for financial development and legal development.²⁵

We argue that institutional development is also an important factor. If this factor affects cross-border capital flows, they should also affect the extent of sensitivity to financial shocks occurring to the centre economies.

To measure the level of financial development, the first principal component of financial development (*FD*) using the data on private credit creation, stock market capitalization, stock market total value, and private bond market capitalization (as shares of GDP) is used. Also included is a measurement of legal development – the first principal component of law and order – (*LAO*), bureaucratic quality (*BQ*), and anti-corruption measures (*CORRUPT*), all from the ICRG database. Higher values of these variables indicate better conditions.²⁶

The variables in *MC* and *INST* are included in the estimations as deviations from the US, Japanese, Chinese, and euro area's counterparts. The variables in vectors *OMP*, *MC*,

²³ As Mundell (1963) argued and Aizenman et al. (2013) and Ito and Kawai (2012) have empirically shown, it holds that a country may simultaneously choose any two, but not all, of the three goals of monetary policy independence, exchange rate stability, and financial market openness to the full extent. Given this linearity, we only include two of the three trilemma indexes.

²⁴ We also tried the variable for bank lending provided by the centre economies. However, since it turned out to be persistently insignificant across different estimation models, we dropped the variable from the estimation models.

²⁵ See Caballero, Farhi and Gourinchas (2008) and Alfaro et al. (2008) for theoretical predictions, and Chinn and Ito (2007) for empirics.

²⁶ The precision of $\hat{\gamma}_{Fit}^{C}$ could be reduced by economic or financial disruptions. To control for this, we include a vector of currency and banking crises (*CRISIS*). The crisis dummies from Aizenman and Ito (forth-coming) are included in order to identify the two types of crises. For currency crises, Aizenman and Ito use the exchange market pressure (EMP) index using the exchange rate against the currency of the base country. The banking crisis dummy is based on papers by Laeven and Valencia (2008, 2010, 2012).

and *INST* are sampled from the first year of each three-year panel to minimize the effect of potential endogeneity. The specification includes time-fixed effects.

Empirical Results

The results of estimating equation (2) are reported in Tables 1 and 2, for policy interest rates and REER, respectively. The results indicate that exchange rate regimes do matter; countries with greater exchange rate stability tend to be more sensitive to changes in the centre economies' monetary policies, though the estimate is only marginally significant. Financial openness also contributes to higher degrees of sensitivity to the centre economies' policy interest rates, and its estimate is more persistently and strongly significant. These results suggest that developing countries or emerging market economies with more stable exchange rate movements and open financial markets are more subject to changes in the policy interest rates of the centre economies. Interestingly, holding higher levels of foreign reserves tends to help non-centre economies to shield themselves from the impact of changes in the centre economies' policy interest rates and the rate stability, financial openness, and IR holding are jointly significant for the group of developing or emerging market countries.

Among the variables for macroeconomic conditions, only the current account balance seems to matter. However, the positive estimate on the current account balance appears somewhat puzzling considering that a country running a current account *deficit* – and not a surplus – should be more susceptible to the monetary policy changes of the centre economies. The result indicates that a net capital exporter, rather than an importer, is more sensitive to the monetary policies of the centre economies.

As for the external link factors, financial linkage through foreign direct investment is the most important variable in determining how shocks to the centre economies' monetary policies affect those of other non-centre economies for both developing and emerging market countries. A country that receives more FDI from the centre economies tends to be more sensitive to changes in the monetary policies of those economies.

Financial development is also significant for the LDC sample. In fact, its impact (i.e. the magnitude of the estimate) is found to be larger among LDCs than among IDCs (results not reported). Countries with more developed financial markets tend to be more sensitive to changes in the monetary policies of the centre economies. This suggests that countries with deep financial markets can be good investment destinations for foreign investors, so that their arbitrage actions may lead those countries to follow the monetary conditions of the centre economies more closely.

Generally, the models for REER fit well, as reported in Table 2. Given certain degrees of price stickiness, pursuing greater exchange rate stability would lead both the nominal and the real effective exchange rate to be more sensitive to those of the centre economies. The results show the positive impact of greater exchange rate stability on the REER connectivity for all the subsample country groups. Greater financial openness also contributes to greater sensitivity in developing countries, though not significantly so for the emerging market group.

Interestingly, irrespective of group, a country with a higher level of IR holdings tends to be more sensitive to REER changes of the centre economies. One interpretation of this is that a country could respond to changes in the centre economies' real currency appreciation by using foreign exchange market interventions, inducing a positive correlation; the interpretation of this coefficient is, then, not causal.

Emerging market countries with larger government debt or budget deficits tend to be less sensitive to the REERs of the centre economies. These results may reflect the fact that such countries, which likely face higher inflationary expectations, often also face some difficulty in maintaining real exchange rate stability against the currencies of the major economies despite their general desire to pursue greater (nominal) exchange rate stability (Aizenman et al. 2013, and Calvo et al. 2000).

Not surprisingly, countries with greater bilateral trade links with the centre economies tend to be more sensitive to the REER movements of the centre economies. The negative impact of trade competitiveness means that peripheral countries with more competitive trade structures compared to those of the centre economies tend to become alternative investment destinations if a shock occurs to the centre economies. For example, if a shock happens in a way that causes real depreciation of the centre economies' currencies – such as, for example, a prediction of slow output growth, an institutional change leading to greater labour rigidities, or a falling appetite for the centre economies' financial assets – the demand for financial assets in peripheral economies can rise and drive up the real values of their currencies. Interestingly, financial linkage through FDI does not matter for the level of REER connectivity.

In contrast, countries with more developed financial markets tend to be less sensitive to the REER movements of the centre economies. These results are consistent with the observation that greater financial development allows a country to enjoy more flexible exchange rate movements. In other words, countries can afford to detach movements in the values of their currencies from those of the centre economies.

In the baseline results of the previous subsection, open macro policy variables are found to affect the extent of connectivity through financial variables. While these variables may directly affect the extent of sensitivity to the centre economies' financial variables, it is also possible that they affect the financial linkages indirectly through other variables.

To investigate this possibility, the specifications are re-estimated, including interactive terms between the variables for exchange rate stability and financial openness, and some selected variables – namely, current account balances, government gross debt (both as a share of GDP), trade demand from the centre economies, and the level of financial development. The results are reported in Tables 3 and 4 for policy interest rates and the REER, respectively.²⁷

We obtain several interesting results. First, while financial development alone would make developing countries more sensitive to centre economies' monetary policy changes,

²⁷ The estimates for inflation volatility, trade competition, legal development, and currency and banking crises are omitted from the presentation in the tables due to space limitations.

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the sensitivity would be even greater if the country had more open financial markets or adopted a more *flexible* exchange rate regime; although, theoretically, more flexible exchange rate movements should make the country less subject to the monetary policies of the centre economies – that is to say, allow for greater monetary autonomy.

The interaction terms make it difficult to interpret the coefficients directly. However, the implied sensitivities can be interpreted. The net impact of a 10 percentage point (ppt) increase in the level of financial development (as a deviation from the centre economies) is usually positive.

The results presented in Table 3 indicate a significant estimate for the interaction between ERS and import demand from the centre economies. The net impact of a 5 ppt increase in the level of import demand is larger, or less negative, for economies with more open financial markets or more stable exchange rate regimes. Greater trade linkage leads to faster transmission of monetary policy from the centre economies to peripheral economies in this globalized world, especially when these peripheral economies pursue exchange rate stability.²⁸

The combinations of exchange rate regimes and financial openness also affect the connectivity with the centre economies through REER changes. The net impact of a 2 ppt *deterioration* of the current account balance (CAB) is larger for economies with more flexible exchange rate movements, while its interactive effect with financial openness is negligible and insignificant. That is, if a shock occurs to the centre economies' REERs, it will be transmitted to peripheral economies more through nominal exchange rate movements, especially for a country with worsening current account balances. Hence, given price rigidity, the shock to the centre economies if they are trying to maintain exchange rate stability.

Pursuit of greater exchange rate stability and financial openness also makes the net impact of gross debt larger for REER influences. Holding a larger amount of debt makes a developing country more susceptible to the REER movement of the centre economies' currencies if that country pursues greater exchange rate stability and more financial integration, which is consistent with the economic characteristics of emerging market economies that have gone through financial crises in the past. In those crises, a policy interest rate increase in the centre economies, usually in the US, led first to real appreciation of the centre economy's currency, then was transmitted to peripheral economies especially when an indebted country pegged their currencies to the centre economy's currency and had more open financial accounts. This may also mean that an indebted country is tempted to monetize its debt, so that the REER transmission would take place more in the form of higher inflation than that of nominal exchange rate flexibility.

Overall, the results shown in Tables 3 and 4 demonstrate that the type of exchange rate regime does matter for the degree of linkage of financial variables between centre and

²⁸ Such a positive interactive effect between import demand from the centre economies and greater exchange rate stability is also observed in the estimation for the stock market price connectivity model (not reported). Peripheral economies that face strong trade demand from the centre economies could be more sensitive to the stock market movements of the centre economies if they pursue more stable exchange rate movements.

peripheral economies, both directly and indirectly through other macroeconomic variables such as current account balances, gross government debt, trade linkages, and financial development. In this sense, our findings differ from Rey's "irreconcilable duo", in which policymakers face only the dilemma between financial openness and monetary autonomy, and do not need to take the type of exchange rate regime into account.

Instead of examining variable by variable the impact of core country policies, one could look at a summary measurement. One such measurement is exchange market pressure – a weighted average of exchange rate depreciation, interest rate increase, and reserve decumulation, relative to the base country. The EMP index is constructed using the methodology introduced by Eichengreen et al. (1995, 1996).²⁹ The weights are inversely related to each country's variances of the three components.

We are repeating the second-step estimation, but substituting in for ($\hat{\gamma}_c$) the response of either EMP to core country REER or EMP to core country EMP. Only when interactive terms are included are significant results obtained. The results are reported in Table 5. Columns (1) through (3) report the estimation results on the estimated linkage between the centre economies' REERs and the non-centre economies' EMPs, and columns (4) through (6) those on the estimated linkage between the centre economies' EMPs and the non-centre economies' EMPs. Centre economy real exchange rate appreciations are particularly stressful for non-centre economies, more so than – for instance – interest rates. Why this is so is unclear. However, balance sheet effects are likely important; countries that have inflexible exchange rates have likely accumulated currency mismatches of the nature discussed in Section 4.

Once again, the inclusion of many interaction terms complicates interpretation. For a developing country with greater exchange rate stability or a relatively "closed" degree of financial openness, greater financial development makes its economy's EMP levels more sensitive to changes in the centre economies' REERs. If a given economy runs a current account *deficit*, a peripheral economy's EMP will be more sensitive to REER changes in the centre economies when it pursues greater exchange rate stability or more financial openness, though the impact of financial openness is insignificant and rather small. When a non-centre economy strengthens its trade ties with the centre economies (by 5 percentage points), this makes the non-centre economy's EMP more sensitive to the centre economy's REER if the non-centre economy has more flexible exchange rate regime and more open financial markets.

The indirect effects of exchange rate stability and financial openness for the EMP-EMP link are such that if a country experiences a deterioration in its current account balance, the impact of that deterioration would be larger, or less negative, on the EMP-EMP connectivity of a country that pursues greater financial openness and greater exchange rate *flexibility*. During the 2007–09 and 2010–12 periods particularly, a country with a worsening current account balance would have faced a more negative EMP-EMP link with the centre economies if it had had a more rigid exchange rate regime and more closed financial markets,

²⁹ See Data Appendix for more details.

while the effect of exchange rate regime type would have been stronger than that of the openness of the financial regime.

Similar interactions with exchange rate stability and financial openness are also found for the impact of stronger trade linkages with the centre economies. Having greater trade linkages with the centre economies would contribute to more positive EMP-EMP linkages if a country pursued greater financial openness and greater exchange rate *flexibility*. However, it also means that the extent of the negative EMP-EMP relationship is stronger for a country with more closed financial markets and a more rigid exchange rate regime, though the estimate with exchange rate regimes is statistically insignificant.

Concluding Remarks

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, a related susceptibility to rapid reversals in capital in- and outflows, a minimal ability to influence global markets, an inability to borrow internationally in the domestic currency, and balance sheet mismatches. On top of these conditions, these economies are typically relatively small in economic terms, and the international trilemma thus binds more tightly.

Rey (2013) argues that increased financial globalization means that the trilemma has been reduced, in practice, to a dilemma – essentially, insulation from world capital markets via capital controls is not feasible. There is some empirical basis for the idea that capital controls in many instances fail to insulate (e.g. Forbes et al., 2013). Hence, core country monetary policies *do* drive non-core country financial conditions, regardless of exchange rate regimes.

Nonetheless, while there is something to the view that flexible exchange rates do not provide complete insulation, Aizenman et al. (forthcoming) and Klein and Shambaugh (2013) provide evidence that floating regimes (and to a lesser extent capital controls, particularly if they are durable and extensive) do provide greater monetary autonomy than fixed regimes.

The results of Aizenman et al. suggest that while levels of direct trade linkage, financial linkage through FDI, trade competition, financial development, current account balances, and national debt are important, the arrangement of open macro policies such as the exchange rate regime and financial openness are also found to have a direct influence on the sensitivity to the centre economies. In accordance with simple (Mundell-Fleming) theory, an economy that pursues greater exchange rate stability and financial openness faces a stronger link with the centre economies through policy interest rates and REER movements. Sometimes, however, the effect is more subtle; for instance, the interest rate link is most pronounced when the trade link to the base country is extensive.

While the insights of the trilemma are extremely useful for identifying the constraints on exchange rate policies, they are not comprehensive. Holdings of foreign exchange reserves modulate the effects of financial changes to core countries. Sometimes, reserve holdings can afford policymakers an extra degree of freedom. Alternatively, pegging the exchange

rate could also cause reserve accumulation/decumulation, depending on the value of the peg. On the other hand, balance sheet considerations, in particular the currency composition of cross-border holdings of assets and liabilities, can severely constrain exchange rate policies, particularly at times when a devaluation would be necessary to spur an adjustment to balance of payments shocks.

Data Appendix

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.³⁰

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.³¹

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; 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:

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

³⁰ The data are extracted from the IMF's International Financial Statistics (60B..ZF...). For the countries whose money market rates are unavailable or are available but only in an extremely limited form, the money market data are supplemented by those from the Bloomberg terminal and also by the discount rates (60L..ZF...) and the deposit rates (60L..ZF...) series from IFS.

³¹ 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.

Single year pegs are dropped because they are quite possibly not intentional. 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 from 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 of multiple exchange rates, restrictions on current account transactions and 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.

Other Variables

Policy short-term interest rate/money market rates. Extracted from the IMF's *International Financial Statistics (IFS)*.

Stock market prices – stock market price indices from the IFS.

Sovereign bond spread – the difference between the long-term interest rate (usually the ten-year government bond) and the policy short-term interest rate (i.e. the slope of the yield curve, *IFS*).

Real effective exchange rate (*REER*) – REER index from the *IFS*. An increase indicates appreciation.

Global interest rate – the first principal component of US, FRB, ECB, and Bank of Japan's policy interest rates.

Commodity prices – the first principal component of oil prices and commodity prices, both from the *IFS*.

VIX index – available at http://www.cboe.com/micro/VIX/vixintro.aspx; measures the implied volatility of S&P 500 index options.

"Ted spread" – the difference between the three-month Eurodollar Deposit Rate in London and the three-month US Treasury Bill yield.

Industrial production (IP) – based on the industrial production index from the IFS.

Exchange rate stability (*ERS*) and financial openness (*KAOPEN*) indexes – from the trilemma indexes by Aizenman et al. (2013).

International reserves (IR) – international reserves minus gold divided by nominal GDP. The data are extracted from the IFS.

Gross national debt and general budget balance – both are included as shares of GDP and obtained from the World Economic Outlook (WEO) database.

Trade demand by the centre economies $(_{TR} __{LINK} _{_{ip}}) - TR__{LINK} _{_{ip}} = IMP_{_{ip}}^{C}/GDP_{_{ip}}$ where $IMP_{_{i}}^{C}$ is total imports into centre economy C from country i, which is normalized by country i's GDP based on data from the IMF *Direction of Trade* database.

FDI provided by the centre economies $(FDINV_i^{C})$ – the ratio of the total stock of foreign direct investment from country C in country i as a share of country i's GDP. We use the *OECD International Direct Investment* database. Due to possible non-stationarity of the data series, we include the first-difference of the FDI data series.

Trade competition (*Trade_Comp*) – constructed as follows:

$$Trade_Comp_i^{C} = \frac{100}{Max(Trade_Comp)} \sum_{k} \left[\frac{Exp_{W,k}^{C}}{Exp_{W,k}^{W}} * \frac{Exp_{W,k}^{i}}{GDP_i} \right]$$

where $Exp_{W,k}^{C}$ is exports from large-country c to every other country in the world (W) in industrial sector k and $Exp_{W,k}^{W}$ is exports from every country in the world to every other country in the world (i.e. total global exports) in industrial sector k. $Exp_{W,k}^{'}$ is exports from country i to every other country in the world in industrial sector k, and GDP_i is GDP for country *i*. We assume merchandise exports are composed of five industrial sectors (K) – that is to say, manufacturing, agricultural products, metals, fuel, and food.

This index is normalized using the maximum value of the product in parentheses for every country pair in the sample. Thus, it ranges between zero and one.³² A higher value of this variable means that country *i* has a trade structure that is more comparable to the centre economies.

Financial development (*FD*) – the first principal component of private credit creation, stock market capitalization, stock market total value, and private bond market capitalization all as shares of GDP.³³

Legal development (*LEGAL*) – the first principal component of law and order (*LAO*), bureaucratic quality (*BQ*), and anti-corruption measures (*CORRUPT*), all from the ICRG database. Higher values of these variables indicate better conditions.

Currency crisis (*CURRENCY*) – from Aizenman and Ito (forthcoming), who use the exchange market pressure (EMP) index using the exchange rate against the currency of the base country. We use two standard deviations of the EMP as the threshold for identifying a currency crisis.

Banking crisis (*BANKCRISIS*) – from Aizenman and Ito (forthcoming), who follow the methodology of Laeven and Valencia (2008, 2010, 2012). For more details, see Appendix 1 of Aizenman and Ito (forthcoming).

³² This variable is an aggregated version of the trade competitiveness variable in Forbes and Chinn (2004). Their index is based on more disaggregated data from14 industrial sectors.

³³ Because the private bond market capitalization data go back only to 1990, the FD series before 1990 are extrapolated using the principal component of private credit creation, stock market capitalization, and stock market total values, which goes back to 1976. These two FD measures are highly correlated with one another.
Exchange market pressure (EMP) index – defined as a weighted average of monthly changes in the nominal exchange rate, the international reserve loss as a percentage, and the nominal interest rate. The nominal exchange rate is calculated against the base country that we use to construct the trilemma indexes (see Aizenman et al., 2008). The weights are inversely related to each country's variances of each of the changes in the three components over the sample countries.

)

$$\begin{split} EMP_{i,t} &= \alpha(\%\Delta e_{i,t}) + \beta[\Delta(i_{i,t} - i_{b,t}) - \gamma(\%\Delta r_{i,t} - \%\Delta r_{b})] \\ \text{where} \quad \alpha &= \frac{(1/\sigma_{\%\Delta e_{i,t}})}{(1/\sigma_{\%\Delta e_{i,t}}) + (1/\sigma_{\Delta(i_{i,t} - i_{b,t})}) + (1/\sigma_{\%\Delta r_{i,t} - \%\Delta r})}, \\ \beta &= \frac{(1/\sigma_{\Delta(i_{i,t} - i_{b,t})})}{(1/\sigma_{\%\Delta e}) + (1/\sigma_{\Delta(i_{i,t} - i_{b,t})}) + (1/\sigma_{\%\Delta r_{i,t} - \%\Delta r})}, \\ \gamma &= \frac{(1/\sigma_{\%\Delta e_{i,t}}) + (1/\sigma_{(1/\sigma_{\%\Delta r_{i,t}})}) + (1/\sigma_{\%\Delta r_{i,t} - \%\Delta r})}{(1/\sigma_{\%\Delta e_{i,t}}) + (1/\sigma_{(1/\sigma_{\%\Delta r_{i,t}})}) + (1/\sigma_{\%\Delta r_{i,t} - \%\Delta r})}, \end{split}$$

where *b* stands for the "base country", which is defined as the country that a home country's monetary policy is most closely linked with, as in Shambaugh (2004) and Aizenman et al. (2013). The base countries are Australia, Belgium, France, Germany, India, Malaysia, South Africa, the UK, and the US. The base country can change as has happened to Ireland, for example. Its base country was the UK until the mid-1970s, but it changed to Germany when Ireland joined the European Monetary System (EMS).

Figure 1 – The Trilemma of International Finance



To construct the crisis dummies in three-year panels, we assign the value of one if a crisis occurs in any year within the three-year period.



Figure 2 – Trilemma Indices for Industrial Countries' Economies

Figure 3 – Trilemma Indices for Emerging Market Group Economies





Figure 4 – Trilemma Indices for Less Developed Countries

Figure 5 – Trilemma Indices for Emerging East Asia







Figure 7 – Emerging Asian Economies and China





Figure 8 – International Reserves

Figure 9 – Average marginal effects of reserves with 95% CI



		FULL	FULL
		(1)	(2)
Open Macro Policy	Exchange rate stability	-0.167	-0.349
(OMP)		(0.796)	(0.878)
	Financial openness	0.223	0.249
		(0.720)	(0.805)
	IR Holding	-1.419	-2.034
		(2.082)	(2.277)
Macro. Conditions	CA balance (%)	6.550	5.943
(MC)		(2.979)**	(3.580)*
	Inflation Vol.	14.135	9.400
		(11.231)	(6.003)
	Gross debt (%)	0.064	
		(0.467)	
	Budget balance (%)		7.715
			(4.818)
External Link	Trade competition	0.442	0.390
(LINK)		(2.764)	(2.800)
	Trade demand	-0.133	1.263
		(3.104)	(3.422)
	FDI from CEs	17.785	19.231
		(4.191)***	(4.791)***
Institutional Dev.	Fin. Dev.	-0.346	0.370
(INST)		(0.699)	(0.803)
	Legal Dev.	-0.718	-1.766
		(1.384)	(1.482)
Crises	Currency crisis	-0.058	-0.739
(CRISIS)		(0.658)	(0.704)
	Banking crisis	0.415	0.596
		(0.532)	(0.574)
	N	611	674
	Adj. R2	0.05	0.05
	# of countries	59	59
	F-test, OMP	0.88	0.76
	F-test, Macro	0.10	0.01
	F-test, Ext. Link	0.00	0.00
	F-test, Inst. Dev.	0.59	0.49
	F-test, All	0.00	0.00

Table 1 – Factors Affecting Policy Interest Rate Sensitivity, 1986–2012

LDC	LDC	EMG	EMG
(3)	(4)	(5)	(6)
4.862	3.392	3.657	3.098
(2.693)*	(2.447)	(2.448)	(2.268)
5.455	5.777	7.930	7.491
(2.403)**	(2.259)**	(2.245)***	(2.154)***
-13.803	-11.343	-12.400	-13.557
(7.342)*	(6.541)*	(6.254)**	(5.820)**
19.282	24.284	41.092	39.017
(9.666)**	(10.541)**	(10.507)***	(10.451)***
19.270	23.910	9.839	10.727
(34.312)	(15.012)	(28.624)	(12.515)
-0.963		-1.420	
(1.592)		(1.289)	
	-2.145		22.313
	(15.342)		(16.492)
-4.540	-6.454	-11.187	-11.246
(9.166)	(7.550)	(7.868)	(6.633)*
6.868	8.340	11.068	11.898
(11.125)	(10.116)	(9.170)	(8.609)
49.264	44.044	42.633	41.347
(16.003)***	(15.113)***	(13.001)***	(12.732)***
9.570	7.651	8.137	7.931
(2.500)***	(2.427)***	(2.207)***	(2.168)***
-4.831	-5.933	-7.132	-7.115
(6.555)	(5.974)	(5.530)	(5.199)
-3.589	-2.712	-3.212	-3.422
(2.595)	(2.178)	(2.167)	(1.872)*
0.544	1.410	0.766	1.292
(2.096)	(1.838)	(1.870)	(1.676)
386	432	327	371
0.09	0.08	0.12	0.13
41	41	31	31
0.01	0.01	0.00	0.00
0.24	0.03	0.00	0.00
0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.00
0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * p<0.1; ** p<0.05; *** p<0.01. The second estimation is conducted for the estimates $\hat{\gamma}_{Fi}^C$ from the first-step estimation that does not include China as one of the centre economies. Time-fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

		FULL	FULL
		(1)	(2)
Open Macro Policy	Exchange rate stability	0.614	0.643
(OMP)		(0.076)***	(0.074)***
	Financial openness	0.348	0.263
		(0.077)***	(0.075)***
	IR Holding	0.936	0.863
		(0.208)***	(0.202)***
Macro. Conditions	CA balance (%)	1.096	0.668
(MC)		(0.342)***	(0.328)**
	Inflation Vol.	3.429	-0.973
		(1.234)***	(0.493)**
	Gross debt (%)	-0.078	
		(0.049)	
	Budget balance (%)		0.401
			(0.472)
External Link	Trade competition	-1.606	-1.326
(LINK)		(0.275)***	(0.244)***
	Trade demand	1.744	1.703
		(0.295)***	(0.280)***
	FDI from CEs	-0.618	-0.634
		(0.381)	(0.380)*
Institutional Dev.	Fin. Dev.	-0.002	-0.030
(INST)		(0.071)	(0.070)
	Legal Dev.	-0.103	-0.098
		(0.138)	(0.130)
Crises	Currency crisis	0.159	0.121
(CRISIS)		(0.066)**	(0.063)*
	Banking crisis	-0.013	-0.062
		(0.052)	(0.049)
	N	537	592
	Adj. R2	0.23	0.22
	# of countries	49	49
	F-test, OMP	0.00	0.00
	F-test, Macro	0.00	0.03
	F-test, Ext. Link	0.00	0.00
	F-test, Inst. Dev.	0.68	0.51
	F-test, All	0.00	0.00

Table 2 – Factors Affecting Real Effective Exchange Rate (REER) Sensitivity, 1986–2012

LDC	LDC	EMG	EMG
(3)	(4)	(5)	(6)
0.718	0.807	0.725	0.760
(0.132)***	(0.121)***	(0.135)***	(0.123)***
0.377	0.311	0.157	0.074
(0.126)***	(0.121)**	(0.137)	(0.132)
1.038	0.919	0.761	0.606
(0.334)***	(0.320)***	(0.331)**	(0.314)*
0.921	0.459	1.360	0.684
(0.545)*	(0.536)	(0.563)**	(0.553)
2.824	-0.840	2.706	-0.868
(1.674)*	(0.671)	(1.672)	(0.634)
-0.072		-0.138	
(0.078)		(0.075)*	
	1.018		2.366
	(0.963)		(0.956)**
-1.625	-1.262	-1.275	-0.866
(0.427)***	(0.372)***	(0.429)***	(0.374)**
1.763	1.877	2.022	2.151
(0.483)***	(0.460)***	(0.463)***	(0.439)***
-0.335	-0.372	-0.110	-0.272
(0.673)	(0.668)	(0.643)	(0.639)
-0.171	-0.211	-0.076	-0.125
(0.119)	(0.117)*	(0.119)	(0.117)
-0.007	-0.212	0.076	-0.234
(0.296)	(0.290)	(0.296)	(0.289)
0.282	0.165	0.349	0.207
(0.127)**	(0.113)	(0.120)***	(0.108)*
0.001	-0.108	-0.092	-0.204
(0.096)	(0.087)	(0.102)	(0.091)**
294	332	254	290
0.22	0.23	0.27	0.28
30	30	23	23
0.00	0.00	0.00	0.00
0.12	0.25	0.02	0.01
0.00	0.00	0.00	0.00
0.33	0.10	0.81	0.33
0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * p<0.1; ** p<0.05; *** p<0.01. The second estimation is conducted for the estimates $\hat{\gamma}_{FI}^{C}$ from the first-step estimation that does not include China as one of the centre economies. Time-fixed effects for the three-year panels and the constant are also included, though their estimates are not reported.

	FULL	FULL	FULL	LDC
	(1)	(2)	(3)	(4)
Exchange rate stability	0.330	-0.619	-1.166	5.309
	(0.909)	(1.547)	(1.733)	(2.751)*
Financial openness	-1.575	0.323	-1.467	-1.269
-	(1.485)	(0.750)	(1.517)	(5.169)
IR Holding	-2.079	-1.826	-2.209	-12.865
	(2.370)	(2.217)	(2.477)	(7.555)*
CA balance (%)	6.666	13.660	11.367	28.248
	(8.238)	(6.801)**	(10.431)	(23.271)
Gross debt (%)	0.133	0.178	0.571	0.497
	(0.997)	(0.924)	(1.299)	(3.049)
Trade demand	-6.866	-1.300	-11.344	-4.779
	(8.407)	(6.050)	(10.104)	(23.448)
Fin. Dev.	5.090	0.817	7.242	17.031
	(1.670)***	(1.302)	(1.986)***	(4.719)***
KAO x CAB	0.682		2.780	-8.557
	(10.604)		(10.864)	(31.196)
KAO x Debt	-0.076		-0.167	-2.212
	(1.439)		(1.470)	(5.014)
KAO x Trade Demand	9.961		10.946	16.625
	(10.026)		(10.224)	(29.872)
KAO x FD.	-7.340		-7.209	-15.549
	(2.097)***		(2.152)***	(6.714)**
ERS x CAB		-13.799	-12.085	
		(10.909)	(12.174)	
ERS x Debt		-0.476	-1.044	
		(1.680)	(1.878)	
ERS x Trade Demand		2.812	8.142	
		(10.849)	(12.105)	
ERS x FD.		-1.977	-4.651	
		(2.200)	(2.469)*	
N	611	611	611	386
Adj. R2	0.07	0.04	0.07	0.09
# of countries	59	59	59	41
F-test, OMP	0.61	0.76	0.48	0.13
F-test, Macro	0.52	0.12	0.40	0.59
F-test, Ext. Link	0.00	0.00	0.00	0.12
F-test, Inst. Dev.	0.01	0.72	0.00	0.00
F-test, Int. Terms	0.01	0.63	0.02	0.25
F-test, All	0.00	0.00	0.00	0.00

Table 3 – Interactive Effects and Policy Interest Rate Sensitivity, 1986–2012

LDC	LDC	EMG	EMG	EMG
(5)	(6)	(7)	(8)	(9)
-7.884	-11.771	5.130	-5.971	-3.383
(7.206)	(8.226)	(2.570)**	(5.128)	(5.496)
6.516	5.335	0.974	9.544	3.303
(3.105)**	(7.412)	(4.436)	(2.450)***	(4.863)
-13.232	-10.147	-10.817	-9.973	-9.538
(9.713)	(10.706)	(6.644)	(7.006)	(7.298)
41.970	63.029	19.791	32.486	21.459
(29.384)	(39.890)	(20.440)	(22.619)	(26.431)
-0.544	1.770	-0.799	-0.481	0.318
(4.196)	(5.395)	(2.508)	(2.829)	(3.406)
-56.321	-100.895	-2.923	-23.766	-37.035
(26.507)**	(40.442)**	(19.569)	(18.546)	(26.549)
30.152	30.181	17.133	19.735	23.187
(5.726)***	(7.591)***	(3.992)***	(3.985)***	(4.896)***
	-35.884	41.950		32.968
	(44.266)	(28.319)		(31.667)
	-6.466	-1.060		-1.710
	(7.066)	(4.206)		(4.516)
	43.098	31.202		33.056
	(41.279)	(25.211)		(26.674)
	18.749	-17.676		-11.610
	(9.583)*	(5.954)***		(6.511)*
-49.790	-52.504		7.265	-2.590
(43.898)	(49.343)		(35.144)	(37.970)
-3.001	-1.671		-2.863	-2.430
(7.163)	(7.990)		(4.841)	(5.062)
123.275	148.706		67.204	62.633
(48.777)**	(53.871)***		(35.799)*	(36.936)*
-30.529	-43.333		-21.751	-16.831
(9.015)***	(10.280)***		(6.665)***	(7.173)**
386	386	327	327	327
0.15	0.18	0.16	0.15	0.16
41	41	31	31	31
0.07	0.33	0.14	0.00	0.45
0.50	0.43	0.77	0.56	0.88
0.00	0.00	0.27	0.00	0.05
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.02	0.01	0.04
0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * p < 0.1; ** p < 0.05; *** p < 0.01. The estimates for inflation volatility, FDI from the CEs, trade competition, legal development, currency and banking crisis dummies, and time-fixed effects are omitted from the presentation due to space limitations.

	FULL	FULL	FULL	LDC
	(1)	(2)	(3)	(4)
Exchange rate stability	0.623	0.341	0.355	0.735
Ū .	(0.077)***	(0.160)**	(0.159)**	(0.134)***
Financial openness	0.330	0.362	0.309	0.523
	(0.142)**	(0.077)***	(0.140)**	(0.277)*
IR Holding	0.944	1.171	1.141	1.042
	(0.208)***	(0.212)***	(0.212)***	(0.344)***
CA balance (%)	0.413	-0.194	-0.810	-0.139
	(0.737)	(0.640)	(0.895)	(1.056)
Gross debt (%)	0.064	-0.175	-0.042	-0.215
	(0.099)	(0.090)*	(0.123)	(0.155)
Trade demand	1.794	0.801	0.705	1.920
	(0.722)**	(0.547)	(0.839)	(1.019)*
Fin. Dev.	-0.165	0.394	0.252	-0.253
	(0.155)	(0.124)***	(0.182)	(0.217)
KAO x CAB	0.936		0.975	1.426
	(0.928)		(0.915)	(1.424)
KAO x Debt	-0.228		-0.208	0.258
	(0.135)*		(0.133)	(0.249)
KAO x Trade Demand	-0.033		0.385	-0.052
	(0.859)		(0.848)	(1.340)
KAO x FD.	0.225		0.210	0.087
	(0.193)		(0.191)	(0.330)
ERS x CAB		2.010	1.827	
		(1.128)*	(1.123)	
ERS x Debt		0.223	0.213	
		(0.164)	(0.164)	
ERS x Trade Demand		1.823	1.534	
		(0.998)*	(0.996)	
ERS x FD.		-0.798	-0.820	
		(0.223)***	(0.223)***	-
N	537	537	537	294
Adj. R2	0.23	0.26	0.26	0.21
# of countries	49	49	49	30
F-test, OMP	0.00	0.00	0.00	0.00
F-test, Macro	0.10	0.01	0.09	0.22
F-test, Ext. Link	0.00	0.00	0.00	0.00
F-test, Inst. Dev.	0.23	0.01	0.32	0.47
F-test, Int. Terms	0.17	0.00	0.00	0.68
F-test, All	0.00	0.00	0.00	0.00

Table 4 – Interactive Effects and REER Sensitivity, 1986–2012

LDC	LDC	EMG	EMG	EMG
(5)	(6)	(7)	(8)	(9)
0.552	0.566	0.743	0.520	0.528
(0.327)*	(0.331)*	(0.136)***	(0.329)	(0.335)
0.431	0.537	0.381	0.188	0.392
(0.122)***	(0.266)**	(0.269)	(0.131)	(0.255)
1.682	1.668	0.717	1.188	1.131
(0.333)***	(0.342)***	(0.342)**	(0.326)***	(0.339)***
-2.651	-2.966	0.110	-0.849	-1.175
(1.024)**	(1.285)**	(1.044)	(1.036)	(1.217)
-0.435	-0.525	-0.278	-0.464	-0.541
(0.155)***	(0.195)***	(0.146)*	(0.147)***	(0.184)***
1.135	1.200	2.404	1.030	1.072
(0.879)	(1.286)	(0.972)**	(0.843)	(1.212)
0.461	0.371	-0.260	0.475	0.276
(0.195)**	(0.256)	(0.213)	(0.186)**	(0.239)
	0.535	1.873		0.533
	(1.383)	(1.487)		(1.463)
	0.182	0.247		0.151
	(0.242)	(0.237)		(0.226)
	0.052	-0.291		0.032
	(1.292)	(1.279)		(1.215)
	0.078	0.271		0.388
	(0.318)	(0.337)		(0.324)
4.950	4.834		2.873	2.722
(1.640)***	(1.672)***		(1.634)*	(1.713)
0.727	0.714		0.638	0.631
(0.281)**	(0.284)**		(0.273)**	(0.277)**
0.759	0.748		1.893	1.809
(1.750)	(1.782)		(1.734)	(1.761)
-1.326	-1.280		-1.217	-1.263
(0.348)***	(0.354)***		(0.341)***	(0.354)***
294	294	254	254	254
0.32	0.31	0.27	0.37	0.36
30	30	23	23	23
0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.13	0.00	0.01
0.00	0.00	0.00	0.02	0.01
0.03	0.23	0.46	0.02	0.29
0.00	0.00	0.51	0.00	0.00
0.00	0.00	0.00	0.00	0.00

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * p < 0.1; ** p < 0.05; *** p < 0.01. The estimates for inflation volatility, FDI from the CEs, trade competition, legal development, currency and banking crisis dummies, and fixed effects are omitted from the presentation due to space limitations.

	Corr. b/w CE's REER and Countries' EMP		
	FULL	LDC	EMG
	(1)	(2)	(3)
Exchange rate stability	8.351	19.587	18.713
	(6.225)	(6.890)***	(7.407)**
Financial openness	-10.296	-21.161	-17.558
	(5.571)*	(6.143)***	(6.421)***
IR Holding	-20.095	-14.726	-6.901
	(8.947)**	(9.031)	(10.064)
CA balance (%)	59.261	67.269	28.283
	(38.237)	(33.026)**	(34.914)
Gross debt (%)	-5.544	-2.352	-0.804
	(4.768)	(4.475)	(4.500)
[•] Trade demand	39.433	8.589	14.270
	(36.107)	(33.085)	(34.822)
Fin. Dev.	-11.077	-10.351	-12.094
	(7.359)	(6.344)	(6.609)*
KAO x CAB	-54.082	-24.893	-68.213
,	(40.153)	(36.908)	(42.483)
KAO x Debt	5.922	-7.144	-5.077
	(5.373)	(5.804)	(5.926)
KAO x Trade Demand	-21.672	18.136	-0.896
	(37.200)	(34.012)	(35.047)
KAO x FD.	-8.619	-16.551	-19.001
	(7.891)	(7.932)**	(8.584)**
ERS x CAB	-65.220	-108.129	-1.265
	(44.338)	(40.888)***	(50.437)
ERS x Debt	6.127	10.041	6.626
	(6.840)	(6.647)	(6.758)
ERS x Trade Demand	-75.257	-90.629	-89.484
	(42.484)*	(44.369)**	(49.458)*
ERS x FD.	17.335	26.167	32.941
	(9.273)*	(8.749)***	(10.051)***
N	625	382	320
Adj. R2	0.16	0.18	0.16
# of countries	59	40	30
F-test, OMP	0.03	0.00	0.01
F-test, Macro	0.29	0.23	0.88
F-test, Ext. Link	0.05	0.07	0.17
F-test, Inst. Dev.	0.00	0.21	0.06
F-test, Int. Terms	0.11	0.01	0.02
F-test, All	0.00	0.00	0.00

Table 5 – Interactive Effects and Exchange Market Pressure Sensitivity to Core Exchange Market Pressure, 1986–2012

Corr. b/w CE's EMP and Countries' EMP				
FULL	LDC	EMG		
(4)	(5)	(6)		
-0.277	0.402	0.439		
(0.220)	(0.302)	(0.322)		
-0.204	0.097	0.118		
(0.197)	(0.269)	(0.280)		
0.460	-0.058	-0.087		
(0.317)	(0.395)	(0.438)		
1.191	0.973	2.029		
(1.353)	(1.446)	(1.520)		
-0.029	-0.281	-0.357		
(0.169)	(0.196)	(0.196)*		
-2.600	-3.573	-3.522		
(1.278)**	(1.448)**	(1.516)**		
0.827	0.495	0.240		
(0.260)***	(0.278)*	(0.288)		
-3.164	-3.496	-2.907		
(1.421)**	(1.616)**	(1.849)		
-0.108	-0.170	-0.198		
(0.190)	(0.254)	(0.258)		
4.677	5.619	5.333		
(1.317)***	(1.489)***	(1.526)***		
-0.635	-0.326	-0.243		
(0.279)**	(0.347)	(0.374)		
3.797	4.131	1.684		
(1.569)**	(1.790)**	(2.196)		
-0.013	0.313	0.431		
(0.242)	(0.291)	(0.294)		
-1.263	-2.984	-2.035		
(1.504)	(1.942)	(2.153)		
-0.510	-0.038	0.225		
(0.328)	(0.383)	(0.438)		
625	382	321		
0.22	0.31	0.32		
59	40	30		
0.17	0.48	0.46		
0.04	0.01	0.01		
0.02	0.06	0.13		
0.01	0.11	0.42		
0.00	0.00	0.02		
0.00	0.00	0.00		

Notes: The estimations are conducted with the robust regression method due to the existence of outliers. * p<0.1; ** p<0.05; *** p<0.01. The estimates for inflation volatility, trade competition, legal development, currency and banking crisis dummies, and fixed effects are omitted from the presentation due to space limitations.

4. Panel Discussions

Panel Participants

Dr Peter Benczur Research officer, European Commission, DG Joint Research Center

Dr Fancis Blankson Assistant Director, Financial Stability Department, Bank of Ghana

Dr Matthieu Bussière Lecturer, Paris School of Economics

Ms Emina-Brodlija Ćeman Head of Banking Department, Central Bank of Bosnia and Herzegovina

Dr Jorge Toro Cordoba Head of the Economics Studies Department, Central Bank of Colombia

Dr Andrew Filardo Head of Monetary Policy, Bank for International Settlements

Dr Ayhan Kose Director, Development Prospects Group, World Bank

Dr Thomas Moser Member of the Board, Swiss National Bank

Dr Bui Quoc Dung Director General, Monetary Policy Department, The State Bank of Vietnam

Mr Renzo Rossini General Manager, Central Bank of Peru

Dr Sukudhew Singh Deputy Governor, Central Bank of Malaysia

4.1 Panel 1 THE STANDARD VIEW: REAL SHOCK ABSORBERS AND NOMINAL ANCHORS



Chair UGO PANIZZA Graduate Institute of International and Development Studies

"The Standard View: Real Shock Absorbers and Nominal Anchors", Panel 1, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 51–54.

Presentations by panellists

The first panellist focused on the role of exchange rate regimes in the context of policy effectiveness, and on their impact on the cost of crises. The presentation addressed two specific questions. First, the panellist discussed whether fiscal policy is more effective under a fixed exchange rate regime than under a flexible exchange rate regime. The Mundell-Fleming model predicts that the impact of fiscal policy on output should be larger under a fixed exchange rate regime as such a regime allows for the implementation of expansionary fiscal policy. Under a flexible exchange rate regime, in contrast, the model implies that fiscal policy is ineffective. This prediction is supported by empirical studies that find that a shock to government spending leads to a larger response of output growth when the exchange rate is fixed. Hence, fiscal policy seems to be more effective under a fixed exchange rate regime relative to a flexible exchange rate regime.

The second question addressed by the panellist was whether the cost of financial crises differs across exchange rate regimes. Theoretical models do not make clear-cut predictions as to which type of exchange rate

regime is more able to mitigate the effect of crises. The literature has shown that the impact of the exchange rate regime depends on the economy's characteristics. For example, the effectiveness of fixed exchange rate regimes in mitigating the effect of financial crises is affected by the level of debt in the economy. In an empirical study the panellist analyses the behaviour of output under different exchange rate regimes and finds that the role the exchange rate regime plays depends on the type of crisis. Specifically, the movement of output does not vary much under different exchange rate regimes during banking crises. For currency crises, fixed exchange rate regimes appear to be less costly than flexible or intermediate exchange rate regimes, whereas flexible exchange rate regimes are associated with a lower cost for debt crises. For crises stemming from "sudden stops" of foreign capital flows the results are less clear. Consequently, both theory and empirical findings provide inconclusive results with regard to the cost of financial crises under different exchange rate regimes. The relationship between the impact of financial crises and exchange rate regimes appears, thus, to be a fruitful area for further research.

The next panellist discussed the relative performance of fixed versus floating exchange rate regimes in the context of financing constraints, particularly foreign exchange (FX) mismatches. Such financial frictions can substantially impact the ability of the exchange rate to act as a shock absorber, and thus add an additional consideration to the choice between fixed or floating exchange rates. FX mismatches primarily result from the dollarization (or "euroization") of liabilities. The mismatch substantially impacts the response of the economy to a big external shock, such as a sudden stop of external financing. Such a shock usually leads to a depreciation of the domestic currency, which should facilitate external adjustment through net exports. Under an FX mismatch however, the depreciation results in a negative balance sheet effect that works in the opposite direction. The trade-off between the two aspects then leads to the question of the optimal extent of depreciation.

The panellist considered a small open economy model where the FX mismatch can be introduced by assuming that households borrow in foreign currency but have a motive to hold assets in the local currency. An external financing shock implies external rebalancing. Under a floating exchange rate regime, this leads to a depreciation and to an even larger mismatch. In contrast, a fixed exchange rate regime protects households' balance sheets, but hinders external adjustment. The relative performance of the two exchange rate regimes depends, then, on the severity of the mismatch. The model suggests that with a larger mismatch there is a marked trade-off between employment and consumption: the former recovers more guickly under a float, while the latter recovers more quickly under a peg. This trade-off is less pronounced when the mismatch is small.

The panellist emphasized that it is difficult to eliminate an FX mismatch once it exists. It is thus important to act in a timely manner to limit its build-up. Policymakers should be aware of the main drivers, which typically are sustained interest rate differentials and exchange rate stability. Policies to prevent the build-up of an excessive FX mismatch include both microprudential and macroprudential measures. The former might consist of currency-specific loan-to-value or payment-to-income caps, whereas the latter might focus on higher capital requirements for FX loans and corrective taxes on banklevel mismatches.

The third panellist drew on the specific experience of a country in choosing a suitable exchange rate regime. The central bank's exchange rate management framework has continuously adjusted to the development of the economy. The panellist stressed that there is no single exchange rate regime that is suitable under all circumstances. Specifically, in a period marked by high inflation, large capital inflows and high world commodity prices, the central bank opted to commit to a clear path for the exchange rate. This involved the announcement of an official interbank exchange rate between the domestic currency and the US dollar and lower deposit rates on foreign currencies to counter capital inflows. In addition, the central bank's commitment entailed regular communication with business circles leading them to anchor their behaviour on the central bank's signals.

The panellist pointed to several challenges policymakers and researchers should pay attention to in the next few years. First, methods of exchange rate equilibrium evaluation are uncertain and require improvement. While central banks' assessment of economic fundamentals is crucial for the success of any managed exchange rate regime, the existing analytical models of the equilibrium exchange rate frequently yield inconclusive results. Second, exchange rate communication should be studied in more depth. The literature on central bank communication largely concentrates on inflation targeting and related issues, while little attention is paid to exchange rate communication. Third, the conduct of monetary policy under dollarization merits further discussion. In a dollarized economy, central banks face a trade-off between monetary easing to support economic growth and maintaining high deposit rates on domestic currency to avoid further dollarization.

General Discussion

One audience member pointed to potential asymmetries in the discussion on the effectiveness of fiscal policy. Specifically, an expansionary fiscal shock might have different implications than a contractionary fiscal shock.

Another participant remarked that the analysis of the cost of currency crises under different exchange rate regimes did not differentiate between those currency crises during which the peg was broken and those during which the peg was maintained. Differentiating between these two cases might yield different conclusions. Another participant expressed concerns about the argument that currency crises are costlier for economies that have flexible exchange rate regimes. This finding might be due to differences in periods where there is ample international liquidity. The participant suggested stratifying the sample to not average over periods marked by different liquidity conditions.

A participant focused on the issue of regular communication between the cen-

tral bank and business circles and asked to what extent this communication was aimed at foreign investors as compared to domestic investors. The participant noted that foreign investors could be the ones driving the exchange rate.

Another participant observed that many countries have flexible exchange rates, rapidly increasing inflation and slowing economic growth. In this case the flexibility of the exchange rate regime may not be sufficient to address the economic challenges faced.

Finally, the general discussion steered towards the question as to whether an increase in the US interest rate would lower uncertainty for emerging market economies. Participants from emerging markets widely agreed that normalization of US monetary policy would substantially reduce uncertainty and thereby benefit these economies.

Replies from the Panellists

In response to asymmetries in the context of fiscal policy shocks, one panellist mentioned that the effect of fiscal policy shocks are certainly asymmetric. Studying them requires different approaches, and is an interesting avenue for further research.

With respect to the findings on the cost of currency crises under different exchange rate regimes, one panellist confirmed that the analysis did not differentiate between pegs that were broken and pegs that were upheld during currency crises. Indeed, it is frequently the case that a country switches its exchange rate regime in the middle of a crisis. Incorporating this into the analysis might lead to different results. Given that growth regressions are rather fragile, conditioning this type of question might be useful. Another panellist clarified that communication between the central bank and businesses also included foreign actors.

Finally, a panellist explained that in situations when flexible exchange rates alone are not enough to foster economic growth and maintain stable inflation, a complex policy mix with multiple tools is needed to fulfil multiple objectives. In the long run, policymakers need to resort to structural policies. Another panellist added that it is important to clarify whether inflation is high due to the exchange rate or for structural reasons.

4.2 Panel 2 THE NEW VIEW: THE GLOBAL FINANCIAL CYCLE AND POLICY AUTONOMY



Chair ALEXANDRE SWOBODA Graduate Institute of International and Development Studies

"The New View: The Global Financial Cycle and Policy Autonomy", Panel 2, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 55–59.

Presentations by the Panellists

The first panellist considered the monetary policy lessons learnt from the global financial crisis, which has brought about important changes in the thinking about policy frameworks, in particular the role of financial and exchange rate (FX) stability. The panellist highlighted two lessons to be learnt from the crisis. First, we cannot ignore the financial cycle. Business cycles and financial cycles are not necessarily synchronized, and present different frequencies and amplitudes. Consequently, central banks need to lean against the cycle process rather than just fight a one-off crisis. Moreover, cross-border flows are not purely exogenous and are linked to loose monetary policy and risk appetite. They risk fuelling and amplifying domestic and global financial cycles and are thus an essential factor that central banks need to address. The challenge is to develop theoretical models that incorporate the financial cycle. Standard models integrate only financial frictions – which only amplify the small perturbations around the business cycle – rather than a truly endogenous financial cycle. However, financial frictions and the financial cycle are different phenomena that have different implications for the monetary policy trade-off and exchange rate regimes. This suggests that the debate needs to be reframed from frictions to endogenous flows of funds cycles. At the same time, it is important to take into account that the drivers of the financial cycle are changing. While the first wave of global liquidity was related to traditionally leveraged sectors such as banks, it is important to also to look beyond banks and consider unleveraged financial institutions such as asset managers.

The second aspect stressed by the panellist was that monetary spillovers and spillbacks point to shortcomings in the international monetary system. Monetary policy in the world's major economies provokes global financial cycles. Hence, an important question is whether we need better coordination. The conventional wisdom of having domestic monetary policy focused on inflation and using macroprudential policies to deal with financial stability appears inadequate given the strong spillover effects. Monetary policy frameworks could address this shortcoming by not only focusing on the traditional pillar - inflation and output - alone, but by also taking into account the financial cycle and exchange rate stability. Any discussion of such a change should encompass the tradeoff associated with a holistic approach that allows central banks to design a monetary policy framework that addresses all three pillars. From a practical policy standpoint, this implies a focus on the medium-term perspective, including a policy interest rate that leans against the financial cycle symmetrically. In such a framework macroprudential tools and interest rates work as complements rather than as substitutes for one another

The second panellist centred his presentation on four major questions. He first focused on policy autonomy and the question of whether financial integration has made it illusive. Financial integration has globalized monetary policy and weakened the national transmission of such policy. Periods of loose monetary policy in some core countries in the wake of the global financial crisis have created spillovers into emerging markets and advanced economies alike, consequently leading to domestic policy complications. Some of these peripheral countries, for example, raised policy rates during boom periods, resulting in even higher capital inflows. Others were reluctant to raise interest rates, with some even lowering them to negative levels in order to stem inflows and appreciation. Hence, while flexible exchange rates can guarantee policy autonomy in normal times, they cannot do so in unusual times. Policy independence is guaranteed only by a limitless capacity for tolerating exchange rate volatility.

Next, the panellist discussed whether policymakers should rely on new tools to regain their autonomy. Financial integration has made the policy environment more complex, entailing multifaceted risks. To effectively deal with these risks, policymakers need to be proactive and consider combinations of policy tools, such as monetary policy, microprudential and macroprudential measures, capital flow management measures, fiscal policy and building buffers. Temporary capital controls should be an essential part of the policy toolkit. They can be effective in preventing capital flows from undermining domestic macroeconomic and financial stability, especially by changing the nature of the flows from short-term flows to longterm flows. Although capital flow measures and macroprudential policies have a lot in common, capital controls might be more suitable for addressing the root of the problem. In addition, the recent experience of many countries suggests that central banks with larger financial systems need to hold more FX reserves as long as their currencies are not internationalized.

In his third point the panellist raised the question of whether policymakers should distinguish between normal times and crisis times. Having good fundamentals and sound buffers lowers the probability of crises and ensures a greater flexibility to react if a crisis does still occur. The introduction of pricebased capital flow management measures and macroprudential measures during normal times can discourage capital inflows that give rise to overvalued exchange rates and other vulnerabilities. This reduces the likelihood of a crisis and provides policymakers with policy space in which to address critical macroeconomic and financial issues. While capital controls can be useful during both normal and crisis times, they may need to be quantity-based during crises to avoid panics.

Last, the panellist touched upon the question of how to stabilize the exchange rate. Over the long term managed floats monitored against a basket of currencies appear to be optimal for emerging markets. Yet, in a crisis, a temporary peg might be reasonable. Such a peg increases visibility and can send signals of stability.

Another panellist presented a specific example of how a central bank has been handling the global financial cycle. The economy faces a major challenge in the form of partial dollarization. While the share of dollarized credit has been declining over time, it remains substantial. This implies that a rapid depreciation would impact the share of non-performing loans in the banking system, and potentially lead to a financial crisis. The country has experienced this situation before when the currency depreciated by more than 20 per cent in real terms during a prior crisis.

An important lesson from that prior crisis is the need to prevent credit booms and busts. Given that the central bank does not have the mandate - and hence the instruments – to regulate the financial system, the reserve requirement is the main instrument used to prevent credit booms. In recent years, the central bank has extended the use of reserve requirements in several ways. First, there is a clear differentiation between foreign currency and the local currency, with the reserve requirement being higher for foreign currency liabilities than it is for local currency liabilities. Second, the reserve requirement for foreign currency liabilities does not only apply to deposits, but also to the external credit lines of commercial banks. Third, the reserve requirement is modified in a countercyclical way in order to stabilize the stock of credit in the financial system. In addition, the central bank has worked towards de-dollarizing credit in the economy by using the reserve requirement in an innovative way. Specifically, it imposes an additional reserve requirement in dollars on banks that have not reduced their stock of credit in dollars and reduces the reserve requirement on liabilities in the domestic currency. This measure has proven very effective in reducing dollarized credit and increasing credit in the local currency. Not only has this led to a reduction in total credit in foreign currency, it has also resulted in a decline in the most critical components of dollarized credit, such as mortgages and loans taken out to purchase automobiles. Furthermore, the central bank has introduced a swap facility to provide the banks with liquidity in the local currency, thereby addressing the funding mismatch that banks are facing as a result of the local currency's depreciation. This measure has helped to further reduce the vulnerability of the financial system.

In addition, the panellist stressed that the precautionary accumulation of foreign reserves is important as it allows the central bank to intervene in the foreign exchange market when there is significant pressure on the local currency. Intervention is concentrated on curtailing excessive exchange rate volatility such that the equilibrium exchange rate is consistent with the evolution of fundamentals. This measure entails intervention not only in the spot market but also in the derivatives market.

The last panellist shared his country's experience with the global financial cycle and policy autonomy in the context of the standard view and what is referred to as the "new view". Under the standard view – the monetary policy "trilemma" – the country's current monetary policy can best be described as independent monetary policy and capital mobility. A key merit of this monetary policy setup is that the flexible exchange rate regime helps to absorb the impact of adverse external and domestic shocks and thereby avoids large costs to the real economy.

The new view suggests that in times of high capital mobility floating exchange rates do provide less autonomy than commonly thought. This can be explained by the fact that deep financial integration compromises the insulation provided by independent monetary policy. Funding conditions in the core economies, rather than domestic financial conditions, determine local interest rates or the domestic monetary policy stance. Under this new view, the trilemma is in fact a dilemma: countries can shield themselves from the global financial cycle only by managing the capital account or resorting to macroprudential policies. This new view is pertinent to the panellist's country, as that country has not been insulated from the challenges posed by financial integration. For instance, large currency movements have been difficult for businesses to deal with

Yet, the panellist argued that the trilemma is still relevant. The literature suggests that the correlation of the global financial cycle with financial markets in various economies is a question of interdependence. The trilemma does not rule out common shocks that affect all economies, and monetary autonomy does not guarantee insulation from the world economy. Rather, an implication of the trilemma is that there is more scope for addressing shocks with monetary policy in a country with floating exchange rates than in a country with fixed exchange rates. Events during the past few years speak for the trilemma. Countries with open capital markets and floating exchange rates concentrated monetary policy on conditions in their domestic economies. Countries with fixed exchange rates, in contrast, could not influence policy on their own.

General Discussion

The general discussion focused largely on the debate on broadening the mandates of central banks to incorporate financial stability. One member of the audience expressed concerns about the consequences for central banks' independence. Whereas it is possible to observe inflation and thus to monitor central banks' performance under an inflation-targeting mandate, this is not viable for targets related to financial stability. Monitoring thus becomes more challenging, and this could lead to increased interference by other actors at the expense of central bank independence.

Another participant asked the panellists to elaborate on the practicalities of a monetary policy framework that addresses three pillars, including financial stability and exchange rate stability. It seems challenging to implement such a medium-term framework in an environment where we do not know how economic equilibrium values, such as house prices, will evolve over a period of two to three years.

Finally, one participant added that the trilemma framework suggests that fiscal policy is quite efficient under a fixed exchange rate while it is less influential under a flexible exchange rate. Hence, from the perspective of policy effectiveness, a broader policy framework should not be restricted to monetary policy alone, but rather should be concerned with economic policy more generally.

Replies from the Panellists

With respect to central bank independence, one panellist observed that a narrow policy focus does not necessarily imply independence. This is particularly true in emerging markets where inflation is often the result of external forces rather than of domestic policies. Moreover, it is possible to define financial stability, for example in terms of financial intermediation, and to thereby ensure the accountability of the central bank towards its stakeholders. One panellist pointed to a central bank that has a clear mandate in terms of monetary stability. Yet this central bank also aims to stabilize credit. Independence can be preserved by defining clear targets and achieving them.

On the practicalities of addressing financial stability, one panellist argued that implementation is a matter of risk management. This panellist argued that deviations from the inflation target are not necessarily very costly whereas the financial cycle has proved itself to be costly and to carry with it high economic risk. Central banks should not blindly follow a narrow mandate that has been given by law, but rather should aim to maximize welfare in the economy. Addressing the financial cycle is consequently an issue of prioritization and risk management. One panellist added that for central banks it is necessary to look at both inflation and financial stability, especially in the wake of expansionary monetary policies in advanced economies that have created abnormal reactions in emerging markets. This panellist confirmed the view of the previous panellist that implementation is a matter of risk management. Another panellist disagreed and raised concerns that such a holistic framework might overburden central banks and render them relatively inefficient.

4.3 Panel 3

A PRACTICAL VIEW: THE POWER OF POLICY TOOLS AND RESERVES MANAGEMENT



Chair CÉDRIC TILLE Graduate Institute of International and Development Studies

"A Practical View: The Power of Policy Tools and Reserves Management", Panel 3, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 61–66.

Presentations by panellists

The first panellist focused on two specific issues – namely, the desirability of foreign exchange (FX) interventions and the uses of accumulating FX reserves. On the desirability of interventions to stabilize exchange rates, the speaker sounded three notes of caution. First, not all exchange rate changes are harmful to the economy. Assessing the desirability of intervention in response to an exchange rate change thus requires an understanding of the nature of the shock (productivity or monetary) that has moved the exchange rate. The panellist referred to recent research, which shows that different shocks with similar impacts on the exchange rate have very different effects on growth. Therefore, the appropriate policy response is not necessarily to limit exchange rate movements, but perhaps to address inefficiencies in the economy directly. Second, there is considerable uncertainty with regards to the level of equilibrium exchange rates that reflect fundamentals. This makes it difficult to gauge the appropriateness and chance of success of interventions. Finally, there is also a considerable amount of uncertainty with regards to the optimal level of FX reserves. Researchers have proposed many reference variables, including imports, short-term debt, and broad money aggregates (M2). However, the lack of a clear consensus on any reference and levels - even within a given reference - has led to the so-called Machlup problem. This refers to the tendency of economies to accumulate reserves infinitely since they do not have a clear reference variable. Countries also have an incentive to stand out positively from their neighbours due to a "keep-up-with-the-Joneses" effect, which - along with a "fear of losing reserves" - further contributes to uncertainty about the appropriate level of reserves. The panellist also acknowledged that exchange rate movements can harm the economy by constituting obstacles to trade or causing currency mismatches. However, promoting local currency bond markets could address these problems to some extent.

Turning to the uses of accumulating reserves, the panellist distinguished between ex ante (crisis prevention) and ex post (actual interventions) uses of international reserves. He first considered whether having large reserve stocks avert currency or other crises, and argued that – empirically – higher reserves levels are helpful in averting crises. In addition, countries with high levels of international reserves as a ratio of their short-term debt tend to perform better during currency crises. Reserves are also found to be complementary to capital controls.

The panellist concluded with a discussion of the effectiveness of FX interventions. Assessing the effect is a difficult task because of a central endogeneity problem – namely, that countries with vulnerabilities could accumulate reserves in expectation of an impending crisis. Researchers have handled this problem through applying many approaches, including the use of instrumental variables, a reliance on high-frequency interventions data, and the Blanchard approach (using exogenous gross inflows). Studies find that FX interventions have some positive impact but it is difficult to establish that impact precisely because of the endogeneity problem.

The second panellist focused on the workings of FX interventions in practice. He relied on a case study of a particular country, in which the central bank had to manage large inflows, declining outflows, and pressures of appreciation while at the same time maintaining an accommodative monetary policy stance. This led to an exchange rate intervention with a clear target level as the only available option, as the policy rates had already been brought down to zero, and the narrow market of domestic currency assets meant that a standard quantitative easing policy was not an option.

The panellist highlighted the high frequency of market movements during the intervention, and made two striking observations. The first was that the central bank's announcement had a signalling effect. The effect of the announcement alone contributed significantly to reaching the target level, and very little actual intervention needed to take place on that given day. The second observation related to the pace at which markets reacted to the news, with volumes picking up only after some delay. The panellist also discussed the consequences of the policy – maintaining the target level has led to a significant accumulation of FX reserves, and consequently asset management has become an important aspect of the central bank's activities.

The third panellist focused on the case of a particular country that has a long experience of dealing with pressures of appreciation. The presentation focused on the effectiveness of FX interventions and capital controls in managing these pressures. The data show a clear appreciation trend for the nominal exchange rate during the period under consideration, interrupted only by the global financial crisis and transitory events. However, recurrent intervention in the FX market was unable to stop this trend, and only led to a significant accumulation of international reserves. The panellist indicated that sterilized intervention turned out to be quite costly for the central bank, due to a significant interest rate differential during most of the period.

Against this background, the panellist discussed the main factors behind the appreciation of the currency: factors that can shed light on why the pressures were so persistent despite recurrent and costly interventions. The first was a positive albeit varying interest rate differential in favour of the domestic economy. Second, convergence of inflation towards its long term target reduced the pressure of depreciations stemming from the purchasing parity channel. The third factor was an improvement of the fiscal situation. Fourth, the terms of trade became increasingly favourable, partly due to a boom in commodity markets. Fifth, external debt, both public and private, declined as a percentage of GDP. These economic factors, together with other positive domestic developments, led to a significant reduction in the perceived riskiness of the country on the part of international investors, leading to historically high foreign capital inflows. Foreign direct investment and debt flows dominated capital inflows in the initial stages. Subsequently, portfolio inflows have become important.

The panellist pointed to econometric research that concludes that the effectiveness of the interventions was short-lived and in some cases led to higher volatility. These studies concluded that capital controls were ineffective as a tool for modifying the path of the exchange rate. However, they were able to reduce short-term flows and induce a shift from short-term to long-term capital inflows. The speaker also noted that in some instances capital controls increased the autonomy of monetary policy by relaxing the "trilemma". The joint use of FX interventions and capital controls was effective in producing a depreciation of the exchange rate without increasing its volatility.

The fourth panellist spoke regarding a certain country's experience with exchange rate policies. The country's policy framework is to limit exchange rate movements by using a tight peg with a reference currency. The panellist laid out the obligations that this regime places on the central bank, as it has to keep the currency freely convertible into the anchor currency, at a fixed rate. The panellist also highlighted limits on the central bank's ability to government spending and on its ability to act as a lender of last resort a challenge compounded by the central bank's lack of regulatory powers over the banking system, and the need to maintain high foreign reserves. These restrictions are needed to prevent inflationary pressures and ensure a credible link to the anchor currency.

Given this environment, the reserve requirement ratio is the only tool available to the central bank with which it can steer bank and systemic liquidity. This tool was effectively used during the recent crisis to ensure adequate liquidity. Specifically, a swift reduction of the reserve requirement ensured that the panic was short-lived and sums withdrawn from banks were promptly returned.

The panellist highlighted the importance of managing the FX reserves of the central bank in a safe and profitable way. However, current market conditions make this task difficult as profitability is limited. The panellist also noted that there are no serious concerns on the liquidity front as the FX reserves are constantly growing.

The last panellist focused on two broad issues. The first was the profound change in central bank thinking about monetary policy and exchange rate policy, FX interventions, and reserve management that has taken place since the crisis. Central bank balance sheets have expanded to unprecedented levels. The panellist noted that while this expansion was due to FX interventions for emerging markets central banks, the same was due to unconventional policies for advanced economies central banks. The panellist focused specifically on changes in FX interventions.

The panellist pointed to a renewed interest in the FX management aspect of the monetary policy framework. This is primarily driven by central banks' recognition that the excess volatility in exchange rates is not driven by fundamentals but by risk perceptions. This volatility is also aided and abetted by cross-border capital flows. The level and misalignment of exchange rates is another important concern for central banks in their thinking about FX management. The panellist drew on the results of a survey of central banks to point out that the two main motives for interventions are the need to curb speculative pressures on exchange rates, and the need to smooth the trend path of exchange rates. The results suggest that intervention is more effective if it addresses temporary capital flows, especially portfolio inflows. There is also recognition among the surveyed central banks that intervention is likely to cause spillovers. Finally, reserve accumulation is viewed as an important by-product of intervention.

Turning to the specific tactics of interventions, the survey suggests that there have only been modest changes. However, the panellist observed that over the last couple of years central banks have been experimenting more. Central banks have usually mostly intervened in spot markets, and have favoured transparent interventions over covert ones. In addition, interventions have tended to be reactive and not pre-emptive. The size and frequency of interventions rose during the crisis and has since fallen, but not to pre-crisis levels. Going forward, tactics are likely to evolve with growing international financialization and interconnectedness especially towards the use of FX derivatives. Central banks are also experimenting with policies such as asymmetric interest rate corridors, and foreign reserve deposit facilities with returns that vary with the extent of capital flows.

In terms of the effectiveness of intervention, 80 per cent of the 20 emerging market central banks surveyed felt that their interventions were "partly or wholly successful". However, most felt that the interventions had only had a temporary impact. The survey also noted that surprise (but not covert) interventions were viewed as more effective. Although distinguishing between the signalling and the portfolio balance channels is hard empirically, the signalling channel seems to be more important. The panellist concluded the first part of the presentation by suggesting that FX interventions need to be viewed as an "important part of any healthy diet".

The panellist then turned to the practical problems of central banks' reserve management, and the implications of the abovementioned changes for strategic asset allocation. The rise in central bank assets has set off new trends in reserve management. First, there is greater emphasis on risk-return trade-offs, as compared to the earlier, narrower focus on ultra-safe assets. Second, the "feasible" asset universe is growing larger and more complex. Finally, there is increasing recognition of the multidimensional aspects of risk tolerance for central banks.

General Discussion

The ensuing general discussion focused on the changes in reserve management practices, and to a lesser extent on the role of FX interventions, and the link between the two. One member of the audience wondered if central bank risk management behaviour could be characterized by loss aversion as opposed to risk aversion. In addition, the participant also highlighted that if central banks as asset managers grow in importance, they may exert general equilibrium effects.

The second question from the audience concerned the motives for FX intervention and was based on two earlier statements made by the panellists. First, it seems there are excess levels of reserves around the world as measured by various ratios. Second, interventions are intended to curb excess volatility and smooth the exchange rate path. If interventions are truly not carried out with the intention of influencing the trend and there is an excess of global reserves, why is there so much growth in international reserves? This question is even more pertinent given the fact that the main assets in international reserve expansion are US dollar government assets. This line of thinking suggests that reserve accumulation is a result of countries trying to prevent the appreciation of their currencies vis-à-vis the US dollar.

Another participant highlighted an emerging trend in reserve management that was not mentioned by the panel. Increasingly, emerging market central banks are investing in other emerging market assets. Even central banks from advanced economies are investing in emerging market assets. The participant stated that for emerging markets an intervention is a losing proposition given the current macroeconomic environment and the interest rate differential. However, if they do not pick up marginal reserves, even at a cost, their liquidity positions may be questioned by rating agencies.

The general discussion then steered towards the recent fall in the levels of reserves in many emerging markets and potential reasons for this. One participant noted that falling export revenues and the decision to use reserves to meet fiscal needs in some countries, particularly oil-exporting economies, has driven this trend.

Another participant asked if the issue of "keeping up with the Joneses" can be addressed through regional coordination. Another responded that while this works to a certain extent, given the diversity in economies full coordination is difficult. The participant also added that a reserve pooling mechanism could be one means of addressing this concern.

Replies from the Panellists

One panellist acknowledged that the distinction between loss aversion and risk aversion is very important. Even pension funds face similar choices. However, related theory remains very underdeveloped making it difficult to assess the relative importance of each. Another panellist noted that their country's central bank is risk averse, but that loss aversion is also an important concern for that central bank.

The panel noted that as newer assets make their way into reserve management practices, the general equilibrium effects of central bank asset allocation choices will become much more relevant. This can be dealt with partly by introducing certain governance principles, much like for sovereign wealth funds.

With regards to the observation about the true motive of intervention and reserve accumulation, a panellist noted that central bankers believe that they need a much greater buffer than that which the academic literature suggests. It seems that almost all central banks are very comfortable with huge buffers. During a period where buffers accumulated there were accusations of central bankers leaning against appreciation and one has to take that seriously. One panellist added that the notion of excess reserves could arise from measurement problems associated with high levels of uncertainty. Consequently, current ratios may not be capturing the true extent of reserves needed and reserve managers may prefer to keep reserves. The third panellist mentioned that it is difficult to foresee risk, and when a shock arises reserve accumulation provides support to the balance of payments. Reserves, albeit costly, could provide protection during shocks.

Another panellist mentioned that diversification of portfolios brings with it newer problems. For example, when central banks enter newer asset classes, including equities, and if they become a very large investor, how do they deal with voting rights? Hence, a lot of practical problems accompany diversifying the portfolio, and these include legal systems and voting rights.

In response to a question regarding if the size of the intervention relative to the size of the market matter for the effectiveness of intervention, a panellist reiterated the importance of the signalling effect but conceded that it is difficult to assess the relative importance of the size of the intervention. 5. Poster Session

5.1 A FACTOR APPROACH TO THE YIELD CURVE FOR THE COLOMBIAN ECONOMY

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Guarín, A., and A. Murcia, "A Factor Approach to the Yield Curve for the Colombian Economy", in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 67–73.

Introduction

The recent literature in macro finance has shown that the term structure of interest rates is a potential source of implicit information on current macroeconomic shocks and changes in markets' expectations (Ang & Piazzesi (2003), Diebold et al. (2006) and Andreasen (2008)). The extraction of this information is, however, a complex task.

The yield curve has been studied using several approaches: the latent-factor model² (e.g. Dai & Singleton (2000)), VAR models (e.g. Evans & Marshall (2007)), the semi-structural

¹ The views expressed in this document are those of the author and do not necessarily reflect the position of the Central Bank of Colombia.

² This branch of the literature decomposes the yield curve into three unobserved factors: level, slope, and curvature.

approach³ (e.g. Hordahl et al. (2006), Rudebusch & Wu (2008) and Bekaert et al. (2010)) and DSGE models (e.g. Andreasen (2008) and Zagaglia (2009)).

In this paper, we make use of the factor approach under the no-arbitrage condition for modelling the term structure of interest rates. First, we use the latent-factor model to decompose the yield curve into three unobserved factors. Second, we employ a macro-factor model in a closed economy setting. We express bond yields as a function of the economic activity growth rate, the inflation rate, and the monetary policy rate. We extend this framework for a small open economy (SOE) setting by including a foreign, long-term interest rate adjusted by local risk.

The empirical application is performed on monthly data for the Colombian economy between January 2006 and December 2013. The model parameters are estimated using Bayesian methods. Results show that domestic macroeconomic variables are able to explain the dynamics of the shortest segment of the yield curve. However, their ability to fit long-run yields is low. The foreign, long-term interest rate adjusted by local risk is, however, crucial to explaining the dynamics of Colombian medium- and long-term yields.

Model

Following Ang and Piazzesi (2003), we suppose that short-term interest rate $i_{1,t}$ is an affine function $i_{1,t} = \delta_0 + \delta'_1 X_t$. The vector of state variables X_t follows a VAR(1) process, $X_t = \Phi X_{t-1} + \Sigma \varepsilon_t$, where ε_t is a vector of Gaussian errors.

Under the no-arbitrage restriction, the bond price P_t^n time t and maturity n periods ahead satisfies $P_t^n = E_t \{ m_{t+1} \ P_{t+1}^{n-1} \}$. The variable $m_{_{t+1}} = \exp{(-i_{_{1,l}})} \xi_{_{1+l}}/\xi_{_{1}}$ stands for the one-period stochastic discount factor and $\xi_{_{t+1}}$ is the Radon-Nikodym derivative. This latter variable follows a log-normal process $\xi_{_{t+1}} = \xi_t \exp{(-\frac{1}{2}\lambda_t'\Sigma\lambda_t - \lambda_t'\varepsilon_{t+1})}$, where $\lambda_t = \lambda_0 + \lambda_t X_t$ is the time-varying market price of risk. The variable λ_t measures the additional expected return that an investor requires per unit of risk ε_t .

Ang and Piazzesi (2003) show that bond prices are exponential affine functions of X_t such that $P_t^n = (\widetilde{A}_n + \widetilde{B}'_n X_t)$. For n = 1, bond prices P_t^n are calculated with $A_1 = -\delta_0$ and $B_1 = -\delta_1$, while those for n>1 are computed recursively as

$$\widetilde{A}_{n} = \widetilde{A}_{1} + \widetilde{A}_{n-1} - \widetilde{B}_{n-1}^{\prime} \Sigma \lambda_{0} + \frac{1}{2} \widetilde{B}_{n-1}^{\prime} \Sigma \widetilde{B}_{n-1}$$
(1)

$$\widetilde{B}_{n} = \widetilde{B}_{1}' + \widetilde{B}_{n-1}' \left(\Phi - \Sigma \lambda_{1} \right)$$
⁽²⁾

The yields can be computed as $y_t^n = A_n + B_n X_t$ with $A_n = -\frac{\bar{A}_n}{n}$ and $B_n = -\frac{\bar{B}_n}{n}$. Now, we consider the state-space representation

$$\begin{bmatrix} \mathbf{y}_{t} \\ \mathbf{m}_{t} \end{bmatrix} = \begin{bmatrix} \mathbf{A} \\ \mathbf{0} \end{bmatrix} + \begin{bmatrix} \mathbf{B}^{f} & \mathbf{B}^{m} \\ \mathbf{0} & \mathbf{I} \end{bmatrix} \begin{bmatrix} \mathbf{f}_{t} \\ \mathbf{m}_{t} \end{bmatrix} + \begin{bmatrix} \mathbf{\eta}_{t}^{y} \\ \mathbf{0} \end{bmatrix}$$
(3)

³ For instance, a New Keynesian macro structure.

$$\begin{bmatrix} \mathbf{f}_{t} - \boldsymbol{\mu}^{f} \\ \mathbf{m}_{t} - \boldsymbol{\mu}^{m} \end{bmatrix} = \begin{bmatrix} \boldsymbol{\Phi}^{f} & \boldsymbol{\Phi}^{m} \end{bmatrix} \begin{bmatrix} \mathbf{f}_{t-1} - \boldsymbol{\mu}^{f} \\ \mathbf{m}_{t-1} - \boldsymbol{\mu}^{m} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\epsilon}^{f}_{t} \\ \boldsymbol{\epsilon}^{m}_{t} \end{bmatrix}$$
(4)

for t = 1, ..., T, where a set of bond yields of various maturities can be expressed as a function of a small set of both latent factors and macroeconomic aggregates.

The measurement equation (3) describes a vector of observable variables $[\mathbf{y}'_t \mathbf{m}'_t]'$ as an affine function of a state vector \mathbf{X}_t . The vector \mathbf{y}_t denotes the set of bond yields for selected maturities while \mathbf{m}_t stands for the set of J macroeconomic variables. The values for \mathbf{A} and \mathbf{B} come from equations (1) and (2), respectively. \mathbf{A}_n and \mathbf{B}_n allow us to express bond yields \mathbf{y}_t as a function of state variables \mathbf{X}_t subject to the no-arbitrage condition. We suppose that yields are observed with an error vector $\mathbf{\eta}_t^{\mathbf{y} \ iid} = \mathbf{N}(\mathbf{0}, \mathbf{R})$ and that these errors are uncorrelated.

The transition equation (4) describes the dynamics of the state vector as a VAR(1) process, where \mathbf{f}_t denotes a vector of latent factors, $\boldsymbol{\mu}$ is a vector of means and $\boldsymbol{\Phi}$ is a coefficient matrix. The transition error vector is given by $\boldsymbol{\epsilon}_t \stackrel{iid}{\sim} \mathbf{N}(\mathbf{0}, \mathbf{Q})$. We suppose that latent and macro factors' transition errors are correlated.

Data and Estimation

Our data set consists of monthly observations of Colombian Government bonds yields and macroeconomic aggregates between January 2006 and December 2013. The set of yields includes bonds with maturities from three to 180 months (see Figure 1). On average, the yield curve shows a slope upwards, with long-term yields being less volatile than shorter-term ones. Besides, there is a high level of correlation (see Table 1). Following Piazzesi (2010), we perform a principal component analysis (PCA) on the total set of bond yields and their first difference for all available maturities. Our results suggest that the dynamics of the term structure of the interest rates are driven mainly by two different factors (see Table 2).

The set of macroeconomic variables includes the annual growth rate of a domestic economic activity index (i.e. IMACO), the annual CPI inflation rate, the short-term nominal interest rate (i.e. 1-month to maturity) and the US, long-term interest rate (i.e. constant maturity Treasury Bill rates to 10 years) adjusted by local risk (i.e. Colombian EMBI). The source of both bond yields and domestic macroeconomic variables data is the Central Bank of Colombia. The foreign interest rate is taken from the US Federal Reserve, while the Colombian EMBI is obtained from Bloomberg.



Figure 1 – Term Structure of Interest Rates

We perform the estimation with Bayesian methods (Rabanal & Rubio-Ramirez (2008) and Rubio-Ramirez et al. (2010)). We employ the MCMC Metropolis-Hastings random-walk algorithm to approximate the posterior probability density function of the parameters. Under Gaussian assumptions, we use the Kalman filter to compute optimal yield predictions and the likelihood probability. We set non-informative priors.

We consider the bond yields vector $\mathbf{y}_t^n = [\mathbf{y}_t^{12} \quad \mathbf{y}_t^{60} \quad \mathbf{y}_t^{120}]'$ because these rates are obtained from bond trading and capture the short, medium, and long terms of the yield curve. The vector \mathbf{A} and the matrix \mathbf{B} are computed recursively through equations (1) and (2), respectively. The values of A_n and B_n are functions of the parameter set δ_0 , δ_1 , λ_0 , λ_1 , Φ , Σ . The matrix \mathbf{R} is diagonal while \mathbf{Q} is a full matrix.
Empirical Exercises

We estimate the latent-factor model and the macro-factor model for both a closed economy and an SOE setting. Table 1 presents the mean and the standard deviation of the root mean squared error (RMSE) computed on the difference between the estimated and the observed yields for each model.

Maturity (M)	Average Yields	Std. Dev.	Autocorrelations	Average Spreads	Vol. Ratios
1	6,04	2,22	0,98		
12	6,38	2,34	0,99	1,31	1,06
24	7,03	2,24	0,99	1,96	1,01
60	8,17	2,03	0,97	3,09	0,91
120	8,76	1,77	0,96	3,69	0,80

Table 1 – Descriptive Monthly Statistics of Colombian Government Bond Yields

Table 2 – Principal Component Analysis for Bond Yields

		Accumulated Variance up to the <i>n</i> th PC (%)				
Variable	1st	2nd	3rd	4th	5th	
Yields	90,95	99,52	99,92	99,98	100	
Yield Changes	80,01	94,96	98,47	99,73	99,97	

Table 3 – Statistics of Yield Measurement Errors: RMSE (%)

NA - 4	Latent Factors Closed Eco		conomy	nomy SOE		
iviaturity (ivi)	Mean	SD	Mean	SD	Mean	SD
12	0.04	0.01	0.76	0.10	0.53	0.02
60	0.15	0.02	1.22	0.05	0.79	0.02
120	0.24	0.03	1.20	0.03	0.73	0.03

Figure 2 compares, for macro-factor models, the evolution of the estimated yields for maturities to 12, 60 and 120 months with those observed from the market.

The RMSE for the latent-factor model is small for each maturity and the model fits the yield curve for the short, medium, and long term. Although it is possible to link the dynamics of latent factors with monetary policy decisions, these factors do not have a useful interpretation in terms of macroeconomic aggregates. The macro-factor models show a larger RMSE than the latent-factor model but there is an economic explanation of the effects of each variable on the yields.

The macro-factor model for a closed economy shows good performance in explaining the short-term yield. However, its ability to explain the yield curve using macroeconomic aggregates decreases quickly for long maturities. This result highlights the lack of a variable that captures the dynamics of the long-term yield curve.

In an SOE setting, we include the foreign, long-run interest rate adjusted by local risk within the set of macro factors. The results show an important improvement in the ability of the model to explain long-term yields. This result suggests that movements, in the long-run, of the yield curve are driven by external factors.

Figure 2: Yield Fitting: Macro-Factor Models



(A) Closed Economy

(B) SOE Setting



Conclusions

The term structure of interest rates is a source of valuable information for distinct market practitioners and policymakers. However, the extraction of this information in terms of the dynamics of macroeconomic variables has been a challenge for the recent literature in macro finance.

We found that the domestic macroeconomic aggregates are able to explain the short term of the Colombian yield curve. However, it is necessary to include a proxy for the foreign, long-term interest rate to explain the dynamics of the yield curve, and particularly, its long term behaviour.

5.2 BALANCE SHEET AND CURRENCY MISMATCH: EVIDENCE FOR PERUVIAN FIRMS¹



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Ramírez-Rondán, N., "Balance Sheet and Currency Mismatch: Evidence for Peruvian Firms", in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 75–79.

Introduction

Since the recovery of the US economy and the beginning of a period during which US monetary policy is being normalized, the US dollar has been strengthened worldwide. In this context, the Peruvian sol has been depreciating against the US dollar, as shown in Figure 1.

¹ This document summarizes the presentation "Balance Sheet and Currency Mismatch: Evidence for Peruvian Firms" given at the 3rd Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme, October 29–30, 2015, in Geneva, Switzerland. This work is still in progress, and for this reason the results presented here are preliminary. The views expressed in this document are those of the author and do not necessarily reflect the position of the Central Bank of Peru.



Figure 1: Exchange Rate (Peruvian sol per US dollar)

In conventional open economy models (Mundell–Fleming), a depreciation of the local currency has a positive effect on products because exported products become relatively cheaper; thus the country gains in competitiveness in terms of international trade.

In the Peruvian economy, an important proportion of the amount of debt held by firms is denominated in dollars (see Figure 2 on the evolution of the dollarization of loans), even when firms generate income in the domestic currency. Exchange rate depreciation increases the debt-asset ratio, making it more difficult to access alternative sources of financing. Thus, for firms in the private sector, such balance sheets negatively affect firms' plans with regards to investment and production, which can lead to a contractive effect at the aggregate level by dominating the competitiveness effect.



Figure 2: Dollarization Ratio

In theoretical terms, a large body of literature is being developed based upon the work of Bernanke et al. (1999). If there exists a significant currency mismatch in the economy, a large devaluation will deteriorate firms' net worth. Using this balance sheet channel, Krugman (1999), Aghion et al. (2001) and Orrego et al. (2011) present models with multiple equilibria.

Empirical analysis, however, has found only weak evidence of this effect (for a review, see Luengnaruemitchai, 2003), and usually only in the context of quite large depreciations. These empirical findings suggest that aggregate investment may present a nonlinearity in its dependence on the (real) exchange rate. Carranza et al. (2011) show that the negative balance sheet effect may be observable only if the magnitude of the depreciation is large enough. Azabache (2010) shows that the effects depend on the firm's leverage level.

Thus, in this work, given the non-linear effects suggested by theory and empirical evidence, we estimate a threshold currency mismatch as a percentage of total assets, in which the balance sheet effect dominates the competitiveness effect.

The remainder of this paper is organized as follows. Section 2 discusses the empirical methodology, including the specification, data, and estimation method. Section 3 presents the empirical results. Finally, Section 4 concludes.

Empirical Methodology

Specification

In order to consider the threshold level of currency mismatch that triggers the balance sheet effect, we estimate the following variation of an investment model with a threshold variable:

$$I_{it} = \alpha_{i} + \beta I_{it-1} + \theta 1 q_{t} 1 (D_{it} < \gamma) + \theta_{2} q_{t} 1 (D_{it} < \gamma) + \pi Z_{it} + \upsilon_{it}$$
(1)

where *I* is the firm's investment, *q* is the bilateral (PEN/USD) real exchange depreciation, *D* is the currency mismatch as a fraction of total assets, α_i is an unobserved country-specific effect, γ is a threshold level of currency mismatch, *1(,)* is an indicator variable, *z* is a set of other determinants of investment, *i* refers to a nonfinancial firm, and *t* refers to time period (years).

Data

The period of study spans from 2002 to 2014 for a sample of 76 nonfinancial firms. Data are constructed manually from the financial information on firms available from the *Superintendencia de Mercado de Valores*. Firms are distributed across the following sectors: manufacturing sector (42%), services (22%), mining (15%), construction (9%), commerce (8%) and agriculture (4%). Table 1 shows definitions of the variable used in this study.

Table 1 – Variables Defined

Variable	Definition
Investment	Investment flow in the period over total assets. Investment is expenditure on machinery and equipment net of fixed asset sales.
Debt in USD	Total liabilities in the foreign currency expressed in terms of the domestic currency as a percentage of total liabilities.
Currency mismatch	Total assets minus total liabilities in the foreign currency expressed in terms of the domestic currency as a percentage of total assets.
Leverage	Total liabilities divided by equity.
Sales	Real sales growth divided by total assets.
Working capital	Current assets minus current liabilities divided by total assets.
Firm size	Logarithm of total sales.
Real exchange rate	Bilateral rate PEN per USD divided by the consumer price index (CPI).

Estimation Method

Threshold regression models have been developed significantly in the context of time series analysis; Hansen (1999) extends such models in a panel data context and Ramírez-Rondán (2015) extends this work to allow dynamics in a panel data threshold model.

We consider a two-threshold dynamic model, which defines three regimes: (1) a significant negative currency mismatch (the balance sheet effect should dominate the competitiveness effect), (2) moderate currency mismatch (one effect should offset the other), and (3) low currency mismatch (the competitiveness effect should dominate the balance sheet effect).

Estimation and Inference of Results

Table 2 presents the results of our estimations, showing that for firms with a currency mismatch (as a percentage of total assets) below -10 per cent, the balance sheet effect dominates the competitiveness effect. For firms with a currency mismatch (as a percentage of total assets) between -10 per cent and 4 per cent, the competitiveness effect offsets the balance sheet effect. Finally, firms with currency mismatches (as a percentage of total assets) greater than 4 per cent see the competitiveness effect.

Table 2 – Estimation Results

Dependent variable: Investment			
Explanatory variables	Estimates	ML SE	White SE
Real exchange rate depreciation (currency mismatch < -10%)	-0.07	0.04	0.05
Real exchange rate depreciation (–10% < currency mismatch < 4%)	0.02	0.05	0.06
Real exchange rate depreciation (currency mismatch > 4%)	0.08	0.04	0.05
Investment in the previous period	0.23	0.04	0.07
Cash flow	0.01	0.01	0.02
Sales growth over total assets	0.00	0.01	0.01
Working capital	-0.03	0.01	0.02
Firm size	1.36	0.31	0.47
Leverage over equity	0.00	0.00	0.00
Number of firms (n)	76		
Number of periods; years (T)	13		
Observations used in the estimation (n*(T-1))	912		
Negative log-likelihood	1693.3		

Note: SE refers to standard errors.

Conclusion

We investigate the exchange rate depreciation effects on firms' investments for a sample of 76 nonfinancial firms during the 2002–14 period.

We basically estimate a set of dynamic panel threshold models, finding that such effects depend on the specific regime.

We find that for firms with a currency mismatch debt below -10 per cent of total assets, the balance sheet effect dominates the competitiveness effect.

5.3 BANKING LIMITS ON FOREIGN HOLDINGS: DISENTANGLING THE PORTFOLIO BALANCE CHANNEL

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Cardoso, P., F. Gamboa, D. Perez-Reyna and M. Villamizar-Villegas, "Banking Limits on Foreign Holdings: Disentangling the Portfolio Balance Channel", in *Exchange Rate Policy: Limits to Flexibility, Capital Controls,* and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 81–84.

Summary

The extensive literature on the effectiveness of sterilized foreign exchange intervention identifies two main channels through which the exchange rate can be affected: the *signalling channel* and the *portfolio balance channel*. Theoretical surveys of these are provided in Sarno and Taylor (2001), Evans (2005), Lyons (2006), and Villamizar-Villegas and Perez-Reyna (2015).

We thank participants at the 3rd BCC conference in Geneva. We also thank Jesahel Higuera for providing with our assistance research. The views expressed herein are those of the authors and not necessarily reflect those of the bank nor those of its Board of Directors.

However, the empirical literature has yet to reach a consensus regarding the effectiveness of foreign exchange intervention. One reason for this might be that managing the exchange rate while at the same time allowing for free capital flows and retaining monetary policy autonomy is an impossible "trilemma" because of arbitrage by foreign investors. In principle, policy effects should be limited.

In this paper we attempt to disentangle the portfolio balance channel by studying the effects of banks' foreign exchange exposure limits on the exchange rate. We first construct a tractable, two-period general equilibrium model with a representative household, and a monetary authority (central bank) that issues domestic debt and holds foreign reserves. The household faces a constraint on its holdings of foreign assets relative to its income. As such, our model shares similar features with those of Gabaix and Maggiori (2015) and Kuersteiner et al. (2015); namely, that the uncovered interest rate parity (UIP) condition does not hold due to some market friction. However, in our model the friction results from a financial regulation, construed as lower and upper bounds on the household's foreign exchange positions. We need limits on banks' foreign exchange exposures to allow departures from the UIP condition. In contrast, frictions found in Gabaix and Maggiori and Kuersteiner et al. consist of imperfect intermediation by international financiers due to limited commitment or to taxes on foreign capital, respectively.

Our model yields multiple equilibria: if constraints are not binding, then the UIP condition holds in equilibrium and the household is indifferent between holding domestic or foreign assets. In this case, the exchange rate is constant across any asset composition of the household. Hence, foreign exchange intervention is futile. Alternatively, when constraints are binding, departures from the UIP condition depend on the household's relative amount of foreign bonds held. This equilibrium creates a wedge on expected returns, which is then absorbed by the exchange rate.

The underlying mechanism of our model centres on how departures from the UIP condition affect the income of the household. That is, the government makes a lump-sum transfer each period equivalent to the difference between the return on its foreign assets and its debt, denominated in foreign and domestic currency, respectively. If the UIP condition does not hold, then the income of the household changes. And, since constraints are relative to income, the resulting change in income determines whether constraints are binding.

In order to test the postulations of our model, we conduct a sharp regression discontinuity design so as to fit the description of the data generating process imposed by the explicit regulations on banking limits. Specifically, we compare episodes of the exchange rate and portfolio balances when banks' foreign exchange exposures reached a binding limit to episodes during which they barely missed the cut-off point. Intuitively, the cut-off creates a natural experiment in which financial institutions arbitrarily face binding constraints (i.e. a treatment group) as long as they are in close proximity to the required limit.

Alternatively, institutions that barely missed the threshold (i.e. a control group) represent ideal counterfactuals to financially constrained institutions, had the constraint not been binding. We capitalize on the fact that the Colombian regulatory framework limits the foreign exchange exposure of banks relative to their capital. When these limits bind, portfolio shifts should, in principle, have an effect on the exchange rate. Moreover, these effects should be amplified if the central bank conducts sterilized interventions by issuing or purchasing domestic sovereign debt.

In Colombia, the liquid foreign exchange exposure for banks is defined as the difference between assets and liabilities denominated in foreign currencies (without including positions in derivatives). Specifically, this ratio is computed as the three-day average liquid foreign exchange exposure relative to the total capital. Regulations forbid banks from having a foreign exposure that exceeds 50 per cent of their capital, and – equally – their foreign exposure cannot be negative.

Even though the regulation in force states that the lower limit on the foreign exchange exposure of banks is zero, we notice that the actual limit that is important for banks is 1 per cent. One reason for this might be that it is very costly for banks to not abide by the regulation. On a given day there can be unexpected changes in their exposure, and banks must take this into account. We estimate that the total (daily) change in banks' foreign exposure relative to their capital was, on average, 1 per cent during the period February 2011–January 2013. Consequently, financial institutions required a capital buffer of at least 1 per cent in order to avoid a financial sanction.

We employ proprietary and high-frequency data from the Colombian financial sector during the period 2010–14, including the relative asset holdings of every financial institution and the official foreign exchange interventions made by the Central Bank of Colombia (CBoC). This period offers methodological advantages given that pre-announced auctions of foreign currency were the only method of foreign exchange intervention. Also, the size of these interventions did not present high variations and only on few occasions did the CBoC not intervene. Our running variable consists of the daily ratio between banks' liquid foreign exchange exposure and their capital. Figures 1 and 2 depict the implied impulse response functions (IRFs) of exchange rate changes in response to financial constraints imposed on the entire financial sector assuming that banks' liquid foreign exchange exposures are close to a cut-off point of 1 per cent of their capital. Our findings indicate that the effects of financial restrictions on the exchange rate are short-lived, and significant only when banking limits are binding. Effects are similar for the composition of relative asset holdings.



Figure 1 – Implied IRFs of Exchange Rate Changes of the Financial Sector (RDD)

Figure 2 - Implied IRFs of Exchange Rate Changes of the 5 Largest Banks (RDD)



Periods after foreign exposure hits threshold

5.4 EXCHANGE RATE POLICY TOWARDS A SUSTAINABLE CURRENT ACCOUNT



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Nguyen, D.T., "Exchange Rate Policy towards a Sustainable Current Account", in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 85–88.

Introduction

The IMF (2006) has provided a number of methods for assessing exchange rates – methods which are popular and which are used in most IMF reports. Of those methods, in this paper we follow the macroeconomic balance approach, which calculates the required exchange rate adjustment in order to close the gap between Vietnam's underlying current account balance and the current account norm or the estimated medium-term equilibrium current account balance at current exchange rates. However, we will employ this method in a forward-looking manner, using the forecast for Vietnam's underlying current account and then computing the forecast real and nominal exchange rate movements and comparing with the authority's commitment with regards to exchange rates.

¹ The author is affiliated with the State Bank of Vietnam. The views expressed are those of the author and do not necessarily reflect those of the bank.

A Review of Vietnam's Exchange Rate and Management of International Reserves

For a long time, stabilizing the value of the currency has been the main target of the monetary policy of the State Bank of Vietnam (SBV), as enshrined in the Law on the SBV 1997 and again in the Law on the SBV 2010. After joining the World Trade Organization in 2007, capital inflows surged, creating a huge surplus in the foreign exchange market and keeping the USD-VND exchange rate at low levels.

Since 2012, the foreign exchange rate has remained stable, with a much closer gap between the exchange rate traded by banks and that used on the black market. For a long time, the official exchange rate has been kept stable with only very slight devaluations over the last four years (unchanged in 2012 and 1 per cent per year 2013–2014). These positive results have been possible thanks to the activeness of the SBV in conducting exchange rate policy by announcing its exchange rate stabilization commitments at the beginning of every year. These commitments and the actual changes implemented have shown to be the most effective, anchoring well devaluation expectations in four consecutive years. In particular, based on the macroeconomic performance of previous years and the forecast for the following year, the SBV calculated a threshold for devaluation in the following year based on its macroeconomic models and kept its promises throughout the year (see Table 1). For example, for 2015, a 2 per cent devaluation commitment was introduced by the Governor and was, indeed, implemented in the first half of that year.

Year	Devaluation commitment (%)	Actual change(s) (%)
2012	< 3	0
2013	2–3	1
2014	< 2	1
2015	2	2

Table 1 – Devaluation Commitments and Actual Changes

Source: SBV, FY2015 is updated to June 2015.

The Models

Macroeconomic Balance Approach (MBA)

The macroeconomic balance approach has been adopted in advanced and emerging countries to manage the foreign exchange market. Based on the internal and external balance, the equilibrium exchange rate is derived by three steps, as follows:

Step 1 – The CA norm

Theoretically, the medium-term equilibrium current account is determined by fiscal balance, demographics, net foreign assets, oil balance, economic growth, economic crises, and the performance of the financial centre. An econometric model is used to estimate the CA norm. However, in this research I avoid modelling and apply the medium-run average of the actual current account as the alternative method.

Step 2 – Underlying current account (UCUR)

The formula for the UCUR is

 $\mathcal{CA/Y} = \alpha + \Psi_{\chi}(X/Y) Y \mathcal{GAP}^{i} - \Psi_{M}(M/Y) Y \mathcal{GAP} - [\beta_{\chi}(X/Y) + \beta_{M}(M/Y)] \times \mathcal{CA/Y} = \alpha + \Psi_{\chi}(X/Y) Y \mathcal{GAP}^{i} - \Psi_{M}(M/Y) \mathcal{G$

 $(0.6 \ln R + 0.25 \ln R_{-1} + 0.15 \ln R_{-2}) + (M/Y) \ln R - (X/Y) \ln R$

where CA/Y is the underlying current account balance to GDP; M, X, and Y are the nominal domestic currency values of imports, exports, and GDP respectively; YGAP is the domestic output gap; YGAPF is the foreign trade -country output gap; lnR is the log of the real exchange rate; ψ is income elasticity; and β is real exchange rate elasticity.

Step 3 – Solving for the exchange rate

This step is straightforward and involves setting the UCUR equal to the CA norm that has been estimated. The exchange rate is the solution of this equation. The result tells us how much the exchange rate has to change to equilibrate the underlying current account with the medium-term current account position.

Vector Error Correction Model

In order to test the impact of the determinants on the exchange rate in both the short and the long run, I employ the vector error correction model, as follows:

 $\Delta Y_t = Y_t - Y_{t,1} = \pi Y t_{1,1} + C_1 \Delta Y_{t,1} + C_2 \Delta Y_{t,2} + \dots + C_{p-1} \Delta Y_{t,p} + \mu X_t + u_t$

in which endogenous variables (Y) consist of foreign exchange reserves (GIR), exchange rate (EXR), domestic interest rate (IR), and money supply (M2).

Exogenous variable (X) consists of the World Commodity Price Index (WCPI), World Spot Crude Oil Price (OILP), and the US consumer price index (USCPI).

Measurement and Data Sources

Quarterly data for the period 2001–14 were used in this research. Regarding the domestic variables – GDP, export, and import data were supplied by the General Statistical Office of Vietnam; monetary supply (M2), exchange rate, current account balance, and interest rate were supplied by the State Bank of Vietnam.

Empirical Results

Macroeconomic Balance Approach

The ten-year average of Vietnam's current account to GDP is -1.47 per cent. This value is the CA norm, which expresses the medium-term equilibrium current account balance of Vietnam. The estimate of the UCUR to GDP for 2015 is -5.63 per cent. In order to maintain the current account and hence reduce the vulnerabilities of the foreign exchange market, the gap between the CA norm and the UCUR should be minimized. According to Step 3,

above, the real effective exchange rate is needed to adjust by +2.11 per cent in 2015 to maintain the current account equilibrium level completely.

Vector Error Correction Model

5.2.1. Co-Integration Analysis

Having confirmed that all variables included in the causality test are integrated of order one, the next step is to test for the existence of a co-integration relationship among the endogenous variables (GIR, EXR, IRD, M2).

5.2.2. Long-Run Relationship

The co-integration equation is

Ln(GIR) = 5.8416*Ln(EXR) + 0.4791*IRD - 4.5312*Ln(M2) - 34.2225.

This long-run equation can be interpreted as a total deposit demand function, which shows that the foreign exchange reserve depends on the exchange rate (+), the interest rate differential (+), and the money supply (-).

Concluding Remarks

By using a macroeconomic balance approach, this study examines the medium-term balance of Vietnam's exchange rate. The framework of a cointegrated vector error-correction model is employed to measure the impact of the exchange rate, interest rate, money supply, and current account on Vietnam's international reserves- reserves that play an important role in exchange market stabilization. The detailed conclusions are now presented.

First, in Vietnam the underlying current account in 2015 was much lower than the medium-term equilibrium current account (respectively, -5.63 per cent of GDP and -1.47 percent of GDP). This imbalance may place pressure on the foreign market if the SBV does not devaluate the dong appropriately.

Second, the macroeconomic balance model shows that the equilibrium condition of Vietnam's current account in the medium term would be satisfied if the real effective exchange rate was increased by 2.11 per cent in 2015. This matches the commitment made by the SBV's Governor at the beginning of the year.

Finally, the exchange rate, interest rate, and money supply all have an impact on foreign reserves in the long run. The effects of the exchange rate and interest rate are positive, while that of the money supply is negative.

5.5 LOAN-LOSS PROVISIONS: EVIDENCE FROM BANKS IN ALBANIA

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Dushku, E., and A. Frashëri, "Loan-loss Provisions: Evidence from Banks in Albania", in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 89–90.*

The latest financial crisis has again brought to the fore the important relationship between credit growth, banks' income, the capital adequacy ratio, and provisioning practices (FSF, 2009). Loan-loss provision policies are critical to an assessment of the stability of a financial system and are vital policies that influence the earnings of banks and banks' capital position, and therefore the supply of credit to the economy. Therefore, investigating the loan-loss provisioning behaviour of banks remains an important issue with regards to the stability of the financial system and to the whole economy.

Policies on loan-loss provisioning are believed to vary from one country to another and are influenced by accounting practices, and by the regulatory and tax policies of the country in question. There are two main approaches to provisioning – specific provisioning and general provisioning (Cortovaria et al., 2000). Specific provisioning is determined based on specific accounting rules and depends on recognized credit losses, which increase the specific reserve for loan losses and are deducted from total assets. General provisioning, on the other hand, needs to cover expected credit losses and is added to the overall reserve for loan losses on the liability side (banks' balance sheet liabilities).

¹ The authors are affiliated with the Bank of Albania. The views expressed are those of the authors and do not necessarily reflect those of the bank.

Based on a literature review, the two components that compose loan-loss provisions are the non-discretionary component and discretionary component (Bouvatier and Lepetit, 2008). The non-discretionary component covers the expected credit losses in a bank's loan portfolio (Perez et al, 2006). Thus, the provisioning practices of the banks depend on the assessment that banks make of expected credit risk, which is linked with default risk, macroeconomic risk, interest rate risk, exchange rate risk, etc. This element of provisioning is said to be backwards-looking since banks mainly relate non-discretionary provisions to identified credit losses. During economic upswings, the number of credit losses is minor, which implies that banks make lower provisions; while during economic downturns, loan-loss provisions increase due to the higher risk of loans defaulting. Hence, the non-discretionary component strengthens the cyclical nature of loan-loss provisioning, leading to a misevaluation of expected credit losses (Bouvatier and Lepetit, 2008).

The discretionary component takes into consideration the use of loan-loss provisions for management objectives – namely, income smoothing, capital management, and signalling (Liu et al, 1997, Ahmed et al, 1999, Lobo and Yang, 2001). Through income smoothing, banks tend to minimize the variance of reported earnings, which implies increasing loan-loss provisions during an expansionary phase and decreasing them during a recessionary phase. As a result, this income smoothing may have a positive impact on bank lending. Capital management refers to the use of loan-loss provision to achieve regulatory capital targets when banks face capital constraints. Signalling behaviour refers to an increase in loan-loss provisions to signal the financial strength of banks, indicating that they are robust enough to absorb potential future losses by increasing current loan-loss provisions

Our study aims to estimate the behaviour of loan-loss provisioning at banks in Albania during the period 2004–14, taking into consideration both the discretionary and the non-discretionary components of loan-loss provision, and economic growth. To investigate the main determinants of loan-loss provisioning we have used bank-level data from the Bank of Albania's database; macroeconomic variables are supplied by the Albanian Institute of Statistics.

Following the empirical work of Leaven and Majnoni (2003), Bikker and Metzemakers (2005), and Bouvatier and Lepetit (2008), we investigate the cyclicality of loan-loss provisioning in the Albanian banking sector using panel data OLS regressions.

Our empirical results show that banks in Albania have used loan-loss provisioning to carry out income smoothing, taking advantage of periods of higher profitability. Furthermore, our results show that banks do not behave in an asymmetric manner when they have generated negative income. We do not support the capital management hypotheses, so banks have not consumed their capital to create more provisions. Similarly to other studies, we believe that certain banks – especially those with lower capitalization – have adopted a procyclical provisioning model approach to macroeconomic cycles and have carried out income smoothing. While, on the whole, better-capitalized banks tend to adopt a countercyclical approach to provisioning over the business cycle.

We show evidence that the loss provisioning model used in banks in Albania is backwards-looking, in the sense that it requires that a loss event occurs before a provision can be made. We suggest that the use of systems of forward-looking provisioning for banks in Albania would be more effective in reducing credit risk.

5.6 SOVEREIGN RISK AND THE EQUILIBRIUM EXCHANGE RATE IN COLOMBIA¹

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Ojeda-Joya J.N., G. Sarmiento, and C. Palacios, "Sovereign Risk and the Equilibrium Exchange Rage in Colombia", in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 91–94.

Introduction

Monetary policy authorities need access to a comprehensive analysis of the evolution of both real and nominal exchange rates in order to make better assessments with regard to the performance of their exchange rate regimes. In particular, central banks are interested in analyzing alternative measures of the equilibrium level of the real exchange rate (RER) as this enables them to detect possible misalignments (see Lee et al., 2008). An important relationship, which has been difficult for economists and policymakers to understand, is that between exchange rates and sovereign risk (see Coudert and Mignon, 2013). For example, the important increase of sovereign risk that occurred during the initial phase of the 2008–09 financial crisis was clearly behind the steep depreciation of Latin American exchange rates and thus such an episode should not be regarded as a misalignment.

¹ The findings, recommendations, interpretations and conclusions expressed in this paper are those of the authors and do not necessarily reflect the view of the Central Bank of Colombia or its Board of Directors.

Addressing this concern, this paper estimates a model of the medium-run equilibrium RER that allows the effect of sovereign risk movements to be incorporated. This effect is integrated through an augmented interest rate parity condition. The empirical model also takes into account gradual adjustments to purchasing power parity (the long-run equilibrium) and the effect of long-term interest rates. In addition, the econometric framework allows for the non-linear effects of sovereign risk on the exchange rate equation. This effect is captured through a smooth-transition, co-integrated regression, which implies a time-varying effect of sovereign risk on the RER as a function of the international degree of risk aversion. This specification follows Coudert and Mignon (2013).

This model is estimated for Colombia. Equilibrium RER levels are computed for the bilateral rate vis-à-vis the US using monthly data. Our results show evidence of a non-linear effect of sovereign risk on the RER. The estimation of the linear model leads to consistent and well-behaved econometric results. In addition, it is found that the effects of sovereign risk on the RER are larger when they do not coincide with increased global risk aversion. When they do so coincide, the effect is lower since the market interprets this as an external episode that is unlikely to be related to domestic fundamentals.

Our results from the equilibrium assessment show that exchange rates started an over-depreciation period right after the global financial crisis episode. Then, between 2010 and 2012, exchange rates went through some periods of over-appreciation as monetary policies became expansive in the US and the euro zone and international capital — in search of higher yields — flowed into emerging economies. The depreciation episode that began during 2013–14 can be partially related to a correction to equilibrium levels once international capital flows had finally begun returning to the US.

A Simple Model of Exchange Rate Parities and Adjustment

We follow the capital-enhanced equilibrium exchange rate approach (CHEER) described by Keblowski and Welfe (2012) among others. This approach incorporates not only the UIP and purchasing power parity (PPP) conditions, but also long-term interest rates, inflation rates and sovereign risk.

Juselius and MacDonald (2003) assume that the nominal exchange rate partially adjusts each period in order to correct deviations of the RER from its purchasing power parity (PPP) long-run level. This mechanism implies a reaction function of the nominal exchange rate to domestic inflation, US inflation, and the distance between the observed RER and its PPP level. This equation along with the UIP condition implies the following reduced form:

$$q_{t} = \phi_{0} + \phi_{1}i_{t} + \phi_{2}i_{l,t} + \phi_{3}i_{t}^{us} + \phi_{4}i_{l,t}^{us} + \phi_{5,t}s_{t} + \phi_{6}\pi_{t} + \phi_{7}\pi_{t}^{us} + \varepsilon_{t}.$$
 (1)

Equation (1) is estimated with co-integration methods and data for Latin American economies. Domestic and US inflation are represented by π_t and π_t^{us} respectively. The natural logarithm of the observed RER is represented by q_t . The nominal short-run interest

rates for the domestic country and for the US are i_t and i_t^{US} , respectively. Long-run interest rates correspond to the / subscript. Finally, the sovereign risk index is denoted as s_t .

We would like to detect misalignments as significant deviations of the observed RER from the positions that its economic fundamentals predict. Therefore, we define a measure of the medium-term equilibrium RER by rewriting Equation (1) in terms of the observed fundamentals. Therefore, the error term $(\epsilon,)$ can be interpreted as the RER misalignment.

 $\boldsymbol{q}_t = \boldsymbol{\bar{q}}_t + \boldsymbol{\varepsilon}_t \tag{2}$

Real Exchange Rate Misalignment

The model proved useful for evaluating whether the real exchange rate in each country is misaligned – that is, if the observed real exchange rate (RER) is too far away from its estimated equilibrium level in each period. This analysis is carried out by computing the equilibrium level of the RER using the estimated co-integration vector. This estimation is compared to the observed RER in order to identify those periods above and below the equilibrium by drawing confidence intervals around the equilibrium RER. This methodology is applied to Colombia using the estimations of Equation (1) and the results are depicted in Figure 1.



Figure 1 – Analysing RER Misalignment in Colombia

Source: Authors' calculations.

It is possible to identify some stylized facts from the misalignment analysis presented in Figure 1. First, there is an over-depreciation period during the second half of 2003 and the

first months of 2004. This period is related to the high uncertainty prevalent in emerging markets after the sovereign debt problems of Argentina, Russia, and Brazil.

The second stylized fact is a short over-depreciation period observed in 2006. This period is characterized by a brief period of domestic uncertainty on the sovereign bonds and stock markets. There is no misalignment in Colombia during the financial crisis of 2008 and 2009. The reason for this is that the currency went through an extended over-appreciation period during the months preceding that financial crisis.

The third fact is the over-appreciation observed once US (and later the euro zone) authorities had implemented expansive monetary and fiscal policies, starting in the second half of 2009 and lasting until 2012. The ensuing presence of low interest rates and broad liquidity increased capital flows to Latin American economies. Notice that brief events of over-appreciation are scattered throughout the whole period.

Conclusions

In this paper we estimate a real exchange rate (RER) determination model based on interest rate purchasing power parities. The first goal of this estimation is computing the effect of sovereign risk movements within an equilibrium measure of the RER. We use monthly data for Colombia spanning the period 1999–2014.

These results show that sovereign risk movements have significant effects on the equilibrium RER of Colombia. Additionally, we find evidence of time-varying effects by using a co-integrating, smooth-transition regression. Therefore, the effect of a 100-basis-point increase of the EMBI on the RER ranges between 3.4 per cent and 6.0 per cent, being higher when the international risk aversion indicator (VIX) is lower.

The second goal of this paper is performing an RER misalignment analysis using the estimated regressions. These results show that there was an over–depreciation episode in 2003–04 that coincides with high levels of international risk aversion due to sovereign problems in emerging economies. Another over–depreciation episode shows up in 2006 due to domestic volatility in bonds and stock markets. Finally, scattered over-appreciation episodes are detected during the period of expansive monetary and fiscal policy in the US (2009–12).

The explicit incorporation of the effects of sovereign risk in models of RER determination helps policymakers better analyze the movements of domestic currency markets. These types of models allow us to identify whether or not strong exchange rate movements should be regarded as misalignments. For example, the steep RER depreciation during the financial crisis of 2008–09 is not detected as a misalignment since it is explained by the evolution of sovereign risk. Thus the model presented in this paper is especially suited for analyzing short-term RER movements because its fundamentals correspond to financial variables that are readily available to researchers and analysts.

6. Research Workshop

6.1 EARLY-WARNING SYSTEM FOR CURRENCY CRISES BASED ON EXCHANGE MARKET PRESSURE THE CASE OF VIETNAM



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Pham, T.H.A., "Early-Warning System for Currency Crises Based on Exchange Market Pressure: The Case of Vietnam", Research Workshop, in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 95–101.

Introduction

The main objective of this paper is to apply an early-warning system (EWS) based on exchange market pressure (EMP) to identify leading indicators and the most suitable EWS model of a currency crisis in Vietnam. Recently, financial crises in general and currency crises in particular have occurred more frequently, especially in countries that follow a multiple exchange rate regime (official and parallel exchange rates). In order to discover the causes of a currency crisis, policymakers and researchers have usually paid more attention to the development of macroeconomic and monetary indicators around a crisis-hit period.

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This paper contributes to the existing literature on EWSs as follows: *First*, the dependent variable currency crisis (CC) is not only determined by the exchange market pressure (EMP) index, but also based on some events related to the State Bank of Vietnam (the central bank) launching its policy measure related to exchange rates. These events could, for example, be a time of devaluation or time of trading band widening. Second, while most studies on EWSs for a crisis in Vietnam have employed non-parametric models (Nguyen Thi Kim Thanh et al, 2008; Nguyen Ngoc Duy and Huynh Ngoc Huy, 2009; Ho Thanh Son, 2012), this paper combines parametric and non-parametric approaches for identifying indicators and the probability of a currency crisis in the country. Explanatory variables in this model could take an absolute form (model 1) or be coded as "1" if their value exceeds the threshold and as "0" otherwise (model 2). *Third*, unlike recent studies on EWSs in Vietnam, the paper uses real overvaluation as an explanatory variable of a currency crisis model instead of nominal exchange rates. Lastly, this research extends the study period from 1996 to July 2012 so that it covers all recent crises (the Asian financial crisis, the global financial crisis, and the European debt crisis) that could have caused negative impacts on the Vietnamese economy in general, and on the financial market in particular.

There are two main findings of this paper, as follows: *First*, of a total of eight models, model 1a (in which the dependent variable, CC, is defined based on the EMP and other events, and all explanatory variables are expressed in absolute values with a window length of two months) outperforms our other models in predicting a currency crisis-hit period in Vietnam. The empirical results of model 1a suggest that the probability of predicting a true currency crisis is 80.7 per cent; the probability of predicting a crisis-hit period with signal is 84 per cent. *Second*, empirical evidence obtained from models 1 and 2 concludes that real overvaluation and domestic credit growth rate are leading indicators of a currency crisis in the country. The other indicators – including deficits in the balance of trade, industrial production value, money supply growth rate, and international reserves in import weeks – theoretically should be good indicators, but are all statistically insignificant.

The remainder of this paper is structured as follows: The second part will give a definition of a currency crisis in Vietnam based on the EMP index and other events related to the State Bank of Vietnam (the central bank) launching its policy measure related to exchange rates. Part 3 will describe the parametric and non-parametric models that the author employs to identify leading indicators and the probability of a currency crisis in Vietnam. The results obtained from these models, and comments on these results, will be presented in the fourth part. Part 5 presents a summary and a conclusion.

Definition of a Currency Crisis in Vietnam

Based on the definition of currency crises suggested by Kaminsky et al. (1997), Bussière and Fratzscher (2006), and Goldstein et al. (2000), this paper sheds light on new approach which shows that Vietnam could suffer from a currency crisis if:

- Exchange market pressure (EMP) at time *i* is above its country average EMP and two standard deviations (SD);
- ii. The State Bank devalues the Vietnamese dong;
- iii. The State Bank widens the trading bands;
- iv. The parallel market premium is 2 per cent above the targeted trading band;
- v. There is a sharp increase in domestic interest rates.

Specifications of the Model

Parametric or Non-Parametric Model

The paper combines both parametric and non-parametric methods to identify leading indicators and the probability of a currency crisis in Vietnam (however, only some of the results are reported). Logit and probit models of discrete variables are as follows:

$$y_{j}^{*} = \alpha_{0} + \beta_{j}X_{j} + U_{j}$$
⁽¹⁾

in which X_i is the vector of explanatory variables,

 β_i is the coefficient vector of explanatory variables,

 u_i is the error term that is normal distributed, and

 γ_{i}^{*} are unobservable variables, but γ_{i} (CC – *currency crisis* in this case) are observable variables, in which:

$$y_i = 1 \text{ if } y_j^* > 0$$

 $y_i = 0 \text{ if } y_i^* \le 0$

Variables of the Model

- a. Exchange market pressure (EMP) Exchange market pressure (EMP) was first introduced by Girton and Roper (1977), and argues that the status of money market disequilibrium must be removed either through international reserves (ΔlogRES, or ΔRES,/MS₁₋₁) or exchange rate changes (ΔlogH₁).
- b. Other events
- The event of devaluing the weighted-average interbank exchange rate (USD/ VND): CC at time t will be 1 if the SBV devalues the dong at time t; otherwise CC will be 0.
- The event of widening the trading band: CC at time *t* will be 1 if the SBV widens the trading band at time *t*; otherwise CC will be 0.
- The event of increasing the domestic interest rate: CC at time *t* will be 1 if the SBV increases the interest rate at time *t*; otherwise CC will be 0.
- The event of a high parallel market premium: currency crisis in Vietnam will occur if the parallel market premium is 2 per cent higher than the official trading band.

Variables	Threshold	Signal
Overvaluation	5%	+
International Reserves in Import Weeks	10 weeks	_
Deficits in Balance of Trade	15%	+
Money Supply Growth	30%	+
Domestic Credit Growth	25%	+
Growth in Industrial Production Value	10%	_

Table 1 – Threshold of independent variables

Note: (+) indicates that the higher the variable's value, the higher the probability of a currency crisis; (-) indicates that the higher the variable's value, the lower the probability of a currency crisis.

For the Window length of a curry crisis I choose a window length of one and two month for the EWS model.

Empirical Results and Comments

First, overvaluation is found to be one of leading indicators of a currency crisis in Vietnam (Table 2). In other words, the higher the overvaluation, the higher the probability of a crisis, at a significant level of 1 per cent. This finding is consistent with those of Kaminsky et al. (1998) and Llaudes et al. (2010). According to international trade theory, overvaluation will diminish a country's competitiveness leading to an increase in imports and a decrease in exports. This movement will harm trade balance status resulting in depreciation pressure; even to large, unexpected fluctuations in the foreign exchange market. The Vietnamese dong has been largely overvalued since 2008 and exceeded its threshold of 5 per cent. Together with the high level of overvaluation during this recent period, the country faced turbulence in the exchange market. In order to stabilize its exchange rate, the authorities had to implement policy measures, including selling its international reserves and raising domestic interest rates.

Second, the logit model does have a positive coefficient on international reserves in import weeks. Which should be a good indicator of a currency crisis in Vietnam; however, this variable is statistically insignificant. Theoretically, if this indicator is below ten import weeks, the country should have a high probability of facing large fluctuations in the foreign exchange market. This variable is the object of statistically significant findings in studies by Kaminsky (1998) and Comelli (2013).

Third, like the first two factors, high growth in domestic credit was also considered as one of the elements of a currency crisis in Vietnam, at significant level of 10 per cent. This finding is consistent with theory and with the empirical evidence suggested by Kaminsky (1998), Berg and Pattillo (1999), and Edison (2003). A high growth rate of domestic credit would lead to a decrease in the soundness of commercial banks by increasing the non-performing loan ratio, and by reducing the ROA and ROE ratios, etc. – in the worst case it could lead to a banking crisis. The world economy has witnessed a series of banking crises and currency

crises resulting from a boom in domestic credit that occurred not only in developed countries such as the US and Japan, but also in developing ones. In some cases, banking and currency crises have tended to cluster and have come to be known as the "twin crises" (Kaminsky, 1998). Bank lending is the most effective channel in the transmission mechanism for monetary policy in Vietnam (Nguyen Thanh Nhan et al, 2013; Pham Thi Hoang Anh et al, 2013), leading the SBV to employ domestic credit growth as an operating target. The high credit growth rate of 25 per cent during 1996–2012 was seen as a very important determinant of economic growth in the country (To Ngoc Hung et al, 2013; Pham Thi Hoang Anh et al, 2013). However, a domestic credit growth rate above the threshold of 25 per cent will be harmful to the asset quality of the Vietnamese banking system.

Variables	Coefficient	Standard errors	Z-statistics	P-value
С	0.468	0.429756	1.090071	0.2757
DC	0.022*	0.013375	1.661740	0.0966
IPV	-0.0018	0.007139	0.252682	0.8005
M2	0.0125	0.012170	1.030912	0.3026
OVERVALUE3	0.062***	0.008550	7.283094	0.0000
RES	-0.0482	0.032863	-1.468102	0.1421
ТВ	0.0162***	0.006068	2.671976	0.0075

Table 2 – Impacts of explanatory variables in predicting a currency crisis in Vietnam; window length of two months

Note: ***, **, and * indicate that the coefficient is significant at 1 per cent, 5 per cent, and 10 per cent, respectively.

Fourth, the paper found that deficits in the balance of trade, the growth rate of industrial production value, and the money supply growth rate have an impact on the probability of a currency crisis and have the expected signs, in spite of their statistical insignificance. In other words, theoretically one would think that a large trade balance deficit and a high money supply growth rate could increase the probability of a currency crisis. Moreover, when the economy is in a recession this would increase the probability of crises, including a financial crisis; however, these results were not found in our regressions. Other findings, such as those of Kaminsky et al. (1997), Goldstein et al. (2000) and Berg et al. (1999) indicate a statistically significant relationship. This could be explained by investor behaviour in times of crisis, by which investors seem to shift from local currency denominated assets into foreign currency denominated assets, even gold. This movement will create depreciation pressure, and may lead to a currency crisis.

Fifth, empirical evidence collected from all logit models suggests that model 1a outperformed the others models not presented here. In other words, model 1a could be adequate for pre-

dicting a currency crisis in Vietnam. In this model, the explained/dependent variable – CC is defined based on the EMP and other events, and all explanatory variables are expressed in absolute values with a window length of two months. Empirical results suggest that the probability of predicting a true currency crisis is 80.7 per cent; the probability of predicting a crisis-hit period with signal being 84 per cent.

	No signal	Signal	Total
a./ Probability cut-off poir	nt (p) = 0.5		
Non-crisis-hit period	61	19	80
Crisis-hit period	23	96	119
Total	84	115	199
Probability of true observat	tions	(61+96)/19	99 = 78,9%
Probability of predicting a t	true currency crisis	96/119 =	= 80,67%
Probability of a wrong sign	al over total signals	19/115 = 16,52%	
Probability of a currency cr	isis with signals	96/115 = 83,47%	
Probability of currency cris	es without signals	23/84 = 27,38%	
b./ Probability cut-off poir	nt (p) = 0.3		
Non-crisis-hit period	31	7	38
Crisis-hit period	53	108	161
Total	84	115	199
Probability of true observations		(31+108)/199 = 69,85%	
Probability of predicting a true currency crisis		108/161 = 67,1%	
Probability of a wrong signal over total signals		7/115= 6,09%	
Probability of a currency crisis with signals		108/115 = 93,91%	
Probability of currency crises without signals		53/84 =	63,09%

Table 3 – Evaluation of th	e prohit model at different i	nrohahility cut-off noints
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Concluding Remarks

This paper aimed to identify leading indicators and a suitable EWS model for forewarning of a currency crisis in Vietnam based on a combination of parametric and non-parametric approaches with the EMP index for period 1996–July 2012. In the chosen model, the dependent variable – currency crisis (CC) – is not only determined by the exchange market pressure (EMP) index, but also based on certain events related to the State Bank of Vietnam (the central bank) launching its policy measure related to exchange rates. These events could be, for example, a time of devaluation, time of trading band widening, etc. By checking the robustness of the empirical results with total of eight models, the author found that model 1a (in which the dependent variable – CC is defined based on the EMP and on certain other events, and all explanatory variables are expressed in absolute values with a window length of two months) has outperformed our other models for predicting a currency crisis in Vietnam. The empirical results for model 1a suggest that the probability of predicting a true currency crisis is 80.7 per cent; the probability of predicting a crisis-hit period with signal being 84 per cent. Therefore, the State Bank could apply the combination of parametric and non-parametric models suggested in this paper to identify the probability of a currency crisis occurring in Vietnam.

The empirical evidence obtained from two types of model shows that real overvaluation and domestic credit growth rate are leading indicators of a currency crisis in the country. The other indicators – including deficits in the balance of trade, industrial production value, money supply growth rate, and international reserves in import weeks – should be good indicators but are all statistically insignificant. A minor limitation to the model is that capital flows were not included due to the unavailability of monthly data on FDI flows, FPI flows, workers' remittances, and ODA.

6.2 MACROPRUDENTIAL VERSUS EX POST POLICIES: WHEN DOMESTIC TAXES ARE RELEVANT FOR INTERNATIONAL LENDERS

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Parra-Polania, J.A. and C. O. Vargas, "Macroprudential Versus Ex Post Policies: When Domestic Taxes Are Relevant for International Lenders", Research Workshop, in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 103–106.*

The crisis of 2008 brought about a renewed interest among academics and policymakers in the benefits of macroprudential policies and restrictions on capital flows as a way of mitigating the effects of financial crises. The related literature has tried to give a welfare foundation to the role of both ex ante interventions (e.g. a macroprudential tax on debt) and ex post or crisis-management policies (e.g. exchange rate interventions).

Part of this literature, based on a now common theoretical framework proposed by Mendoza (2002), analyses financial crises in the context of an open economy that faces an occasionally binding financial constraint. The negative effect on welfare stems from the

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feedback between the presence of this constraint and the underestimation of the social cost of debt decisions in a decentralised economy.

The standard credit constraint is expressed in such a way that the amount that can be borrowed is limited to a fraction of the borrower's current income. This can be motivated (e.g. in Korinek, 2010) as an incentive compatibility condition that avoids losses for lenders when financial markets are subject to moral hazard problems. If, for any reason, borrowers decided to default, international lenders could go to court; however, due to imperfect legal enforcement or, say, the existence of a non-seizable proportion of assets, lenders can recover – at most – only a fraction of a borrower's income. As a consequence, domestic agents can borrow only up to the amount that lenders can be sure they would recover in a case of default.

Previous literature shows that ex ante or macroprudential policies solve the externality problem by increasing the private cost of debt, equalising it to the social cost (e.g. Korinek, 2010, 2011; Bianchi, 2011). Other papers find that ex post interventions are more effective because they entail larger welfare gains (e.g. Benigno et al., 2013a) and are even able to avoid crises (e.g. Benigno et al. 2013b, 2014) by having a positive effect on the collateral's price and by, in turn, increasing debt capacity.

These results are obtained under the assumption that government policies do not modify the expression for the financial constraint. However, such policies entail imposing taxes or offering subsidies, altering disposable income and – in the end – debt repayment capacity. For instance, consider a subsidy on consumption financed by a lump-sum tax. The subsidy alters borrowers' planned expenditure, ultimately affecting debt decisions. This effect is captured by the standard credit constraint through changes in the desired debt level. However, the lump-sum tax reduces a debtor's income available for debt repayment, a fact that is not captured by such a constraint. By going to court, the lender recovers only a fraction of the disposable income because taxes must be discounted to be paid to the government.

In our paper, we incorporate – into an otherwise standard framework – the effect of taxes on borrowers' debt capacity. As a result, we find that ex post policies are ineffective for managing crises, while macroprudential policies still correct the externality in a decentralized economy.

The Model

The following is a standard theoretical framework widely used for the analysis of financial crises.

A continuum of mass one of identical households maximize the utility function

$$U = E_1[\sum_{t=1}^{\infty} \beta^t u(C_t)] \tag{1}$$

where β is the discount factor, and C_t is the consumption index that aggregates tradable (*T*) and non-tradable (*N*) goods: $C_t = C(C_t^T, C_t^N)$

Every period, each household receives an exogenous stochastic bundle of tradable and non-tradable goods, Y_t^T and Y_t^N and has access to international financial markets through one-period bonds B_{t+1} (a negative value implies debt) at an interest rate r (R=1+r). The budget constraint, in units of tradable goods (the numeraire), is

$$C_t^T + P_t^N C_t^N - RB_t = Y_t^T + P_t^N Y_t^N - B_{t+1}$$
(2)

where P_t^N is the price of the non-tradable goods. 1/ P_t^N can be interpreted as the real exchange rate.

The standard financial constraint, widely used in the literature is

 $-B_{t+1} \le \kappa (Y_t^T + P_t^N Y_t^N) \tag{3}$

Results

Here we summarize the relevant results that are found in the previous literature and those that we obtain using an alternative credit constraint. Technical details can be found in our paper.

The previous literature (e.g. Bianchi, 2011; Korinek, 2011; Parra-Polania and Vargas, 2015) shows that if one compares the solution for the model in the decentralised case to that of the social planner (SP) case, it can be seen that the SP improves social well-being by choosing a lower level of debt, enhancing future borrowing capacity and therefore mitigating the negative amplification effects of previous debt on the economy under crisis. This literature also shows that the SP equilibrium can be implemented in the decentralised economy by means of a macroprudential (i.e. triggered in normal times only) tax on debt.² This tax solves the externality problem by increasing the private cost of debt and equalising it to the social cost.

Another of the literature has found that better results can be obtained via ex post policies (Benigno et al., 2013a, 2013b, 2014). For instance, using the model above it can be shown that a subsidy on non-tradable consumption can avoid crises.³ The government can strengthen the economy's debt capacity to an unlimited extent using the subsidy to increase the price of collateral. However, this analysis implicitly assumes that lenders overlook the fact that financing such a subsidy affects households' debt capacity as well. If, instead, lenders incorporate this fact, the constraint should depend on disposable (rather than total) income:

$$-B_{t+1} \le \kappa (Y_t^T + P_t^N Y_t^N + T_t) \tag{4}$$

where T_t corresponds to the lump-sum tax (subsidy) that is used to finance (return) a subsidy on consumption (a tax on debt).

² This tax (ω_l <0) is returned to the household through a lump-sum transfer $T_{_{\ell'}}$ and hence there is a balanced-budget fiscal policy (this has been a standard assumption in this literature): Tt = $\omega_l B_{_{rel}}$.

³ This subsidy ($\tau_t < 0$) is returned by the household through a lump-sum tax T_t , and hence – as in the case of the debt tax – there is a balanced-budget fiscal policy: $T_t = \tau_t P_t^N C_t^N$.

Our paper incorporates the subsidy on consumption into the standard model but uses the alternative financial constraint (Equation 4) and finds that such a type of intervention not only cannot avoid crises but also leaves completely unaltered the constrained economy. Although this policy increases the price of collateral, the subsidy is returned to the government by taxes and, in the end, the borrowing capacity remains exactly the same.

We also solve the standard model incorporating the tax on debt and using the alternative financial constraint. In this case we find that this macroprudential policy is still able to correct the externality by increasing the private cost of debt. The change of the constraint does not affect the effectiveness of the ex ante policy because both the standard and the alternative constraint are the same during crises ($T_t = 0$), and during normal times, although different they are not relevant for the solution system (i.e. the constraint is not binding).
6.3 DISCUSSION BY PROF. CÉDRIC TILLE

- Tille, C., "Discussion", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 107–109.
 - Early-Warning System for Currency Crises Based on Exchange Market Pressure: The Case of Vietnam Pham Thi Hoang Anh, Banking Research Institute, Banking Academy of Vietnam, State Bank of Vietnam
 - Macroprudential versus Ex Post Policies: When Domestic Taxes are Relevant for International Lenders

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Tensions and frictions stemming from financial markets are a central challenge in the conduct of policy in emerging economies. The two papers presented in the panel offer complementary perspectives on this broad topic from theoretical and empirical standpoints.

The work by Hoang Han presents an empirical assessment of the drivers of the exchange rate in the case of Vietnam. The author focuses on episodes of exchange rate stress, and constructs a broad range of indicators. In addition to a standard exchange rate market pressure index (EMP) that includes movements in the exchange rate and reserves, she draws on information on devaluation, the widening of the trading band for the exchange rate, interest rate movements, and the premium between the official and unofficial exchange rates. A crisis episode is defined as a period during which the exchange rate indicator exceeds a set threshold. The author uses a logit specification to assess which economic factors are likely to lead to such crisis episodes. The analysis shows that the misalignment of the real exchange rate plays a robust role, with some impact of credit growth and money aggregates.

The paper sheds clear light on a question of great policy relevance. A first observation is that the crisis episodes for the various indicators considered by the paper show little co-movements. For instance, the EMP indicator shows crisis episodes primarily in the early years of the sample (1996–2002), while – according to the devaluation indicator – they also occur in later years (2008–10) and the episodes linked to the premium between exchange rates are concentrated in the later years of the sample. As the various indicators are supposed to capture the same underlying phenomenon – namely, exchange rate stress, this lack of correlation warrants further analysis.

Another observation concerns the role of exchange rate misalignment. The author defines the misalignment as the difference between the level of the real exchange rate and a unit value, interpreted as purchasing power parity. As the real exchange rate is computed as an index, with no particular economic meaning of the absolute value, a better approach would be to consider the deviation around a trend, for instance by applying a statistical filter to the data. The dynamics of the real exchange rate are also quite heterogeneous. Over the 1996-2012 sample, the dong initially experienced a real depreciation vis-à-vis the US dollar until 2003, and then a real appreciation that brought it, in 2012, close to its 1996 level. The initial depreciation was driven by a depreciation of the nominal exchange rate, while the price ratio between Vietnam and the US remained steady. The appreciation of the real exchange rate between 2003 and 2012, however, was not driven by the nominal exchange rate - which instead continued to substantially depreciate - but by the inflation differential between Vietnam and the US. This shows that the real exchange rate misalignment could lead to a counterintuitive movement of the nominal exchange rate, as the misalignment is adjusted through inflation instead.

The contribution by Parra-Polania and Vargas considers a simple model of a country with two sectors in order to assess the effectiveness of ex ante and ex post policy measures. The goods produced by the traded sector are sold on world markets, while the output of the non-traded sector can only be consumed domestically. While the country can borrow in international markets, the amount of debt cannot exceed some proportion of the value of the output from both sectors. In normal times, the country borrows little and the constraint is not binding, but in bad times when output is low the borrowing constraint binds.

This is a standard setting in open economy macroeconomics, and its core feature is that a real exchange rate depreciation (i.e. a fall in the price of non-traded goods) reduces the value of the country's output and thus tightens its borrowing constraint. While the impact of the exchange rate on the borrowing constraint is taken into account by a central planner, it is not considered by individual agents when they make their decisions. We are thus confronted with an externality that can be addressed in two ways. First, ex ante measures that tax borrowing while the constraint is not binding so the country enters bad times with a limited debt. Second, ex post measures subsidize consumption of the non-traded good during bad times in order to raise its price and thus limit the tightness of the constraint. This subsidy is funded by a "non-distortionary" tax on consumers. Earlier papers have argued that both types of measure can be effective.

Parra-Polania and Vargas argue that ex post measures are not effective. Specifically, the borrowing constraint states that the debt cannot exceed a proportion of income. The existing literature implicitly considers that the income is consumers' pre-tax income. However, if the income is instead the aftertax income, then the value of the subsidy to consumption of the non-traded good is exactly offset by the tax levied to finance it. Ex post measures are then completely ineffective, but ex ante measures remain effective and thus policymakers should focus on them.

The paper makes a simple, relevant and elegant point. This point however hinges crucially on which economic actor the borrowing constraint is applied to. The authors assume that it applies to consumers. If however the constraint applies to the country as a whole - namely consumers plus the government, then the findings of the earlier literature still apply as the taxes on the consumers constitute an income for the government, and thus cancel out at the level of the country. In addition, if the constraint applies only to consumers then the government can freely lend and borrow on international financial markets. It could then fund the subsidy on non-traded goods by international borrowing instead of running a balanced budget with immediate taxation of consumers. Finally, the results of the paper would stand out more clearly if a simple numerical illustration were used, showing that the subsidy of non-traded consumption does not exceed 100 per cent.

6.4 MOTIVES AND EFFECTIVENESS OF FOREX INTERVENTIONS IN ALBANIA



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Vika, I., "Motives and Effectiveness of Forex Interventions in Albania", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 111–116.

Introduction

The exchange rate is important in an open economy framework, both as a policy variable and for its impact on macro-financial variables. Therefore, in addition to conventional monetary policy instruments – like M2 and setting the interest rate – central banks often conduct operations in the foreign exchange market as a useful tool for containing exchange rate shocks that may put macroeconomic objectives or financial stability at risk.

Although most IMF member countries had abandoned their fixed exchange rate regimes by 1999, in some countries the currency and banking crises spread a "fear of floating" and led to central banks using their foreign reserves heavily to reduce exchange rate variability (Calvo & Reinhart, 2000). The increased capital flows to emerging economies led to hefty forex interventions by central banks accumulating high international reserves before and, even more so, after the global financial crisis as policymakers feared the extraordinary easing of monetary policies in advanced economies would increase financial risks in host countries.

¹ All opinions presented in this paper are those of the author and do not necessarily reflect those of the Bank of Albania.

Nevertheless, the Bank of Albania (BoA) has not rushed to increase or hoard large quantities of reserves. Even though the stock of net foreign investments has more than doubled since the pre-crisis period, reserve accumulation by the central bank appears to be in line with the growth of imported goods and services. The purpose of this study is twofold. First, it tries to understand the reaction function that has prompted the Bank of Albania to step in in the foreign exchange market; second, it then assesses the effectiveness of the central bank's policies and overall objectives.

Some Stylized Facts

The Albanian lek fluctuated substantially in the early years of the twenty-first century. By the end of 2003, the lek started appreciating again and was perceived as fairly stable for about six years, helped by a positive and relatively sustainable macroeconomic environment. The good years ended with the global financial crisis and the subsequent Eurozone sovereign debt crisis. In the period up until mid-2011, the lek gradually lost most of its previous gains, and has fluctuated at around the same level thereafter. Nevertheless, the lek is clearly the most stable currency in the region; in the last five years or so, its coefficient of variation has been less than one, whereas those of other CESEE floating currencies vary from three to 13 times higher.

For that reason perhaps, the Bank of Albania has chosen not to be very active in the FX market. During the period 2000–14, it has intervened on a total of 445 days. Purchases of foreign currencies accounted for nearly 85 per cent of these intervention days. Remarkably, they were conducted more frequently during the 2000-08 period, and less often after the global crisis. On the other hand, the frequency of FX sales operations is very low (only 68 days) and is concentrated in the course of the 2000–02 exchange rate oscillations and later on to defend the domestic currency against negative external shocks in 2009.

Looking at the figures, we get the impression that BoA would intervene to contain exchange rate overshooting or smooth its volatility, whether it was displaying a depreciating or an appreciating trend. Furthermore, the higher statistical properties of purchase transactions as compared to sales imply that BoA has been more inclined to replenish and maintain an adequate level of international reserves, rather than allowing them to deplete at all costs. A visual inspection of the data supports this notion, since the recurrence of BoA's active days is higher during the more volatile 2000–09 period, while it becomes more infrequent in subsequent years when exchange rate changes are relatively steady and less volatile, and import coverage is at historical highs over and above four months, while the ratio of foreign reserves to external, short-term debt (at 176 per cent in the fourth quarter of 2014) stands well above the IMF recommended benchmarks.

Indeed, the relative stability of the lek in recent years is admirable, as it owes nothing to the absence of nominal or real shocks. The domestic currency has been little affected by favourable, though volatile, net foreign investments. The stock of net foreign liabilities in the

form of FDI and non-portfolio investments increased significantly from 36.7 per cent of GDP in 2007 to 65.3 per cent in 2014. Yet, the exchange rate against the euro depreciated in the early years of the global crisis and showed a low variability afterwards. Similarly, the Albanian currency has resisted pressures from negative factors, such as falling private transfers and the relatively large current account deficit. The same is true to the narrowing gap of policy rates between Albania and the euro area – the difference was above 4 per cent in 2010 and only nearly 2 per cent at the end of 2014, shocks in the FX market resulting from the ECB's quantitative easing programmes, and the ongoing debt crisis in neighbouring Greece.

In spite of these macro-financial developments, the rarer actions of the central bank after the global financial crisis remain comprehensible. Primarily, the exchange rate performance and foreign reserve levels have been satisfactory, while there is growing evidence that exchange rate pass-through to inflation has faded away and its role is evaluated as more of a shock absorber rather than being much able to influence Albania's external competitiveness (Tanku, Vika, Gjermeni, 2007).

Determinants of Interventions

The main reasons behind central bank interventions in the foreign exchange market are trend correction, volatility smoothing, exchange rate overshooting, profitability, and international reserve level (Kim & Sheen, 2002). The latter intervention can be conducted for precautionary purposes and for competitiveness motives (Malloy, 2013). The Bank of Albania has officially stated that it has no intention of influencing the value of the domestic currency. It mainly intervenes to smooth undesired fluctuations and exchange rate overshooting, and to maintain an adequate level of foreign currency reserves.

We can employ a probit estimation method to model the probability of an intervention event as a function of an exchange rate's deviation from its trend, exchange rate volatility, and foreign reserves (with the level of foreign currency reserves in months of imports as a proxy). However, at times of large divergences and high volatility with plenty of currency-related events occurring, the central bank may prefer to stay out of the market until exchange rates shows a clearer direction and trading volume returns to normal levels. Thus, I propose another equation to test for non-linearity; one that tries to capture whether the BoA reacts differently in cases where a) the exchange rate deviates from its (1w, 2w, 1m, 3m, and 6m) moving average for five consecutive days (i.e. from t-4 to t); b) the size of the deviation is larger than 2 per cent; c) the variability of the lek occurs on an appreciating/depreciating trend; d) the size of the volatility is above its period average; and e) the ratio of FC reserves to imports is above its period average of 4.5 months.

The estimated results for the likelihood of purchase and sale interventions from January 1, 2000 to December 31, 2014 reveal that BoA has reacted more on the exchange rate deviations from its trend, rather than on the volatility of its level. Whether on the appreciation or the depreciation side, movements away from certain levels raise the likelihood that BoA will "lean against the wind" to stop or smooth further exchange rate divergences.

Comparing the deviations from longer versus shorter time trends, it seems that BoA devotes similar care to all states of "equilibrium". The coefficients have a similar magnitude for all downward deviations. On the other hand, the size of the coefficients for upward overshooting suggests a larger response to depreciations from recent market levels. Furthermore, successive deviations in the same direction might catch the eye of BoA officials in the very short term; deviations for longer periods might not be a real concern. On the contrary, the central bank's actions seem to be encouraged to act on days of large overshooting, particularly when deviations from the past month(s) hit more than 2 per cent.

These results also support the central bank's official statements with regard to its taking action against undesired exchange rate volatility. However, as can be expected, very high fluctuations would encourage the central bank to hold off from stepping in in the market, and to be very cautious with exchange rate oscillations.

Last but not least, a reduction in the reserve coverage of imports appears to definitely influence the decision of policymakers to buy foreign currencies in the market. On the other hand, higher ratios of reserves to imports have not caused the central bank to sell foreign currencies. These results are consistent with BoA's statement that interventions aim to achieve a reserve adequacy level, which has often been agreed upon with the IMF. Nevertheless, the estimated negative coefficient for size indicates that interventions have been made to satisfy this target and not to accumulate indefinite reserves. This might also explain the puzzle of negative coefficients for the FC sale interventions in the probit estimations.

Assessing the Effectiveness of Interventions

The above-mentioned findings suggest that BoA has indeed intervened to smooth exchange rate volatility and prevent its overshooting. A point of interest is, then, to find out how successful these forex market operations have been.

ARCH models are widely used in the literature for testing the effectiveness of interventions simultaneously on both the mean and the volatility of the daily exchange rate. Of a number of alternative estimated models, the author eventually preferred the standard GARCH (1,1) model, in which the conditional mean and variance of daily exchange rate changes were a function of themselves, the interest rate differential (between the overnight rate in Albania and the Eonia interbank rate), and net purchases of foreign currencies on the previous day. Dummy variables are added to the model to check whether larger than average interventions, or consecutive interventions in the same direction for three days, have been more effective or not.

Looking at the estimated effects of net purchase interventions during the 2000–14 period, we can get the impression that BoA has been able to influence the exchange rate to return towards an underlying trend. An increase in purchase (sale) interventions has led to the depreciation (appreciation) of the domestic currency. Nevertheless, the disaggregation of intervention effects indicates that it is the successive nature and/or large size of the interventions that are effective; average (timid and isolated) actions might not be successful. The central bank has also been able to reduce market volatility. Again, the negative sign in all disaggregated slope parameters suggests that sizable interventions and those carried out over a number of days would increase the effectiveness of such measures and dampen exchange rate volatility. The estimated results, thus, suggest that to fully satisfy its market-calming objective, the Bank of Albania's operations need to be aggressive in their magnitude and also to be recurring events.

Nevertheless, the GARCH estimations may not be very reliable in the case of Albania, where idle periods without interventions varied from a couple of weeks to several months or even a year. For that reason, the effectiveness of BoA's interventions has been further analyzed through the lens of event study methodology – as widely used in the finance literature. This approach analyzes and compares the behaviour of variables before and after a certain event occurs. The inspected period is referred to as the event window and includes pre-event days, the event day(s), and post-event days.

Foreign exchange interventions are viewed as successful if the exchange rate subsequently moves in the same direction as the central bank's intervention, or if – at least – the magnitude of these movements is reduced afterwards. In the first case, where the direction of the exchange rate's movement is changed after the central bank's operation, is known in the literature as the "reversal" criterion, or "leaning against the wind". Interventions that reduce exchange rate deviations but do not change their direction are referred to as "smoothing" exchange rate policies. If, on the other hand, interventions in the forex market are neither intended to reverse the exchange rate's direction nor to smooth its trend, but rather to support that ongoing trend, the central bank's policies would be viewed as "leaning with the wind". In such a case, purchases (sales) of foreign currencies would lead to higher (lower) exchange rate changes in the post-event days while maintaining the direction observed in the pre-event period.

Based on the criteria of successfulness, policies aimed at smoothing the exchange rate or leaning against or with the wind have been successful for about 62 per cent of the shorter episodes. The proportion of successful policies is fairly similar for the five- and two-business-day periods, for which "leaning against the wind" accounts for the majority (59.5 per cent) of interventions, followed by "smoothing the exchange rate" (23.8 per cent) and "leaning with the wind" (16.7 per cent). If we change the event window definition such that we allow for a maximum of ten days without an intervention, performance improves to 65, 73, and 69 per cent for the 2, 5 and 10 business days, respectively.

Looking at the shorter episodes, it turns out that the size of forex interventions has not been influential in achieving, or not, the bank's desired policy outcome. "The results show that the average size of successful interventions is much lower than the mean and median of the ineffective operations, suggesting that the size of the interventions was typically not intended to influence the exchange rate level. Similarly, intervention effectiveness seems not to depend on the number of consecutive days. At best, the effects have been satisfactory in either the next two, or the next five days, but not consistently in both.

Redefining the episodes to allow for ten non-overlapping days provides similar results for the two- and five-day windows, but not for the ten-day window. For the ten day window,

the average size of successful interventions is ALL 2,076 M, as compared to ALL 1,744 M for ineffectual episodes (though the median remains smaller), indicating that hefty interventions can become effective in the weeks following. In the same vein, protracted events (and with more days of intervention on average) are shown to produce a stronger exchange rate response for the ten-day window, thus increasing the likelihood of their success.

Lastly, applying the same exercise on exchange rate volatility yields similar results. It is found that central bank interventions were able to reduce exchange rate volatility (employed from the GARCH (1,1) results) more often than not. Nevertheless, the impact was not equal for different post-event windows. Allowing for five- (ten-) day non-overlapping events, the proportion of successful episodes is 74 (65) per cent in the case of a 2-day post-event window, falling closer to 50 per cent for the 5- or 10-day windows. Therefore, the degree or intensity of volatility has more often abated during shorter time windows; a movement that has been less sure for extended pre- and post-event intervals.

Conclusion

Forex market interventions by the Bank of Albania appear to be mainly driven by the need to maintain an adequate level of international reserves, and to calm disorderliness in the forex market. The probit model results indicate that upward movements from a certain trend raise the probability that the central bank will intervene to stop further divergences of the lek's exchange rate. The non-linear estimations indicate that sizable (but not persistent) exchange rate deviations might attract more attention from central bank officials. Regarding exchange rate volatility, the estimated parameters suggest that BoA would act against undesired volatility. However, the asymmetric model results show that very high fluctuations would make the central bank hesitate and assess cautiously the timing of any intervention when dealing with exchange rate oscillations.

A central bank is judged to be effective if it is able to stabilize the foreign exchange market by slowing or reversing currency movements and dampening volatility. The GARCH model results and the event study analysis give us the impression that BoA's actions have weighed on the exchange rate to return to certain "fundamental" levels. The findings show also that substantial and continual interventions would increase the degree of effectiveness in moving the exchange rate (particularly in the couple of weeks following an intervention) and reducing market volatility (at least for the few days following and intervention). Therefore, in order to meet its market-calming objective, the central bank's transactions in the foreign exchange market ought to be aggressive in their magnitude, and also be recurring events.

6.5 FX MARKET STATISTICAL REGULARITIES IN PERU, COLOMBIA, AND CHILE

ANA PAOLA GUTIÉRREZ AND MARCO VEGA¹



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Gutiérrez A.P., and M. Vega, "FX Market Statistical Regularities in Peru, Colombia and Chile", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 117–122.

This empirical paper uses high-frequency exchange rate data for the Chilean peso (CLP), Colombian peso (COP) and Peruvian new sol (PEN) against the US dollar to extract key statistical regularities such as intraday patterns of returns and volatility and the effects of macroeconomic news over the intraday returns. CLP, COP, and PEN are not in the set of main traded currencies so their intraday volatility patterns might be different from those major currencies. Moreover, the three currencies have been subject to varying degrees and styles of official FX intervention by their respective central banks: interventions have been completely discretionary in Peru, while they have been pre-announced in Chile and rule-based in Colombia (see Fuentes et al., 2014). This fact could influence the currencies' patterns and volatility.

We perform our analysis using high-frequency data because it allows us to reveal effects that may not be seen at lower frequencies. The ten-minute PEN/USD, COP/USD, and CLP/

¹ Both authors are affiliated with the Central Bank of Peru. The views expressed are those of the authors and do not necessarily reflect those of the bank.

USD bid and ask quotes from 2007 to 2015 were provided by Olsen and Associates (OANDA), one of the most important worldwide online electronic trading platforms. Transaction prices are not available so the mid-price of bid and ask quotes is taken as an approximation of transaction price. Then, returns were obtained as the percentage log difference of the estimated price of current and previous transactions

 $r_t = 100x[log(s_t) - log(s_{t-1})]$

where r_t is the exchange return at time t and s_t and s_{t-1} are the actual and previous estimated transaction price, respectively.

Return Statistics

Because of the way returns are constructed, the median is always centred in zero for all currencies. However, it is much more interesting to evaluate the intraday variance, as it gives us an idea of return volatility. For a more accurate analysis, the sample has been divided into three periods: the crisis period (January 2008 to December 2009), a post-crisis period (January 2010 to May 22, 2013) and the period of policy normalization (May 23, 2013 onwards²). We only take into account the hours when the local FX market is open. In the case of Peru, the local market opens at 9:00 am and closes at 1:30 pm; in Colombia trading hours range from 8:00 am to 1:00 pm; while for Chile opening hours are from 8:30 am to 1:00 pm.

As shown in Table 1, (i) the PEN is the currency with the smallest variance overall, and (ii) all intraday returns show greater variance during the financial crisis episode. This may be because of the uncertainty surrounding this period: first, a massive inflow of portfolio investment into the three countries seeking carry trade returns, and then, inflows in emerging markets reverted due to the fly towards safe assets in the period following the Lehman Brothers collapse.

	Crisis	Post crisis	Normalization	All
Peru	0,038	0,009	0,003	0,015
Colombia	0,051	0,016	0,020	0,026
Chile	0,076	0,048	0,009	0,045

Table 1 – Return Variance by Period

² We have marked the start of the policy normalization period to May 2013 with the first taper announcement.

Intraday Patterns of Squared Returns

The statistics shown in Figure 1 refer to the mean squared returns for each ten-minute interval across all trading days in the sample. The analysis is carried out only when local markets are open and all times are measured in local time.

A particular behaviour for this measurement during time intervals allows us to discover the existence of volatility patterns within days (volatility seasonals). There are four main statistical regularities:

- 1) Volatility is higher at the beginning of the day. The first trading hour shows the greatest volatility levels within the day. As shown in Figure 1 panel a, in the case of Peru the highest volatility takes place at 9:30 am. For Colombia it is at 8:10 am (see panel c) and for Chile (panel e) at 9:20 a.m. This could be due to order flows arriving from FX trading firms that operate 24 hours a day or to local order flows reacting to news that arrived since the last closing hour.
- 2) All countries have intraday volatility peaks, but the highest is observed in Chile, and the lowest in Peru. The maximum volatility peak value in Peru is 0.0267, 0.0598 in Colombia, and 0.0707 in Chile. This means that Colombia doubles the Peruvian peak, while Chile triples it. This ranking of volatility peaks may reflect the ranking in order flow volumes or turnover among the three currencies.
- 3) Seasonal volatility decreases throughout the day. This is an unquestionable fact in the case of Chile and Colombia, where we can see high volatility levels at the beginning of the day and a decreasing trend within the day. However, this pattern is not so clear in the case of Peru, as volatility tends to rise during several of the trading hours.
- 4) The Peruvian exchange market seems to be the least liquid. When looking at the raw data, we realize PEN/USD bid and ask quotes are not updated frequently and returns stick around the same value for several minutes.

Panels (b), (d) and (f) of Figure 1 show the volatility seasonal estimated for intervention³ and non-intervention days separately. For the COP and the PEN, the within-day volatility levels tend to be higher in periods of no FX intervention. CLP volatilities seem to be the same during intervention and non-intervention days. It is worth mentioning that official intervention in the USD/CLP market is not tied to the aim of reducing volatility while the wordings of interventions in the PEN and COP markets do mention the reduction of FX volatility as the aim of FX intervention.

³ Data on exchange market interventions for each country were obtained from the respective central banks' web sites and only direct purchases or sales were taken into account.



Figure 1 – Intraday Pattern of Squared Returns

The Effect of FED Announcements on Returns

The paper also analyzes the effect of FED policy moves on the currencies. The particular sample period that we have is not adequate for analyzing policy surprises of the type studied by Andersen et al. (2001); in fact, too few measured policy surprises emerge in the data. Therefore we take a different approach: we evaluate the behaviour of the level of exchange rates around policy announcements.

The federal funds rate target is announced at about 2:00 pm by the Federal Open Market Committee (FOMC). When daylight saving time is in force, this announcement – at Peruvian and Colombian local time – takes place at 1:00 pm, when the local market is still open. Only these observations are going to be analyzed here.

The first set of results is provided in Figure 2. Exchange rate levels are normalized at at the time of the FED announcement (t=0), both for the day of the release and for the control days. We follow PEN and COP levels two hours after and two hours before the announcement occurs. The discontinuous line represents the mean levels of normalized exchange rates across all FED release dates while the continuous line denotes the mean levels of normalized

exchange rates across days representing the control group. The control group for each FED policy release date is represented by five previous working days.

Figure 2 shows the behaviour of the COP and the PEN during the crisis period of 2008 and 2009, where the FED funds rate was reduced. Each exchange rate responds differently during this period. In the first minutes following the announcement, the PEN faces a strong depreciation and the announcement implies high volatility. The normalized PEN rate has a V shape also within the control days but the shape is more acute around FED decision times. Conversely, the behaviour of the COP after the FED announcement is as expected with an easing of FED policy.





Figure 3 shows the evolution of the PEN and COP during the post-crisis period, marked by quantitative-easing (QE) announcements rather than announcements of FED interest rate policies. The behaviour of the PEN and COP during controls days is somewhat flat. But the pattern of PEN and COP dynamics is now rather peculiar; especially before FED announcements. Both, the PEN and the COP are lower than their levels at t=0. One hour before the FED announcement, both currencies appreciate and then depreciate strongly. The QE announcements were expected to be of an expansionary nature. There is no gauge to assess how unexpected were those policy moves but presumably markets expected, well in advance, that the policy move needed to be expansionary. This in turn might have induced currencies to appreciate relative to non-FED-announcement days. There seems to be no effect after the announcements.





Figure 4 shows the effects during the FED policy normalization period, which covers the tapering talk and the tapering itself. This is a period of expected policy tightening. For the PEN, the effects are again felt basically before the announcement. Given the type of policy stance, the PEN depreciates before the announcement relative to the control days. In the case of Colombia, the COP is higher relative to its benchmark two hours before, then it is lower just before and after the announcement, and then again higher two hours after the announcement. So the COP is more volatile around FED announcement times.



Figure 4 – The Effect of FED Announcements, Normalization Period

All in all, the effects of FED announcements are heterogeneous on the policy stance the FED had during the sample period and the particular features of the local currency markets around FED policy announcements that may have made the currencies more volatile or not. One striking feature is that, given the known announcement times and expected stance of the policy, the currencies tended to react before the announcements.

Conclusions

The following set of conclusions regarding FX market regularities in the COP, CLP, and PEN against the USD can be made:

- 1. Volatility patterns within typical trading days are not U-shaped (as in major currencies), but start high and decrease during the trading day. This is also documented in Fuentes et al. (2014).
- The ranking of intraday volatility is CLP return volatility > COP return volatility > PEN return volatility. This may reflect the ranking of turnover and scale of transactions in each of the three local FX markets.
- 3. The response of the COP and the PEN to FED policy announcements is heterogeneous but there is a tendency of overreaction before the FED announcements. The reactions before each announcement are compatible with the US policy stance prevalent at the time of that announcement. When the FED was easing its policy, the currencies tended to appreciate; when the policy switched to less easing, the currencies tended to depreciate.

6.6 DISCUSSION BY PROF. UGO PANIZZA



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- Panizza, U., "Discussion", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 123–124.
 - FX Market Statistical Regularities in Peru, Colombia, and Chile Ana Paola Gutiérrez and Marco Vega, Central Bank of Peru
 - Motives and Effectiveness of forex interventions in Albania
 Ilir Vika, Bank of Albania

Here, I will discuss two interesting papers.

The first paper, by Ana Paola Gutiérrez and Marco Vega, studies intraday volatility in the dollar exchange rate of three Latin American currencies (the Peruvian nuevo sol, Chilean peso, and Colombian peso). The second paper, by Ilir Vika, studies the determinants and effects of exchange rate interventions made by the Albanian Central Bank (BoA). The paper by Gutiérrez and Vega identifies several phases of intraday volatility, and also analyzes the effect of FED announcements and central bank interventions. The main findings of the paper can be summarized as follows: (i) while previous works found that intraday volatility is U-shaped (volatility is high when markets open and close and lower in midday trading), this paper finds that volatility is always higher during the morning and becomes lower at the end of the day; (ii) in Colombia and Peru, central bank interventions reduce volatility, but this is not the case in Chile; (iii) FED announcements are associated with sudden increases in volatility.

While the results of the paper are very interesting, the paper would benefit from more details on the methodology used by the authors and from the inclusion of a discussion of possible problems associated with the presence of outliers and the treatment of periods with no trading and/ or price changes. It would also be helpful to present results that include confidence intervals and discuss how intraday exchange rate volatility reacts to other exogenous variables (for instance, the VIX index or equity returns in the US). From the methodological point of view, it would be nice to compare the paper's estimates with the result of an ARCH/GARCH model, which would allow the persistence of volatility to be estimated. Moreover, as the authors have both bid and ask quotes for the exchange rate, they could use a bid-ask spread as a measure of liquidity and study the relationship between liquidity and volatility. Finally, it would be good to include a discussion of the policy implications of the paper.

The paper by Vika starts by using a probit and OLS framework to study the determinants of interventions made by BoA. The author finds that while exchange rate volatility is not an important determinant of interventions, the exchange rate's deviation from trends and the level of reserves are important determinants of forex interventions (the latter, however, is only important for foreign currency purchases and not for foreign currency sales). To study the consequences of forex interventions, the author uses a GARCH model and an event study approach and finds that interventions are effective in reducing exchange rate misalignments and volatility.

This is a very interesting paper, which - however - would benefit from a longer methodological discussion (especially a discussion of the criteria that guided the choice of the different empirical models) and more details on how the author measures misalignments. It would also be interesting to combine long- and short-run effects with an error-correction model. The most important issue, however, has to do with potential simultaneity bias. For instance, in the first part of the paper the author studies whether volatility affects the likelihood of observing a forex intervention and finds no evidence in this direction. In the second part of the paper, instead, he finds that forex interventions reduce volatility; but if forex interventions reduce volatility the results of the first part of the paper suffer from substantial downward bias possibly leading to the - wrong - result that volatility does not have an impact on the likelihood of an intervention. The author should endeavour to address this simultaneity bias either with appropriate exclusion restrictions or with statistical techniques such as identification through heteroskedasticity.

6.7 FIRMS' EXPORTS UNDER EXCHANGE RATE UNCERTAINTY



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Rahmanov, R., "Firms' Exports Under Exchange Rate Uncertainty", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 125–130.

Introduction

The exchange rates of many emerging economies experience large fluctuations over time thereby incurring an exchange rate risk for firms engaged in international trade. Higher volatility of an exchange rate lowers the expected value of a firm's profits. Therefore, an increase in exchange rate uncertainty can force a firm to serve only, or mostly, the domestic market since concentration on the domestic market reduces the exposure of its profits to an exchange rate risk. As a result, we can observe a decline in exports from countries with highly volatile exchange rates. Obviously, firms could hedge their currency risks through futures markets, but in contrast to firms in developed countries, firms in the majority of emerging markets do not have such an option.

Previous theoretical and empirical papers provide mixed evidence for the effect of exchange rate volatility on exports. Early papers find that exchange rate volatility depresses

¹ The author thanks Salman Huseynov from the Central Bank of the Republic of Azerbaijan for helpful comments and advice. All opinions presented in this paper are those of the author and do not necessarily reflect those of the Bank of the Republic of Azerbaijan.

international trade (Clark, 1973; Ethier, 1973; Hooper and Kohlhagen, 1978). However, the follow-up empirical studies do not unanimously support the existence of a negative association between exchange rate volatility and firms' exports (Gotur, 1985; Bailey et al., 1986).

In an attempt to reconcile the mixed empirical evidence with the findings of theoretical models, later studies propose that exchange rate uncertainty reduces trade only under certain conditions. For example, De Grauwe (1988) suggests that an increase in exchange rate volatility will push a firm to reduce exports if that firm is only moderately risk averse. Franke (1991) finds that a disadvantaged firm – that is to say, a firm that will not make a profit if the exchange rate is at parity, will increase exports when exchange rate volatility increases.

This paper presents an attempt to make the theory and the empirical evidence consistent with one another. For this purpose, we extend the model proposed by Feenstra and Kendall (1991) in two ways. First, we introduce the consumer utility function, which allows us to differentiate the effects of exchange rate volatility on the exports of high-quality products from equivalent effects on low-quality products. Firms exporting high-quality products can maintain their share of foreign markets even during periods of high exchange rate volatility because foreign households will continue buying their products, despite an increase in price, due to the high value these products bring them. Therefore, we expect that a higher quality of products attenuates the negative effect of exchange rate volatility on exports. Second, the setup of our model allows firms to import intermediate goods priced in foreign imports of intermediate goods because having equivalent shares of assets and liabilities in foreign currencies can play the role of hedging against currency risks.

The model predicts that an increase in exchange rate uncertainty discourages firms from exporting regardless of the invoicing currency. However, if a firm invoices exports in its home currency, a higher quality of goods reduces the negative effect of exchange rate uncertainty on such exports. The quality of goods does not affect the scale of the negative effect of exchange rate volatility if a firm invoices exports in a foreign currency. The use of imported intermediate goods ambiguously affects the sensitivity of exports to exchange rate volatility, regardless of the invoicing currency.

The empirical testing of the model supports the proposition that exchange rate uncertainty discourages firms from exporting. At the same time, the regression results show that input imports help to lower the negative influence of exchange rate volatility on firms' exports. However, product quality appears to have no significant impact on the magnitude of the negative effect of exchange rate volatility on firms' exports.

The Model

Our model consists of two firms and two consumers; one of the consumers and one of the firms are domestic, and the others are foreign. Both firms produce final goods in their countries of residence but sell their products in both national and international markets. For production, firms use an input that they can purchase in domestic and foreign markets.

The representative consumer in each country receives a lump-sum income, which he or she spends on purchasing domestic and foreign goods.

In this paper, we consider two cases: one in which firms invoice exports in their home currency; the other one in which firms invoice exports in a foreign currency. In the first case, a firm bears no exchange rate risk from export operations but incurs currency risks due to its use of input imports. Consumers face exchange rate uncertainty by buying foreign products. In the second case, consumers encounter no currency risks, but firms bear exchange rate risk both from the exportation of final goods and the importation of inputs. Additionally, we assume that neither firms nor consumers can hedge exchange rate risks, as such an opportunity is not available to them.

Comparative Static Analysis

The static analysis of the export equations leads to the following propositions:

Invoicing in the currency of the exporter

- *Proposition 1.* An increase in exchange rate volatility induces a firm to decrease exports invoiced in the home currency.
- *Proposition 2.* An increase in the use of imported inputs priced in a foreign currency ambiguously affects the firm's exports invoiced in the home currency.
- *Proposition 3.* An increase in the quality of goods stimulates a firm's exports invoiced in the home currency.
- *Proposition 4.* An increase in the use of those imported inputs priced in a foreign currency ambiguously affects the magnitude of the negative response of a firm's exports invoiced in the home currency to exchange rate volatility.
- *Proposition 5.* An increase in the quality of the goods exported reduces the magnitude of the negative response of a firm's exports invoiced in the home currency to exchange rate volatility.

Invoicing in the currency of the importer

- *Proposition 6.* An increase in exchange rate volatility induces a firm to decrease exports invoiced in a foreign currency.
- *Proposition 7.* An increase in the use of imported inputs priced in a foreign currency ambiguously affects a firm's exports invoiced in a foreign currency.
- *Proposition 8.* An increase in the quality of goods stimulates a firm's exports invoiced in a foreign currency.
- *Proposition 9.* An increase in the use of those imported inputs priced in a foreign currency ambiguously affects the magnitude of the negative response of a firm's exports invoiced in a foreign currency to exchange rate volatility.

Proposition 10. An increase in the quality of the goods exported has no effect on the magnitude of the negative response of a firm's exports invoiced in a foreign currency to exchange rate volatility.

Empirical Test

Data and empirical approach

To test the implications of the model, we estimate the following equation:

$$\begin{split} exp_i &= \alpha_0 + \alpha_1 vol_j + \alpha_2 in_i + \alpha_3 q_i + \alpha_4 vol_j \times in_i + \alpha_5 vol_j \times q_i + \alpha_6 ner_j + \alpha_7 p_j + \alpha_8 l_i + \\ & \alpha_9 age_i + \alpha_{10} own_i + \alpha_{11} cust_i + \alpha_{12} fin_i + \varepsilon_i \;, \end{split}$$

where exp_i is the nominal value of a firm's exports in US dollars, vo'_{ji} is the nominal effective exchange rate volatility, in_{ji} is the share of imported inputs used in production, q_{ji} is the quality of products, $vo'_{ji} \times in_{ji}$ is the cross product of the nominal effective exchange rate volatility and share of imported inputs, $vo'_{ji} \times q_{ji}$ is the cross product of the nominal effective exchange rate volatility and quality of products, ner_j is the nominal effective exchange rate, p_j are the relative prices, l'_i is the number of full time employees, age_{ji} is the firm's age, own_i is the share of a firm owned by a foreign agent, $cust_{ji}$ is the customs regulation, fin_i is the access to finance, ε_i is the error term, and *i* and *j* denote a firm and a country, respectively.

For the econometric analysis, we use cross-sectional firm-level data for 16 emerging and developing countries from central and Eastern Europe, the Caucasus, and Central Asia where currency contracts are not available. The data come from the fifth round of the Business Environment and Enterprise Performance Survey (BEEPS) conducted by the European Bank for Reconstruction and Development and the World Bank in 2012–14.

As a measurement of the nominal exchange rate volatility (*vol*_j), we use the one year standard deviation of growth rates of the nominal effective exchange rate. The relative prices (p_{ij}) are defined as a ratio of the real effective exchange to nominal effective exchange rate. The statistics on nominal and real effective exchange rates were taken from the Bruegel data set. Product quality (q_{it}) is proxied by a binary, which is equal to one if a firm has an internationally recognized quality certification, and zero otherwise. The customs regulation (*cust_{it}*) is a binary variable, which equals one if a firm considers the current customs and trade regulation as a serious obstacle to its operations, and zero otherwise. The access to finance (*fin_i*) is proxied by a binary variable, which is one if a lack of access to financial resources causes great difficulty to a firm's operations, and zero otherwise. All variables – except foreign ownership, share of foreign inputs, product quality, customs regulation, and access to finance – are either binary or have a percentage measurement which are transformed into the log form.

Following the prediction of the model, we expect α_1 to be negative since an increase in exchange rate uncertainty reduces the demand for a firm's goods in the international market. The sign of α_2 , as the model predicts, is ambiguous because a larger use of the imported production factor can both increase and decrease the exposure of firms to exchange rate

volatility. α_{a} must have a positive sign because an improvement in the quality of a product increases the demand for that product. α_{i} has an ambiguous sign regardless of the invoicing currency. $\alpha_{_{5}}$ should be either positive if the majority of firms invoice exports in their own currency or equal to zero if the majority of firms invoice exports in a foreign currency.

Dependent variable: Log (exports)				
	(1)	(2)		
Log (volatility)	-0.19	-0.89***		
	(-1.47)	(-3.99)		
Share of imported inputs	0.00	0.06***		
	(1.01)	(4.01)		
<i>Log</i> (volatility) × share of		0.01***		
imported inputs	-	(3.95)		
Ouality	0.58***	0.44		
	(4.32)	(0.51)		
Log (volatility) × Ouality		-0.03		
	-	(-0.16)		
Log (nominal effective	-1.16	-1.36		
exchange rate)	(-1.35)	(-1.62)		
Log (relative prices)	-2.82**	-3.08***		
	(-2.49)	(-2.79)		
Log (number of full-time	1.01***	1.01***		
employees)	(19.05)	(18.97)		
Log (age)	0.03	0.04		
	(0.32)	(0.39)		
Foreign ownership	0.01***	0.01***		
	(4.24)	(3.81)		
Customs regulation	-0.04	-0.03		
-	(-0.29)	(-0.24)		
Access to finance	-0.06	-0.06		
	(-0.48)	(-0.49)		
Constant	13.03***	10.70***		
	(3.35)	(2.83)		
R^2	0.52	0.53		
N	590	590		

Table 1 – Firms' exports and exchange rate uncertainty

Note: * p<0.1; ** p<0.05; *** p<0.01.

Empirical results

Since our data are cross-sectional, we opt for the OLS estimator to perform econometric analysis. The results for the "simple" specification, which does not include the interaction terms, show that the effect of exchange rate volatility on a firm's exports is statistically insignificant at the conventional level. Furthermore, we note that the input imports have no significant effect on exports, while the quality of products has a significantly positive impact on exports. When we estimate the "complex" specification, which according to our theoretical model assumes that product quality and input imports affect the sensitivity of exports to exchange rate volatility, we find that – in fact – exchange rate volatility has a significantly negative effect on a firm's exports. We also note that input imports have a significantly positive association with exports. The interaction of volatility and input imports has a significantly positive coefficient, which implies that a greater use of imported inputs reduces the negative effect of exchange rate volatility and quality appear to be statistically insignificant. The insignicance of the interaction term implies that the product's quality has no significant effect on the sensitivity of a firm's exports to exchange rate volatility. Of the control variables, relative prices, firm size, and foreign ownership are statistically significant; their signs are in accordance with the theory.

The robustness check exercises demonstrate that regardless of the equation specification, we reach the definite conclusion that exchange rate volatility reduces firms' exports, and that input imports partially offset the negative effect of volatility.

Conclusions

The model predicts that an increase in exchange rate uncertainty leads to a decline in firms' exports regardless of the invoicing currency. Furthermore, an increase in product quality reduces the negative effect of exchange rate uncertainty on exports if those exports are priced in the home currency. However, if exports are invoiced in a foreign currency, higher product quality has no effect on the scale of the negative effect of currency volatility on firms' exports. The effect of using imported inputs priced in a foreign currency is ambiguous with regard to the magnitude of the negative effect of exchange rate uncertainty on firms' exports regardless of the currency of invoice.

To examine the veracity of the model's implications, we conduct regression analysis, which confirms the proposition that exchange rate volatility reduces firms' exports. Furthermore, we find that input imports lessen the negative effect of exchange rate volatility on exports, while product quality has no significant effect on the magnitude of the response of firms' exports to exchange rate uncertainty.

6.8 AN ASSET ALLOCATION FRAMEWORK FOR EXCESS RESERVES¹

JULIÁN DAVID GARCÍA-PULGARÍN, JAVIER GÓMEZ-RESTREPO AND DANIEL VELA BARON²



DANIEL VELA BARON (left), World Bank JULIÁN DAVID GARCÍA-PULGARÍN (right), Central Bank of Colombia

García-Pulgarín, J.D., J. Gómez-Restrepo, and D. Vela Baron, "An Asset Allocation Framework for Excess Reserves", Research Workshop, in *Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 131–138.

Foreign exchange reserves have been accumulated on an unprecedented scale in recent years. For a long period the central banks adopted intervention policies to counter excessive volatility in the foreign exchange market and accumulated additional reserves with the purpose of reducing the negative outcomes of balance of payments crises, such as potential sudden stops or even outflows of capital. Despite the potential benefits that can accompany these high levels of foreign exchange reserves, decreasing advantages of holding high levels can

¹ This document is a brief summary of the working paper "An Asset Allocation Framework with Tranches for Foreign Reserves". Previous comments of Peter Fisher, Marco Ruíz, Carlos León and Juan Sebastián Rojas Bohórquez, are highly appreciated, as are the comments of Professor Yi Huang and the participants at the 3rd Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme.

² All opinions presented in this paper are those of the authors and do not necessarily reflect those of the institutions they are affiliated with.

be found and these include the gap between the lending and the borrowing rates, which can substantially increase the cost of high accumulation policies, and the opportunity cost of investing in low return-risk assets.

However, some countries may find it advantageous to hold foreign exchange reserves similar to or higher than peer countries since this may translate into lower borrowing premiums in international markets.

Considering central banks' investment objectives with regards to safety, liquidity and return together with the current high holdings of foreign exchange reserves, this article proposes a framework in which these financial objectives are maximized, while the implicit costs of reserve holdings are reduced. The framework consists in assessing the adequate level of reserves that allows a central bank to achieve its safety and liquidity objectives by investing in liquid, almost default-free and low-volatility securities, such as those usually held in a foreign reserves portfolio. These assets are held in what will be denominated as the safety tranche. If the current level of reserves is above the adequate level, an additional tranche – called the wealth tranche – is proposed, in which the return guideline can be accomplished, thus reducing the implicit costs of holding foreign reserves. This framework establishes an appropriate trade-off between the investment objectives of holding international reserves, without jeopardizing the benefits of such holdings – including decreasing the negative outcomes of balance of payments crises.

Measurements of reserve adequacy seek to hedge possible outflows of the balance of payments by accumulating a specific proportion of a macroeconomic variable. Particularly, the International Monetary Fund (2011) proposes a standardized approach for both fixed and floating exchange rate regimes in which the main reserve adequacy indicators are grouped into a single measurement. The selected variables are: (i) M2, which captures possible outflows during a bank-run crisis, (ii) short-term debt (STD), which includes possible outflows in the contingency of a balance sheet crisis, (iii) other portfolio liabilities (OPL), which captures outflows that occur due to the liquidation of foreign, short-term portfolio investments in periods of market stress, and (iv) exports (X), which shows possible outflows during a current account crisis.

The weights for each variable are based on the negative 10th percentile of historical flows in periods of market pressure, which are determined using the index of exchange market pressures (EMP), following Eichengreen, Rose and Wyplosz (1997). This results in the following two measurements:

Fixed: 30% of STD + 15% of OPL + 10% of M2 + 10% of X

Floating: 30% of STD + 10% of OPL + 5% of M2 + 5% of X

The adequate level of foreign reserves can be tailored to each specific country in order to capture that country's idiosyncratic traits by computing the variables according to their specific historical data and incorporating additional and more characteristic variables, such as remittances, repatriation of dividends from multinational companies, or foreign direct investment. The described methodology considers very extreme scenarios in which all of the studied components of the balance of payments suffer considerable reversals at the same time; thus, only a very conservative central bank should use these exceptional adequacy levels as guidance. In order to circumvent this assumption, Gómez (2014) – focusing on the fact that the metric proposed by the IMF ignores the existing correlation between the variables – upgrades

the metric to include the implied correlations between the variables considered. This creates a less conservative measurement, derived on the premise that in a period of pressure in the foreign exchange market the worst case of each variable does not materialize.

As the surplus given by the metric indicates the amount redirected into an alternative tranche it is important to take into account that the adequate level of reserves should be updated periodically in order to adjust the size of the tranches to the conjuncture of each country.

One of the possible issues that may occur as a consequence of distributing the overall portfolio into two tranches is the effect of sub-optimality resulting from a mental accounting behavioural bias. This bias occurs when an investor considers her or his financial objectives separately and develops distinct portfolios to fulfil her or his financial needs, in lieu of grouping all the available resources into the same basket and building an overall optimal portfolio following Markowitz mean-variance theory. However, Das *et al.* (2010) use behavioural portfolio theory to show that more imprecisions can occur for not establishing correctly the financial goals when grouping all the available resources into one basket.

Once the decision to establish two separate tranches has been made, the next step is to define an appropriate benchmark for each of them following different assumptions. In order to do so, as mentioned by Solnik and McLeavey (2003), three main issues should be considered: (i) the scope of the benchmark, (ii) the attitude towards currency risk, and (iii) the set of weights chosen.

The first issue involves the selection of asset classes; this point is closely related to the risk aversion defined by the top decision-making body for each of the two different portfolios. The approach suggested in this paper is to maintain the same level of risk aversion but under separate time horizons. Therefore, a non-linear constraint is defined that limits the portfolios within the efficient frontier to those not resulting in losses with a 95 per cent confidence level in the given time horizon.

Regarding the selection of the time horizon, Bodie (1995) proves that when the time horizon increases, the risk of an asset does not decline. Although the probability of a shortfall decreases, the size of the shortfall increases over time, increasing the overall risk along the time horizon. Thus, increasing the time horizon by itself does not guarantee a tranche with a different risk-return profile. Consequently, the liquidity and safety constraints of the longterm invested portfolio (wealth tranche) are relaxed in order to allow investment opportunities usually not considered in foreign reserves portfolios. Therefore, the safety tranche will only be limited to the fixed income universe plus gold, whilst the wealth tranche will explore additional asset classes, as suggested by Fisher and Keeley (2013). In an implementation phase a central bank should consider its operational, legal, risk aversion and knowledge constraints before deciding which assets are included in the optimization.

Concerning the second issue with regards to developing an appropriate benchmark – attitude to currency risk – different approaches may be used including minimizing the volatility of the portfolio and the balance sheet, or using an asset–liability management framework in order to replicate the country's expected obligations in foreign currency, thus establishing a numeraire close to the currency composition of those liabilities. These methods are consistent for the safety tranche, which is the main buffer to cover the required liabilities. Given that the main purpose of the wealth tranche is to increase the return of the foreign reserves and the low predictability of the movement of the currency rates, this paper suggests partially hedging the currency risk in this particular portfolio, as explained by Black (1995). This makes possible an appropriate exposure to currencies in order to maximize the numeraire return, which in this case would vary according to the investment and accounting policies of the central bank; USD is used as a reference.

As soon as the first two points have been covered one can proceed to determining the weights within the portfolios. The methodological approach applied in this paper follows the Black and Litterman (1991) framework with some particular enhancements to the estimation of the covariance matrix; as proposed by León and Vela (2011). The Black–Litterman (BL) model has been praised for its low turnover and avoidance of corner solutions, given the use of the global capital asset pricing model (CAPM) equilibrium as a centre of gravity. Additionally, this model allows the investor to incorporate particular views over the asset classes using a Bayesian approach.

Illustration

The framework is tested for an emerging economy where the safety tranche's asset universe is limited to gold and fixed income securities while the wealth tranche broadens the asset space and incorporates more fixed income securities, equities, private equity, hedge funds and real estate.

As to the numeraire of the safety tranche, a representative currency composition of 86% USD, 5% AUD, 4% CAD, 2% SEK and 3% GBP is selected. Conversely, the accounting unit of measurement of the wealth tranche is only dollars, which includes an optimal hedging percentage of 67.47 per cent. Concerning the time horizon the safety tranche follows the central bank's usual practices, which is usually one year. While for the wealth tranche the chosen parameter is ten years, which corresponds to the approximate time frame in which a crisis event occurs, assuming a time-homogeneous Poisson process and a sudden stop probability of 10 per cent.

Once the available data series has been used to optimize the portfolios, the two tranches have to be pooled with the estimated appropriate level of reserves. This will vary according to the country and the selected percentile of the change in each variable in high-pressure periods. For the purpose of illustration, this paper selects one-third of excess reserves to be allocated into the wealth tranche.

On the one hand, the resulting safety tranche is composed entirely of fixed income instruments and concentrates on the short end of the curve (its duration is equal to 0.76), which makes it a low-volatility portfolio. The allocation exposed to currency risk is 14 per cent of the portfolio, which is the result of the selected methodology used to define the numeraire. On the other hand, the resulting portfolio for the wealth tranche is more diversified in terms of asset classes than is the short-term portfolio. In addition, as expected, the allocation in fixed income assets has a significantly longer duration (its duration is equal to 5.68). Although, being a portfolio held by a central bank, its composition can vary to that of a long-term invested portfolio of an endowment, pension fund, sovereign wealth fund or foundation that may hold a higher percentage of alternative assets.



Figure 1 – Asset Allocation of the Safety (A) and Wealth (B) Tranches



- 25% US Bonds
- 18% Equity develop ex. US
- 18% Equity US LC
- 8% Emerging Equity
- 6% Japanese Bonds
- 5% Corporate Bonds
- 5% Mortgages
- 3% Hedge Funds
- 2% Equity US SC
- 2% UK Bonds

In order to evaluate the historical performance of the wealth tranche and the aggregate portfolio against the portfolio with an investment horizon of one year, a back-test exercise (see Table 1) is realized in which the methodology described is applied for the available data each month from December 2001 to September 2014, assuming monthly rebalancing for each portfolio.

It is observed that the average return and the historical volatility of the long-term tranche are higher than those calculated for the one-year investment horizon during the evaluation period (mean 5.55 per cent vs 2.79 per cent and volatility 4.33 per cent vs 2.53 per cent, respectively). This is an effect of the increased duration of the fixed income component and the addition of more volatile financial instruments. The average return and volatility of returns of the total aggregate portfolio are 3.70 per cent and 2.81 per cent, respectively.

In spite of having greater volatility, the aggregate portfolio shows a better risk adjusted performance than the traditional methodology. This is derived from the safety-first-ratio, which allows an investor to select one portfolio rather than another based on the criterion that the probability of the portfolio's return falling below a minimum desired threshold is minimized. This indicator is equal to 1.32 for the total aggregate portfolio versus 1.10 for safety tranche, meaning that the increased volatility of the total portfolio is more than offset by the increase in the excess returns on the defined threshold. In addition, three measurements of tail risk largely favour the pool of the two tranches against the single safety tranche, as a consequence of the almost independent relation between the short-term and long-term portfolios.

	Safety Tranche	Wealth Tranche	Aggregate Portfolio
Annualized mean return	2.79%	5.55%	3.70%
Annualized standard deviation	2.53%	4.33%	2.81%
Safety-first ratio ⁽¹⁾	1.10	1.28	1.32
Annualized VaR (5%) ⁽²⁾	-0.49%	-0.57%	-0.36%
Annualized ES ⁽²⁾	-0.79%	-1.98%	-0.62%
Max. drawdown ⁽²⁾	-1.68%	-6.01%	-1.00%

Table 1 - Back-testing the Main Results

⁽¹⁾Risk adjusted excess return over a desired profitability threshold, which was assumed to be 0%.

⁽²⁾ VaR (value at risk) is the 5th percentile of the series of returns, and ES (expected shortfall) is the average of the lower return to VaR. The max. drawdown is the maximum historic drop in portfolio value over a period. To estimate these measurements, a 12-month moving average return with a monthly periodicity were used.

In order to obtain a forward-looking evaluation of the framework, a bootstrapping with time dependency is developed through a one-year horizon as shown in the fan plots of Figure 2. The plots start with an index value of 100, and are evaluated using the historical data of the previous year and the simulated returns of the next year. Clearly, the wealth

tranche shows the higher expected returns, which simultaneously increase those of the aggregate portfolio proportionally. As expected given the upside potential of this tranche a greater risk is implicit, which may decrease the overall value of the portfolio; this is depicted with a higher expected shortfall of -9.44 per cent with a confidence level of 99 per cent. This same risk measurement for the safety tranche and the aggregate portfolio is 0.02 per cent and -0.55 per cent, respectively. This indicates that regarding the increasingly riskier holdings in the aggregate portfolio, the diversification between each tranche helps to produce a low expected shortfall.



Figure 2 – Safety Tranche and Wealth Tranche Bootstrap

Concluding Remarks

In this paper the traditional investment objectives of a central bank are maximized through a framework that evaluates the adequate level of reserves in order to divide the overall portfolio between two tranches. On the one hand, the safety tranche comprises liquid, almost default-free and low-volatility assets, where the financial goals of safety and liquidity are met. On the other hand, the wealth tranche aims to maximize the return, with a broader range in the asset space and a longer time horizon. It is found that through this framework both the historical and forward-looking performance of an aggregate portfolio is improved, while maintaining the safety and liquidity needs of a traditional foreign exchange reserves portfolio.

The adequate level of reserves is measured using a metric that includes most potential outflows of the balance of payments while implicitly adding the correlations among the variables in periods of exchange market pressure, which outlines the size of the safety tranche. If this measurement indicates an excess of reserves, the framework proposes tranche division by calculating both portfolios using the Black-Litterman methodology, adding a series of adjustments in the covariance matrix calculation. The main strategic asset allocation decisions that differ between the two tranches are the asset space, the investment horizon, the numeraire and the liquidity constraints.

Advantages of the framework include: (i) the opportunity to decrease the implicit costs associated with the gap between the borrowing rate and investment return, particularly in emerging countries, and (ii) the likelihood of the borrowing premiums in international markets decreasing as a result of a relatively high amount of foreign exchange reserves that improves the perception of financial robustness amongst market participants and credit rating agencies.

Furthermore, it is important to note that the strategic asset allocation for the wealth tranche would diverge between countries as they would have to consider their economic particularities and their own investment constraints. The former include their most significant outputs in resources, goods and services and whether they want to establish a counter-cyclical policy with the invested assets or the currency composition. The latter could limit the asset space as the central bank considers its operational, legal, risk aversion and knowledge constraints; this step could also induce further considerations as to whether the international reserves are going to be actively or passively managed.

Additionally, if there is full certainty that the entire or a fraction of the amount in the wealth tranche will not be needed in future scenarios for complying with the central bank's institutional mission, a separate organization for managing these holding could be considered in order to reduce the effects of the traditional risk averse policies of a central bank. This could in turn create a clear separation between the tranches' objectives. However, the framework introduced relies on the fact that both tranches are formed to cover those needs related to the holding of foreign reserves. If this is not the case, further research can be carried out to test the viability of alternative options for using the excess reserves, including paying outstanding foreign debt, developing infrastructure projects or entering into any other social or governmental investments.

Finally, additional improvements and changes can be made to the methodologies used in the framework presented. For instance, as the samples of the macroeconomic variables used in the reserve adequacy measure increase, one can estimate a more robust indicator. Moreover, additional portfolio optimization methodologies can be tested, such as a factor based optimization or increasing the moments under which the optimization is carried out. Additionally, further analysis can be applied to the assets held in the safety tranche, considering that in the face of no risk-free rate one can discern the available "safe" assets, whether they are limited to the fixed income space or not.

6.9 DISCUSSION BY PROF. YI HUANG



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Huang, Y., "Discussion", Research Workshop, in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 139–140.

- *Firms' Exports under Exchange Rate Uncertainty* Ramiz Rahmanov
- An Asset Allocation Framework for Excess Reserves Julián David García-Pulgarín, Javier Gómez-Restrepo and Daniel Vela Baron

Ramiz's paper is an attempt to find the relationship between exports and exchange rate uncertainty. This paper is wide-ranging, involving an analysis of the sensitivity of the response of firms' exports to exchange rate volatility and to the quality of goods and the use of imported inputs under different invoicing methods.

The paper gives us significant results from firm-level data. Using a theoretical model, the author found that exchange rate uncertainty negatively affects export firms regardless of the currency of the invoice; that a higher quality of goods lessens the negative effect of exchange rate volatility; and that quality does not influence the sensitivity of exports to exchange rate volatility, an ambiguous effect of the response of exports to exchange rate uncertainty, regardless of the invoicing currency.

However, a problem arises with the findings of this paper due to the endogeneity of

exchange rate volatility. According to Wei et al. (2004), exchange rate volatility is the result of the volatility in underlying shocks to the economy and the policy regime that determines how these shocks have reacted with exchange rates and other variables. Also, exchange rate volatility and export/ imports might be driven by unobserved factors, such as global business cycles, the global economic cycle, or the oil price. There are three additional caveats to thinking about this research question: invoicing currency choice (Gopinath, Itskhoki, and Rigobon (2009), Bacchetta and van Wincoop (2005), Goldberg and Tille (2008a), and Goldberg and Tille (2008b and 2015)), imported input and adjustment (Pindyck (1982)), and the exchange rate regime (Rose (2000)).

All in all, Ramiz's paper provides us with an interesting result. However, the author also needs to consider the case of the eurozone or of the euro as the invoicing currency. Moreover, cross-sectional regression might not be able to capture the adjustment to production or pricing, whereas general equilibrium models are able to capture the underlying factors. As data was collected for three years, regression with appropriate fixed effects – such as sector and year – could be another empirical method to use when answering this question.

Comments on "An Asset Allocation Framework with Tranches for Foreign Reserves": this paper attempts to find the optimal asset allocation framework for foreign exchange reserves. For this question, the authors present concise analytical steps and rich results, involving a methodological model for estimating the efficient portfolios and an estimation of evolution based on historical returns for each of these portfolios.

The paper begins with the revision of the IMF Reserve Adequacy model with an example of a Colombia case because the IMF measurement does not account for heterogeneity in capital outflows for each country. The authors estimate an index of exchange market pressures (EMP), following Eichengreen, Rose, and Wyplosz (1997) and the IMF (2011). The authors then develop an alternative metric that takes into account the correlations between the variables in periods of exchange market pressure. Based on these models and the data collected, the authors present the efficient asset allocation model for foreign exchange reserves. separated into safety tranche and wealth tranche, along with historical annual and cumulative returns

However, one thing that must be considered for this research question is that an optimal strategy does not always coincide with the reality of a central bank's choice of reserve. According to an IMF survey of reserve management, there are diverse reasons why countries accumulate foreign reserves. The authors could also examine related literature on reserve adequacy: the topic of precautionary motives for reserve accumulation is discussed by Aizenman and Marion (2003) and by the IMF (2011); the topic of opportunity financial cost and the spillover of reserve accumulation with the capital control is discussed by Jeanne and Ranciere (2011) and the IMF (2012 and 2015).

7. Concluding Remarks¹



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Kose, A., "Concluding Remarks", in Exchange Rate Policy: Limits to Flexibility, Capital Controls, and Reserve Management, Proceedings of the Third Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks (BCC) programme, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2015, p. 141–147.

Developing Countries in Transition

I would like to thank the organizers for inviting me to the conference. Developing countries have been going through a challenging transition over the past two years. This transition has two major dimensions. First, *lower oil prices* are having an increasingly pronounced impact on developing economies. In oil-importing countries, the benefits to activity have so far been limited, although they are helping to reduce vulnerabilities. In oil-exporting countries, lower prices are sharply reducing activity and increasing fiscal, exchange rate, or inflationary pressures.

Second, the widely expected *tightening of monetary conditions* in the United States, along with monetary expansion by other major central banks, has contributed to broadbased appreciation in the US dollar and is exerting downward pressure on capital flows to developing countries. Many developing-country currencies have weakened against the US dollar, particularly those of countries with weak growth prospects or elevated vulnerabilities.

¹ I would like to thank Ergys Islamaj and Sandy Ye for their input. This speech is based on the references listed at the end of this piece. The views expressed in the speech are those of the author and do not necessarily represent those of the World Bank Group, its Board of Executive Directors, or the governments they represent.

I would like to provide a brief summary of the growth prospects in developing countries and then discuss in detail the two elements of the transition developing economies face.

What is Happening to Growth in Emerging Markets?

Since 2010, growth has been slowing in emerging market economies (EMs). EM growth has remained well below pre-crisis (2003–08) rates and by 2014 had fallen below its long-term (1990–2008) average. The growth differential between EMs and advanced economies (AEs) has also narrowed to its lowest level since the early years of the twenty-first century. This follows half a decade during which EMs as a group achieved their highest growth since the 1980s and became the main engine of global activity (Didier et al. 2015).

The slowdown has been unusually synchronous and protracted. It has affected a sizeable number of EMs, especially large ones. Although the slowdown is taking place against a backdrop of a weak, but not stressed, external environment, its breadth is comparable to previous episodes of global turmoil. The deceleration in EM growth has been broadbased, with concurrent declines in growth in most components of demand. Growth rates of investment and exports suffered especially sharp cutbacks, falling to less than half of their 2003–08 average levels. The slowdown has been associated with repeated downward revisions in EM growth forecasts.

The EM growth slowdown was initially driven by external factors but domestic factors have increasingly weighed on growth since 2014. External factors holding back growth since 2011 include weak world trade, low commodity prices and tightening financial conditions. I will discuss the decline in commodity prices and tighter financial conditions in detail below. Domestic factors include a steady slowdown in productivity growth, bouts of policy uncertainty, and an erosion of policy buffers that has made it difficult to support activity with fiscal and monetary stimulus.

Both structural and cyclical forces have contributed to the slowdown. Much of the decline in potential growth resulted from a slowdown in productivity growth. Both cyclical and structural policies need to be employed, but their relative importance varies across countries. To the extent that the slowdown reflects, at least in part, a cyclical deceleration, expansionary fiscal and monetary policies could support growth.

What is the Status of Commodity Markets?

It is important to understand the status of commodity markets to get a full grasp of the first transition developing economies face. In this context, the global oil market has a special role, as – following four years of relative stability at around UD 105 per barrel (bbl) – oil prices have declined sharply since June 2014 and are expected to remain low for a considerable period of time. This drop in price likely marks the end of the commodity supercycle that began a dozen or so years ago (Baffes et al. 2015).
In addition, non-energy commodity prices fell 5 per cent in the third quarter of 2015, and are down more than a third from their early-2011 high (World Bank 2015b). Ample supplies and weak demand, especially for industrial commodities, contributed to the continued slide in most commodity prices. All main commodity price indices are expected to decline in 2015, mainly owing to ample supply and, in the case of industrial commodities, slowing demand in China and emerging markets.

Downside risks to the energy price forecast include higher-than-expected production from OPEC producers and continuing falling costs of the US shale oil industry. Slowing demand and high stocks would further weigh on oil prices. Upside risks include accelerating declines in shale output, delayed implementation of the Iran agreement, and supply curtailment because of geopolitical events.

The sharp fall in oil prices since June 2014 is a significant but not unprecedented event. Over the past three decades, five other episodes of oil price declines of 30 per cent or more in a seven-month period occurred, coinciding with major changes in the global economy and oil markets. The recent plunge in oil prices has been driven by a number of factors: several years of upward surprises in the production of unconventional oil; weakening global demand; a significant shift in OPEC policy; unwinding of some geopolitical risks; and an appreciation of the US dollar.

Although the relative importance of each factor is difficult to pin down, OPEC's renouncement of price support and the rapid expansion of oil supplies from unconventional sources appear to have played a crucial role since mid-2014. Empirical estimates also indicate that supply (much more than demand) factors have accounted for the lion's share of the plunge in oil prices. Although the supply capacity of relatively high-cost and flexible producers, such as the shale oil industry in the United States, will need to adjust to lower prices, most of the underlying factors point to lower oil prices persisting over the medium term, with considerable volatility in global oil markets.

The decline in oil prices will lead to significant real income shifts from oil exporters to oil importers, likely resulting in a net positive effect for global activity over the medium term. Activity in oil importing countries should benefit from lower oil prices since a drop in oil prices raises household and corporate real incomes in a manner similar to a tax cut. While the positive impact for oil importers could be more diffuse and take some time to materialize, the negative impact on exporters is immediate and in some cases accentuated by financial market pressures.

However, several factors could counteract the global growth and inflation implications of these lower oil prices. These include weak global demand and limited scope for additional monetary policy easing in many countries. The disinflationary implications of falling oil prices may be muted by sharp adjustments in currencies and the effects of taxes, subsidies and regulations on prices.

While falling oil prices would support activity and reduce inflation globally, some oil-exporting countries may come under stress as falling oil-related revenues put fiscal balances under pressure and exchange rates depreciate on deteriorating growth prospects. Oil price developments may also add to volatility in financial and currency markets and affect capital flows. Investment in the oil industry may fall sharply, not just in oil-exporting countries but also in currently oil-importing countries with a potential for oil extraction.

Since food production tends to be energy intensive, falling oil prices would likely be accompanied by declining agricultural prices. A 45 per cent decline in oil prices could be expected to reduce agricultural commodity prices by about 10 per cent (Baffes et al. 2015). Passed through into domestic food prices, the decline in commodity prices would benefit the majority of the poor. Agricultural prices are projected to fall 13 per cent in 2015. The outlook mainly reflects abundant supplies and a high level of grain stocks.

Falling oil prices affect monetary and fiscal policies differently depending on whether a country is an oil importer or exporter. For importers, the pass-through into slowing inflation may ease pressure on central banks and could provide in some cases room for policy accommodation. However, in a generally weak global growth environment and with policy interest rates constrained by the zero lower bound in major economies, monetary policy might need to respond to deflationary risks. In the euro area and in Japan, several months of outright deflation could contribute to inflation expectations becoming de-anchored from policy objectives. For exporters, central banks will have to balance the need to support growth against the need to contain inflation and currency pressures.

Regarding fiscal policy, the loss in oil revenues for exporters will strain public finances, while savings among oil importers could help rebuild fiscal space (World Bank 2015a). Lower oil prices also present a window of opportunity to implement structural reforms. These include, in particular, comprehensive and lasting reforms of fuel subsidies — which tend to have adverse distributional effects and tilt consumption and production towards energy-intensive activities and less environmentally friendly energy sources — and of energy taxes more broadly. Fiscal resources released by lower fuel subsidies could either be saved to rebuild fiscal space lost after the global financial crisis or reallocated towards better-targeted programmes to assist poor households and support critical infrastructure and human capital investments. In oil-exporting economies, low oil prices reinforce the need to redouble efforts to diversify activity.

What Are the Potential Implications of the Coming US Fed Interest Rate Tightening Cycle?

The second element of the transition developing economies face is the long-anticipated increase in US Federal Reserve (Fed) interest rates. Since the global financial crisis, the exceptionally accommodative monetary policy stance of the US Fed has helped support activity, bolstered asset valuations, and reduced risk premia. In addition, it has been instrumental in boosting capital flows to EMs. As the US economy improves, the Fed is expected to start raising policy interest rates in the near term (an event widely referred to as "lift off") and thus commence a tightening cycle for the first time in nearly a decade.

The mid-2013 "taper tantrum" episode is a painful reminder that even a long-anticipated change in Fed policies can surprise markets in its specifics, and lead to significant financial market volatility and disruptive movements in capital flows to EMs. Recent debates have focused on the potential impact of the lift off on EMs, but there are also significant risks associated with the pace of subsequent rate increases, which is currently expected to be very gradual, but could accelerate at a time when EM policy buffers are eroding (World Bank 2015c).

Activity in the United States continues to pick up, and labour markets are strengthening. While the recovery remains fragile in other major advanced economies, it has gradually firmed since 2013. Despite the recent volatility, global long-term interest rates remain low, and the European Central Bank and the Bank of Japan are continuing to employ exceptionally accommodative monetary policies.

Since the taper tantrum, EM growth prospects and creditworthiness have deteriorated, while vulnerabilities have risen in many countries. Activity has slowed in many EMs, and growth in 2015 is expected to be the weakest since the financial crisis. On average, private debt has increased and fiscal positions have generally deteriorated. Current account balances among several oil-importing countries have improved somewhat but they have deteriorated among many oil exporters. EMs with high levels of total external debt or with a large share of short-term external debt have made only limited progress in reducing such vulnerabilities. Foreign currency exposures remain elevated in some EMs. Corporate debt has increased notably in several countries, with a significant share denominated in dollars.

There are multiple reasons to expect a smooth tightening cycle with only modest impact on EMs. The tightening cycle has long been anticipated and will most likely proceed very gradually. It will take place in the context of a robust US economy, which – according to a vector autoregression analysis – will have positive real spillovers to EMs. The term spread in the United States is likely to remain narrow as happened during some of the past tightening episodes. Other major central banks are expected to continue pursuing exceptionally accommodative policies that would shore up global liquidity and help keep global interest rates low.

The tightening cycle carries significant risks. Five factors heighten the risk of volatility in financial markets with adverse implications for activity in EMs. First, uncertainty about the underlying strength of the US economy creates ambiguity about how far the Fed actually is from achieving its dual objectives. Secondly, US term premia are well below their historical average and could correct abruptly. Third, market expectations of future interest rates are below those of the US Federal Open Market Committee. Fourth, market liquidity conditions are fragile. Lastly, an increasingly challenging external environment is eroding EMs' resilience: global growth is soft, world trade growth is subdued, and commodity prices remain low.

Movements in US yields play a significant role in driving fluctuations in capital flows to EMs. If the tightening cycle were accompanied by a surge in US long-term yields, as happened during the taper tantrum, the reduction in capital flows to EMs could be substantial. According to a vector autoregression model, a 100 basis point jump in US long-term yields (as occurred during the taper tantrum) could temporarily reduce aggregate capital flows

to EMs by up to 2.2 percentage points of their combined GDPs (Arteta et al. 2015). Such a large drop in capital flows could create significant policy challenges for vulnerable EMs.

Financial stress in global markets tends to disproportionately affect those EMs that have weak growth prospects, sizable vulnerabilities, and challenging policy environments. Financial market volatility during the tightening cycle could potentially combine with domestic fragilities to create a perfect storm that could lead to a sharp reduction in capital flows to more vulnerable countries. Over time, this risk could intensify as modest growth prospects become entrenched and vulnerabilities widen in some major EMs. Furthermore, an abrupt change in risk appetite for EM assets could lead to contagion affecting capital flows to many countries, even if they have limited vulnerabilities. This could turn a manageable slowdown in capital inflows to EMs into an episode of multiple sudden stops. An event study exercise suggests that growth in EMs declines, on average, almost 7 percentage points in the two years following such sudden stop episodes.

So, what do these two transitions mean for economic policies in EMs in an environment of weak growth?

Crisis-related fiscal stimulus, both during the crisis and in its wake, has reduced the manoeuvring space in several EMs. Persistently low oil prices have further narrowed fiscal policy room in most oil-exporting countries but widened it in some oil-importing countries. Infrastructure investment can be a particularly effective instrument for fiscal stimulus to help lift activity and boost employment. However, the effectiveness of stimulus measures depends on the availability of fiscal space (World Bank 2015a).

Monetary policy options diverge between commodity-importing and commodity-exporting EMs – while most of the latter have limited monetary policy room to manoeuvre, some in the former group should have some space to counteract shocks and stimulate activity. In commodity-exporting EMs, depreciating currencies have increased inflationary pressures and weakened balance sheets with foreign exposures. In oil-importing countries, the drop in oil prices has reduced inflation and allowed central banks to cut rates.

Structural reforms could mitigate the sources of the growth slowdown in the medium and long term. Since the 2008 Global Crisis, EMs' record with respect to structural reforms has been mixed. Although there has been progress in strengthening infrastructure and reducing administrative obstacles in some EMs, governance reforms have been lagging. Corruption and infrastructure gaps remain key obstacles to doing business in many EMs. Policies for improving the investment climate, enhancing the functioning of labour markets, and raising human and physical capital could boost productivity. EMs have come a long way over the past two decades – they have been able to improve their macroeconomic policy frameworks, reduce debt and inflation levels, diversify their production and exports, and establish stronger global trade and financial linkages. In a nutshell, the EMs of today are certainly not the crisis-prone EMs of the 1980s or 1990s.

However, after enjoying years of strong growth, emerging markets find themselves at a crossroads. While the growth slowdown since 2010 could simply be a rough patch, it could also signal the start of an era of slow growth given the persistent nature of the factors that have driven the slowdown so far. In fact, repeated downgrades in long-term growth

expectations suggest that the slowdown might not be simply a pause, but the beginning of an era of weak growth for EMs. In light of the significant global risks going forward, EMs urgently need to put in place an appropriate set of policies to address their cyclical and structural challenges and promote growth.

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