

A modern reincarnation of Mundell-Fleming's Trilemma

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Abstract

A modern incarnation of the trilemma is essential for understanding the evolving global financial architecture, and for coming up with ways to mitigate financial fragility. The scarcity of policy instruments relative to the policy goals implies complex country-specific tradeoffs between the policy goals. The financial crises of the 1990s induced Emerging markets to converge to trilemma's middle ground -- managed exchange-rate flexibility, controlled financial integration, and viable but limited monetary independence. Capital flight crises added financial stability to trilemma's policy goals. New policies were added to deal with financial fragility associated with financial integration, including precautionary management of international reserves by emerging markets, swap lines among OECD's central banks, and macroeconomic prudential regulations. These trade-offs are impacted by a country's balance sheet exposure to hard currencies, the exchange-rate regime, and the growing sensitivity to shocks emanating from the U.S. and the Eurozone in the aftermath of the Global Financial Crisis.

Keywords: The impossible trinity, international reserves, financial crises, financial stability, swap lines, debt and banking crises, balance sheet exposure.

Highlights:

Emerging markets converged to the trilemma's middle ground following financial crises
Financial stability was added to the original trilemma policy goals
New policy instruments were added to deal with financial stability
The added instruments included macro-prudential, managing buffers, and swap lines
Developed and emerging countries use a different mixture of policy instruments

JEL Classification: F 31, F 32, F33, F34, F36, F38

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1. Introduction

This paper critically reviews and evaluates the relevance of Mundell-Fleming’s open economy trilemma predictions for policy challenges of the twenty-first century. Figure 1 shows the textbook version of the trilemma, in which the three sides of the triangle represent the trilemma’s three policy goals stated in the shaded text adjacent to each side: monetary independence, exchange-rate stability, and financial integration. A key prediction of Mundell-Fleming’s model is the impossibility of accomplishing these three policy goals simultaneously.¹

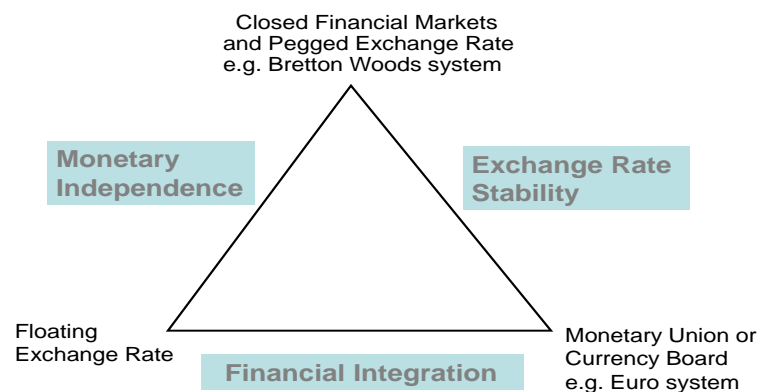


Figure 1: **The trilemma “Textbook Triangle.”**

While the trilemma triangle is widely featured in modern open macro economy textbooks, observers have noted that the Trilemma’s framework was more valid during the Bretton Woods regime— that is, during the 1950s and 1960s, when the Mundell-Fleming’s model was framed— than in today’s global economy. First, the binary nature of the trilemma, as a stark choice of three sharp policy goals, may limit its applicability in a world where countries can opt for mixed regimes (e.g., managed exchange-rate flexibility, controlled financial integration, and viable but limited monetary independence). Second, the post-Global Financial Crisis (GFC) period raised concerns about the importance of exchange-rate regimes. Rey’s (2013) appraisal of the past decades is that U.S. monetary policy overwhelmingly determined the monetary policy of countries that allowed partial financial integration—irrespective of their exchange-rate regimes—thereby reducing the trilemma to a dilemma. Finally, the financial crises of the 1990s (impacting mostly emerging

¹ Each pair of the trilemma’s policy goals can be accomplished by the policy instruments depicted by the vertex determined by the intersection of the two sides corresponding to the two policy goals (e.g., monetary independence and financial integration can be accomplished by adopting floating exchange rate regime).

markets), as well as the GFC and the eurozone crises, have added financial stability as a key policy goal to the original trilemma policy goals. While financial stability is not entirely a new policy goal, the prevalent capital controls during the Bretton Woods period delinked financial stability concerns from open economy considerations. As such, stability was not explicitly featured in the original framing of the trilemma.² This in turn suggests a transformation of the trilemma into a quadrilemma in which added policy instruments (e.g., precautionary use of international reserves, macro-prudential regulations, foreign currency swap lines among central banks, etc.) may affect financial stability, as well as the attainment of other policy goals (Aizenman and Ito, 2012).

Motivated by these developments, this paper reviews research dealing with the relevance of Mundell-Fleming's open economy at the present time, and concludes that an extended version of the trilemma remains viable and relevant. The main insight of the trilemma remains fresh—that is, the scarcity of policy instruments relative to the policy goals implies complex country-specific tradeoffs between the various policy goals. This tradeoff has common features among blocks of countries that are at similar levels of development and institutional capacities, and is impacted by financial developments, the changing landscape of exchange-rate regimes, and the evolving patterns of financial regimes.

The rest of the paper is organized as follows. Section 2 overviews the open economy trilemma, vintage 1960s. Section 3 looks at several key open-economy trilemma developments after the Bretton Woods era, including the transition of most OECD countries to flexible exchange-rate regimes and free capital flows, the formation of the eurozone, and the growing financial integration of emerging markets (EMs) in the 1990s. With a lag, most EMs found that growing financial integration and attempts to maintain exchange-rate stability propagated financial crises that induced convergence to the trilemma's middle ground, which was buffered by precautionary hoarding and using of reserves. Section 4 reviews empirical analyses and tests of modern trilemma versions. Section 5 discusses the recent debate regarding dimensionality of the policy tradeoffs—propagated by the growing importance of financial stability concerns associated with financial globalization—and the growing dominance of U.S. financial and monetary policies in the past decades. Section 6 overviews the proliferation of swap lines and macro-prudential policies. Section 7 concludes.

² Indeed, the earlier versions of Mundell-Fleming's model were non-stochastic models that most overlooked multiple equilibria and a possible exposure to greater financial fragility associated with deeper financial globalization.

2. The open-economy Trilemma, vintage 1960s

A seminal contribution of the Mundell-Fleming 1960s framework is the open macro-economy Trilemma (aka the impossible trinity) that states that a country may simultaneously choose any two, but not all of the three policy goals—monetary independence, exchange rate stability, and financial integration. Accordingly, sustaining monetary policy autonomy and a fixed exchange-rate regime entails capital controls, the preferred choice of most OECD and developing countries during the 1945–1970 Bretton Woods regime. In contrast, maintaining monetary independence and financial integration entails exchange rate flexibility. Over the last four decades, the U.S., the U.K., Japan, and several other OECD countries followed this regime. Exchange rate stability and financial integration entails giving up monetary independence—the preferred choice of the countries that formed the Euro block (a currency union), or currency board (e.g., Hong-Kong, Argentina during the 1990s).

The Trilemma may be explained in the context of an open economy extension of the IS-LM neo Keynesian model (Mundell, 1963). The analysis is considerably simplified by focusing on polarized binary policy choices of a small economy —i.e., a credibly fixed exchange rate or pure float; perfect capital mobility or financial autarky; independent monetary policy or giving up monetary discretion. The trilemma follows from the observation that with capital mobility, interest rates in different countries are linked by arbitrage conditions. Accordingly, a small country, say Denmark, fixing its currency to the euro, will find that its interest rate will equal to the interest rate in Germany of similar maturity, up to minor transactions costs (and possible risk premium in the presence of risk aversion). Thereby, exchange rate stability and financial integration implies that the central Bank of Denmark is unable to set its policy rate in ways that deal with domestic policy goals. In a recession, attempts to increase the supply of money in order to reduce the domestic interest rate will induce incipient excess demand for the Eurobonds. Consequently, Danish bonds are sold, and the proceeds are exchanged at the official rate for the euro. The net effect is that the supply of money in Denmark drop, and the interest rate rises to match the level consistent with uncovered interest parity. Thereby, market arbitrage nullifies the Danish Central Bank intervention.

In contrast, the British Pound (GBP) floats against the Euro. Thereby, a higher supply of money in the UK will reduce the interest rate on GBP bonds, induce incipient excess demand for the Eurobonds and excess supply of GBP bonds, triggering the depreciation of the BP as the outcome of the lower interest rate in the UK. Hence, the Bank of England has the ability to conduct independent monetary policy, at a cost of exchange rate instability. The Danish Central bank can gain monetary independence [i.e., the ability to conduct monetary policy] under the fixed exchange rate by

imposing capital controls, as such controls will prevent the arbitrage that links the domestic interest rate with foreign interest rates, as has been the case under the Bretton Wood system.

Framing the Trilemma as a binary choice of “corner options” in the 1960s fitted the global regime well at that time, as framed by the Bretton Woods agreement of 1944. During this time, repressed financial markets and stringent control of private capital flows among the OECD countries were prevalent —most of which had currencies pegged to the U.S. dollar. Indeed, in the first decades post-WW II financial and exchange rate instability was limited. The sharp predictions of the Trilemma and its crisp intuitive interpretation made it the cornerstone of the open-economy, neo-Keynesian paradigm.

In a string of insightful papers, Obstfeld, Shambaugh and Taylor (2004, 2005, 2010), test key predictions of the Trilemma. Specifically, they evaluate the transmission of interest rate shocks in various regimes, contrasting different regimes that were close to the three Trilemma vertices over time. Overall, the results are in line with the Trilemma prediction. During fixed exchange-rate episodes in the classical gold standard period, a pronounced and rapid transmission of interest rate shocks is found (corresponding to the right vertex of the Trilemma, Figure 1). This is in line with the prediction that the fixed exchange rate coupled with capital mobility nullifies monetary independence. In contrast, during the Bretton Woods era, fixed exchange rates did not provide much of a constraint on domestic interest rates, a by-product of widespread capital controls (corresponding to the top vertex of the Trilemma triangle, Figure 1). In the post-Bretton Woods era, the reversion to a more globalized pattern is manifested through an increased interest-rate transmission among fixed rate countries. Non-peg countries, both before 1914 and in the post-Bretton Woods period, have enjoyed considerably higher monetary independence than countries that pegged their exchange rate.³

3. Open-economy Trilemma developments after the Bretton Woods era: from the Trilemma to the Quadrilemma?

The Bretton Woods system served the OECD countries well during the recovery decades that followed the end of WW II. However, it came under growing pressure during the 1960s, reflecting the successful recovery of Western Europe and Japan, as well as the growing assertiveness of

³ It is noteworthy that an alternative presentation of Mundell-Fleming’s model uses the *internal and external balance policy goals* [see Gandolfo, 2001]. Framing the present discussion using the trilemma interpretation is in line with the frequent reference to the trilemma paradigm in recent policy discussions.

Western Europe, as countries went in search of a more balanced global architecture. The expansionary monetary policy of the U.S., the global anchor of the regime during the 1960s, provided the impetus for the ultimate collapse of the Bretton Woods system in the early 1970s (Eichengreen, 1996, 2007). Since then, the global Trilemma configuration has evolved substantially, resulting in several fundamental changes.

3.1 OECD countries transitioned to greater exchange-rate flexibility and rapid financial integration during the 1980s–1990s period. The outcome was a large increase in private gross financial flows and exchange rate volatility, as well as financial deepening and the proliferation of financial instruments aimed at hedging exposure to greater exchange-rate volatility. In line with the predictions of the Trilemma, greater exchange-rate flexibility and financial integration allowed OECD countries to exercise their monetary independence. With a lag, the dismantling of capital controls induced larger current account deficits and surpluses over time, well above the minor imbalances observed during the Bretton Woods system. These trends led to growing concerns about global imbalances in the 1990s and 2000s. The U.S. current account/GDP deficit reached about 6%, with gross inflows/GDP approaching 20% prior to the Global Financial Crisis of 2007–2008 [GFC henceforth]. Chinese current account/GDP surplus accelerated from close to zero in 1995 to 10% prior to the GFC, while German current account/GDP surplus reached about 7% prior at the same time. In contrast, the current account imbalances of most countries during the Bretton Woods system were close to zero on average, fluctuating in a narrow band of about +/- one percentage point of the GDP.

Bernanke (2005) explained these trends in the context of the *Global Saving Glut* hypothesis. Accordingly, “a combination of diverse forces has created a significant increase in the global supply of saving—a global saving glut—which helps to explain both the increase in the current U.S. account deficit and the relatively low level of long-term real interest rates in the world today.” These trends intensified real estate appreciation, especially in countries running larger current account deficits and liberal leverage regulations. The GFC and the Eurozone crisis put an abrupt end to these dynamics in more than dozen countries, inducing painful balance-sheet adjustments for households and banking systems, and magnifying the recessionary effects of these crises (Adam, Kuang, & Marcet, 2012; Aizenman & Jinjarak, 2009; Bernanke, 2010; Jordà, Schularick, & Taylor, 2015; Lane & Mcquade, 2014).

3.2 The formation of the Eurozone created a new global currency, yet the Eurozone crisis raised questions about the viability and stability of the euro. Growing exchange-rate flexibility is a double-edged sword, as the resultant exchange rate volatility increases the costs of

international trade in goods and assets. While deepening forward markets provide useful hedges for short and intermediate contracts, forward contracts rarely eliminate the costs of exchange rate volatility. These considerations, and the willingness of most EU members to move toward deeper integration in the 1990s, induced the birth of the euro project—morphing most of the EU countries towards a currency union. Following the unification of Germany in the early 1990s, countries that were unhappy with the “straightjacket” of the Bretton Woods system, led by France and Germany, joined forces in pushing the Eurozone countries into their own new straightjacket system. Eurozone members gave up their monetary independence in favor of a common currency, aiming for a deeper financial and trade integration. The short history of the Eurozone has been remarkable and unprecedented: the euro project has moved from the planning board to a vibrant currency within less than ten years, forming a “currency without a country” [see Cohen and Subacchi (2008)]. Most EU countries gave up their national monetary policy, floating jointly against the score of other industrial countries committed to exchange rate flexibility [the U.S., Japan, the U.K., Canada, Australia, and so forth]. Observers viewed the rapid acceptance of the euro as a viable currency and the deeper financial integration of the Eurozone during its first decade as stepping stones toward a stable and prosperous “United Europe,” possibly counter-balancing the dominance of the U.S. [see Chinn and Frankel (2008)]. Yet, the 2007–2008 GFC, and the Eurozone crisis that started in 2010, raised fundamental questions about the stability and the viability of the Eurozone, as well as the future viability of the EU (Eichengreen, 2008).⁴

3.3 Emerging Markets’ growing financial integration propagated financial crises, and a convergence to Trilemma’s middle ground, buffered by precautionary hoarding and using of reserves. The take-off and rapid growth of East Asia and other Emerging Markets at the era of growing trade and financial globalization among the OECD countries shrank the relative size of the matured industrialized countries to about half of the global GDP, adjusted properly for purchasing power differentials. Overall, the 1970s and 1980s were turbulent decades for EMs. These markets were exposed first to the consequences of the price of oil quadrupling following the formation of the OPEC cartel in the early 1970s, as well as a subsequent large increase in foreign currency borrowing by most developing and EM countries, which exposed their balance sheets to the

⁴ Observers have noted that the impossible trinity logic of policy instrument scarcity suggests headwinds facing the euro project. Frankel (1999) illustrated that no single currency regime is right for all countries or at all times. Beck and Prinz (2012) argued that a monetary union among autonomous countries cannot simultaneously maintain an independent monetary policy, national fiscal sovereignty, and a no bail-out clause. These three features make up a new impossible trinity, suggesting that an attempt to preserve all three concurrently will ultimately end in failure.

downside risk associated with possible dollar interest hikes and dollar appreciation. Indeed, the sharp increase of the U.S. interest rate, associated with Volcker's fast-but-painful disinflation in the early 1980s proceeded with EMs and developing countries' debt crisis, leading to their "lost growth decade" of 1980s, with a resumption of growth in the 1990s.

Remarkably, EMs' economies embraced a gradual process of increasing their financial integration in the early 1990s, while attempting to maintain exchange rate stability. This financial opening led to a sizable increase in financial inflows and an economic boom, with growing balance-sheet exposure to hard currency borrowing [dubbed hot money]. This pattern reflected EMs' inability to borrow in their own currencies, as accounted for by the "Original Sin" hypothesis (Eichengreen, Hausmann, & Panizza, 2003). Over time, a growing share of these countries were exposed to deep financial crises, induced by the onset of a "sudden stop" of financial flows and the capital flight of hot money (Calvo, 1998). The resultant drainage of international reserves led to balance of payment and exchange rate crises, collapsing exchange rates, and the frequent bailing out systemic banks and powerful macro players.

These crises also evolved into deep internal and external debt crises, ending with IMF stabilization packages. The resultant domestic debt overhang led frequently to fiscal dominance, reducing the scope of monetary policy [e.g., Mexico in 1994, the East Asian crisis of 1997–1998, the Brazilian and Russian Crises of the late 1990s, and so forth.]. With varying lags, and a "trial and error" learning process, these crises induced profound economic and political changes, in which a growing share of EMs countries converged to "in-between" regimes—managed exchange-rate flexibility, controlled financial integration, and limited but viable monetary autonomy (Aizenman & Pinto, 2013; De la Torre, Yeyati, & Schmukler, 2002). These observations explain the relative resilience of emerging markets—especially in countries with more mature institutions—as they have been buffered by deeper precautionary management of reserves, and deeper fiscal and monetary space (Frankel, 2011; Vegh & Vuletin, 2012; Franke, Vegh & Vuletin 2013). Thereby, for most EMs, the GFC marked another spell of sudden stop crises, testing their coping abilities with the volatility of hot money, and causing subsequent instability of their commodity terms of trade and demand for exports.

Taking stock of the remarkable history of EMs over the past four decades, we note that the key message of the Trilemma is scarcity of macro-policy instruments. Financial instability associated with private capital flows was the exception during the Bretton Woods system, as these flows were mostly prohibited. When allowed, these flows were regulated, requiring frequently authorization

under stringently enforced rules. Consequently, financial instability associated with incipient capital flows was not a priority of policy markets, as these flows were small, mostly predictable, and regulated. Things changed rapidly during the 1990s, a period where emerging markets opted for freer capital mobility, dismantling past controls. The resultant crises put to the fore Financial Stability as key policy concerns of these countries. Arguably, the outcome has been that the original Trilemma of the 1960s morphed during the 1990s into a Quadrilemma, under which financial stability has been added to the original 3-trilemma policy goals.

In line with Tinbergen's principle (i.e., the number of policy goals a policymaker can pursue successfully can be no greater than the number of independent policy instruments the policymaker can control), the aim of greater financial stability has been addressed by adding policy instruments. A possible interpretation of financial instability deals with the presence of multiple equilibria associated with financial fragility. Such financial fragility may reflect concerns regarding the commitment and fiscal viability of policies needed to prevent a run on the banking system in the presence of balance sheet exposure. Bocola and Lorenzoni (2017) provide an insightful model illustrating and explaining these issues in the context of EMs characterized by limited credibility of their fiscal backstop mechanisms. They consider an open economy with flexible exchange rates and financial intermediaries that face a potentially binding leverage constraint and confront the possibility of a self-fulfilling crisis with persistent adverse effects on real activity that produces a current account reversal and a real depreciation. The presence of dollar debt in the financial sector makes a crisis of this sort more likely, inducing multiple equilibria. The authors show that when domestic savers fear the possibility of a future crisis, they self-insure by saving in dollars. However, a reduced supply of domestic currency savings pushes the banks to issue more dollar debt, thus exposing the economy to the risk of future financial crises. Domestic authorities can eliminate the crisis equilibrium by acting as a lender of last resort, but these interventions only work if they are fiscally credible. Foreign currency reserves holding hedge the government's fiscal position and enhance its credibility, thus improving financial stability.⁵

According to this interpretation, the growing balance sheet exposure associated with hard

⁵ The framework by Bocola and Lorenzoni (2017) implies that the "state of fundamentals" (like fiscal space, growth rates, etc.) determines the existence and multiplicity of equilibria. If the fundamentals are very strong, the private sector does not have the incentive to "run on the system," and the regime is stable. If the fundamentals are very weak, the private sector attacks the system, and the regime collapses. In between the very strong and the weak equilibria, a range of multiple equilibria exist. Earlier examples of such systems include Diamond and Dybvig (1983) and Obstfeld (1996).

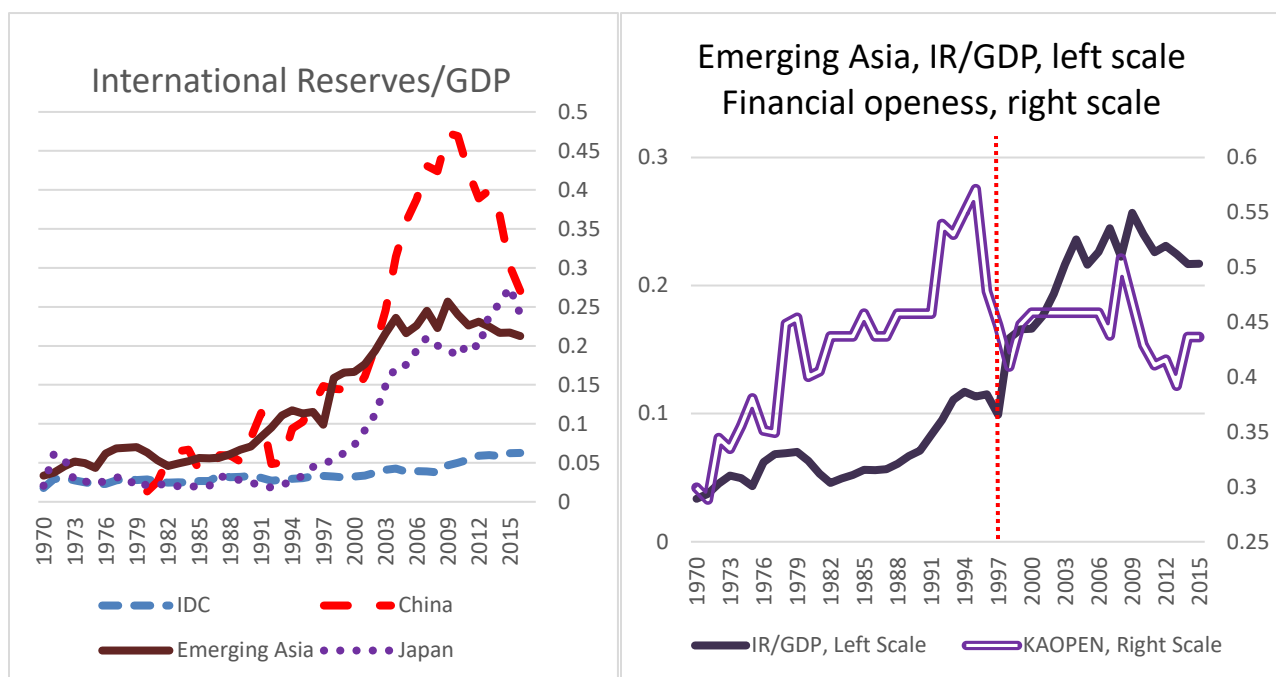
currency debt triggered by greater financial integration added financial stability as a policy goal to the three possible trilemma policy goals. Greater financial stability can be accomplished by several policy instruments, including precautionary hoarding and use of international reserves (aimed at reducing the net balance sheet exposure by public sector accumulation of foreign assets), by macro-prudential regulations that mitigate the incentive to increase hard currency debt, or by insurance services provided by bilateral swap lines among central banks. With a lag, the crises of the 1990s triggered EMs to hoard more international reserves as a precautionary buffer. The GFC induced the U.S. Fed to extend selective swap lines—mostly to OECDs exposed to dollar shortages. The growing volatility of financial flows and unconventional monetary policies initiated by the U.S. and eurozone policies in the aftermath of the GFC induced EMs to experiment with greater application of macro-prudential policies aimed at mitigating growing balance sheet exposures associated with volatile flows of “hot money” (Blanchard, Dell’Ariccia, & Mauro, 2013; Cerutti, Claessens, & Laeven, 2015; Korinek, 2011; Ostry, 2012; Shin, 2011). In the remainder of this section we review the first wave of EM adjustments to financial fragility concerns that deal with hoarding and using international reserves. In Sections 5 and 6, we focus on the post-GFC developments associated with a greater application of macro-prudential regulations, and the selective application of swap lines.

The left panel of Figure 2 vividly illustrates the EMs’ remarkable hoarding of international reserves that occurred during the 1990s and 2000s. Note the relative stability of the international reserves/GDP during the 1980s, a time when the reserve/GDP ratios of developing and industrial economies (IDC) hovered in the single-digit range, between 6% to 8% points of the GDP. This is consistent with earlier literature that has focused on using international reserves as a buffer stock, part of the management of an adjustable-peg, or a managed-floating exchange rate regime. Accordingly, optimal reserves balanced the macro economic adjustment costs incurred in the absence of reserves with the opportunity cost of holding reserves (Frenkel & Jovanovic, 1981). The buffer stock model predicts that average reserves depend negatively on adjustment costs, the opportunity cost of reserves, and exchange rate flexibility; and positively on GDP and on reserve volatility, driven frequently by the underlying volatility of international trade. Overall, the literature of the 1980s supported these predictions. (Edwards, 1983; Frenkel, 1983).

Aizenman and Marion (2003) and Aizenman and Lee (2007) explain the new hoarding trend of reserves by EMs and developing economies, whereby countries aim to insure against the costs of sudden stop and capital flight crises, triggered by the wave of such crises in the 1990s. The right panel of Figure 2 shows the argument for Emerging Asia, where the rise in a financial integration

in the early 1990s (see the double curve) was associated first with a moderate increase in international reserves/GDP (the bold curve) and reached about 10% by 1997. Shortly after the 1997 Asian crisis, the post-crisis policies doubled the IR/GDP of Emerging Asia by 2002 and reached 25% by 2005.⁶ These developments reflected the shifting focus from reserve adequacy measured in terms of trade flows of goods to hard currency debt and countries' balance sheet exposure.

Figure 2: International reserves/GDP and Financial Integration



International reserve/GDP Emerging Asia, IR/GDP [Left]; Financial Opens [Right]

A back-of-the-envelope estimation suggests that the expected benefits following a Guidotti-Greenspan rule is about 1% of gross domestic product. This would be the case if a country holding reserves equal to its short-term debt reduces the annual probability of experiencing a sharp reversal in capital flows by 10 % on average (in line with Rodrik and Velasco (1999)), and if the output cost of a financial crisis is about 10 % of GDP, as found by Hutchison and Noy (2006). Related results have been obtained using more elaborate models (Garcia & Soto, 2004; Ranciere & Jeanne, 2006). These authors have concluded that self-insurance against sudden stops plays an important role in

⁶ See Aizenman and Lee (2007) for a test supporting this timing conjecture for EMs. The rise in international reserves/GDP ratio after the wave of sudden stops follows the logic of a modified Guidotti-Greenspan rule of thumb: countries should hold liquid reserves equal to their foreign liabilities coming due. Countries may opt for deeper reserve coverage in accordance with their risk aversion, their concern regarding the duration of such sudden stop crises and their social costs, the possible need to stabilize the broad supply of money, their saving rates, and other country-specific factors.

accounting for recent hoarding of international reserves, although other factors may account for the rise in EMs' reserves/GDP ratios in past decades. Importantly, Rodrik (2006) notes the puzzle of why EMs and relatively poor developing countries do not rely more on policies curbing balance sheet exposure associated with external hard currency borrowing, instead of the costly hoarding for reserves.

In the aftermath of the EMs' crises in the late 1990s and the early 2000s, many of the EMs, whether they experienced a crisis or not, started rapidly increasing their international reserve holdings. Most notably, China's reserve accumulation, which lagged behind other Asian EMs during the 1990s, took off in the first part of the 2000s. In the mid-2000s, China became the largest holder, reaching an International reserves/GDP of about 48% before the GFC and surpassing Japan, which had been the largest, long-time international reserve holder. In 2006 China held \$3.8 trillion, about 30% of the world's total international reserve holdings. Among the top ten largest international reserve holders, five are East Asian economies, and accounted for about half of the world's total.

While Aizenman and Lee (2008) report evidence on the dominance of the precautionary motive in explaining international reserve accumulation during the 1990s, the trends of the 2000s were consistent with the growing importance of modern mercantilism, in which countries running growing trade surpluses may accumulate reserves in order to delay the onset of real appreciation. This may be explained as part of an export-led growth policy, aiming at benefiting from the "learning by doing" positive externality (Aizenman & Lee, 2008; Obstfeld et al., 2010). While this policy may be optimal for a country, it has potentially adverse implications on other countries that may be exposed to the "dis-learning by not doing" negative externality and raises concerns about possible "hoarding wars." Such perspectives suggest that China's massive hoarding of reserves is a hybrid of the mercantilist and self-insurance motives. Yet mercantilist hoarding by one country may induce competitive hoarding by other countries in order to preempt any competitive advantage gained by the first country, a reaction that would dissipate most competitiveness gains. This view is supported by the interdependence of the demand for international reserves among ten East Asian countries (Cheung and Qian (2009)).

Obstfeld, Shambaugh, and Taylor (2009) link the reserve-hoarding trend to several factors associated with the shifting positions in the Trilemma configuration since 1990. The first is the "fear of floating," manifested in the desire to tightly manage the exchange rate (or to keep fixing it). This desire reflects a hybrid of factors—to boost trade, to mitigate destabilizing balance sheet shocks in the presence of dollarized liabilities, to provide a transparent nominal anchor used to stabilize inflationary expectations, and so forth (Calvo & Reinhart, 2002; Klein & Shambaugh, 2006). The

second factor is the adoption of active policies to develop and increase the depth of domestic financial intermediation through a larger domestic banking and financial system relative to the GDP. The third factor complements the deepening of domestic financial intermediation with an increase in the financial integration of the developing country with international financial

The views linking the large increase in hoarding reserves to growing exposure to sudden stops associated with financial integration face a well-known contender in a modern incarnation of mercantilism, dubbed “Bretton Woods II” (Dooley, Folkerts-Landau, & Garber, 2003). According to this interpretation, reserve accumulation is a by-product of promoting exports, which is needed to create better jobs, thereby absorbing abundant labor in traditional sectors. Dooley et al argue that in the early 2000s, the international system was composed of the Core [USA] issuing the dominant international currency, the U.S. dollar, and a Periphery. The periphery was committed to export-led growth based on the maintenance of an undervalued exchange rate. The argument is that a system of pegged currencies—in which the periphery exports capital to the core, which serves an intermediary financial role—is both stable and desirable. Although intellectually intriguing, this interpretation remains debatable, as the history of Japan and Korea suggests the near-absence of mercantilist hoarding of international reserves during the phase of fast growth, and the prevalence of export promotion by preferential financing in targeted sectors. Floundering economic growth then led to the onset of large hoarding of reserves both in Japan and Korea, which was probably due to both mercantilist motives and self-insurance to deal with the growing fragility of the banking system.

International reserve management in the form of ‘leaning against the wind’ could also lower real exchange-rate volatility induced by terms of trade shocks. Done properly, this may augment macroeconomic management in turbulent times, thus mitigating the impact of external adverse shocks, allowing for a smoother current account adjustment, and reducing the adverse growth impacts of external shocks (Aghion, Bacchetta, Ranciere, & Rogoff, 2009; Aizenman & Riera-Crichton, 2008; Céspedes & Velasco, 2012; Ricci, Milesi-Ferreti, & Lee, 2013). Greater exposures of EMs and developing countries to sudden stops and reversals of hot money; growing trade openness; and the desire to improve competitiveness and reduce real exchange-rate volatility go a long way toward accounting for the observed increase in the rapid and massive stockpiling of international reserves by developing markets, even though the relative importance of these factors varies over time (Aizenman, Cheung, & Ito, 2015; Ghosh, Ostry, & Tsangarides, 2017).

4. Testing the modern version of the Trilemma: the open economy Quadrilemma

The post Bretton Woods era illustrated the lingering challenge of testing the modern manifestation of the Trilemma—in practice, most countries rarely face the binary choices articulated by the original Trilemma. Instead, countries chose the degree of financial integration and exchange rate flexibility. Even in rare cases of adoption of a strong version of a fixed-exchange rate system (like the currency-board regime chosen by Argentina in the early 1990s), the credibility of the fixed-exchange rate changes over time, and the central bank rarely follows the strict version of the currency board. Similarly, countries choosing a flexible exchange-rate regime, occasionally (sometimes frequently) actively intervene in foreign currency markets, resulting in the implementation of a discretionary managed float system. Furthermore, most countries operate in the gray range of partial financial integration, in which regulations restrict flows of funds. These added concerns about financial stability morphed the Trilemma into the Quadrilemma as previously discussed, adding another dimension to empirical tests of the modern Trilemma incarnation. Consequently, testing the predictions of the Trilemma paradigm remains a work in progress, as no unique way exists to define and measure the degree of exchange rate flexibility, monetary autonomy, and financial integration. Against this background, Aizenman, Chinn and Ito (2010, 2013) in a string of papers, aim at testing a generalized version of the Trilemma hypothesis. First, they construct continuous measures of the Trilemma, normalized between 0 and 1, the bipolar ends of the original Trilemma (see http://web.pdx.edu/~ito/Trilemma_indexes.htm for the data and the definition of these indices).

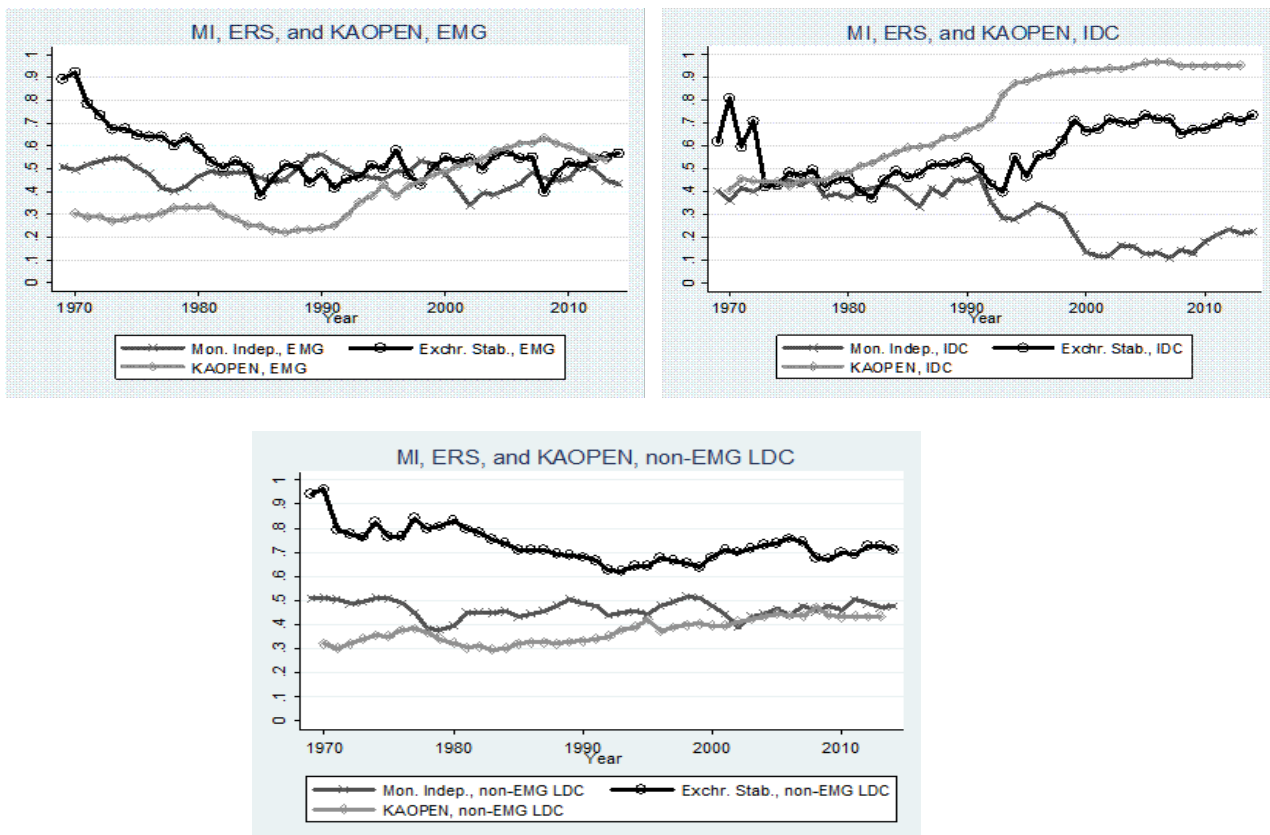
Figure 3 reports the changing patterns of the Trilemma during the post-Bretton Woods period for 181 countries from 1970 through 2014. Curves MI, ERS, and KAOPEN correspond to indexes of Monetary Independence, Exchange Rate Stability, and Capital Account Openness, respectively. The top left panel of Figure 3 reports the averages of these indices for EMs' economies. The trilemma curves began in 1970, at the end of the Bretton Woods System, with a high degree of exchange-rate stability and a low degree of financial integration, which provided a significant degree of monetary independence. Over the next 45 years, EMs converged to the trilemma middle ground, a process that intensified during the 1990s.

Specifically, over time, EMs adopted managed exchange-rate flexibility, underpinned by sizable holdings of international reserves and intermediate levels of monetary independence and financial integration. This choice has facilitated a better adjustment to shocks—EM economies with more converged policy choices tend to experience smaller output volatility (Aizenman and Ito

(2012)). Furthermore, EMs with relatively low international reserves/GDP could experience higher levels of output volatility when they choose a policy combination with a greater degree of policy divergence. This heightened output volatility effect does not apply to economies with relatively high international reserves/GDP holding. The results are consistent with the conjecture that the trilemma middle ground buffered by international reserves reduces the odds of financial crises triggered by policies aimed at greater exchange-rate stability. Greater weight on policies managing buffers may provide more policy space in the presence of shocks (in line with Rodrik and Velasco (1999); Aizenman and Riera-Crichton (2008)).

The top right panel in Figure 3 reports the average patterns of industrial countries in which the formation of the eurozone accounts for the rise in the average exchange-rate stability in the 1990s. The bottom panel reports the patterns for the average developing non-EM economies. These countries show no clear convergence patterns. Figure 3 vividly illustrates the heterogeneity across countries and time of trilemma configuration, as well as the commonality of several trends across groups of countries by their level of development.

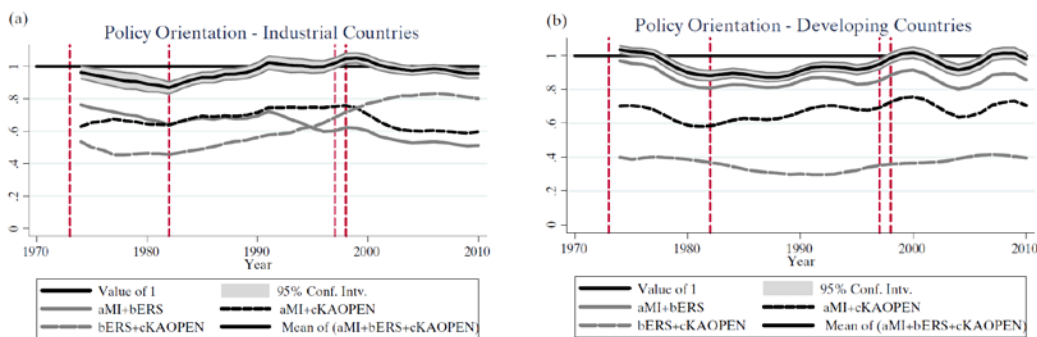
Figure 3: Global Trilemma Patters, 181 countries from 1970 through 2014;



Source: Aizenman, Chinn Ito Trilemma web page http://web.pdx.edu/~ito/Trilemma_indexes.htm
 Top left panel: EMs average patterns; Top Right Panel: Industrial Countries average patterns;
 Bottom Panel: Non-EMs less-developed countries patterns

The additive nature of the trilemma configuration was tested using a linear regression methodology, confirming that the weighted average of the three trilemma variables is almost a constant when the weights are positive (Aizenman, Chinn, and Ito (2013)). This result is in line with the conjecture that a rise in one trilemma policy variable is traded off by a drop in the sum of the other two policy variables (e.g., greater financial integration is associated with a lower weighted average of exchange-rate stability and monetary autonomy). This is illustrated in Figure 4 in which the top shaded curve indicates a 95% confidence interval for the weighted sum of the three trilemma variables, $aMI + bERS + cKAOPEN$,⁷ for the developing and industrial countries. This methodology has been applied, modified, and extended in several follow-up papers, corroborating the essence of the trilemma’s modern interpretation (Cortuk & Singh, 2011; Hutchison, Sengupta, & Singh, 2012; Popper, Mandilaras, & Bird, 2013)

Figure 4: The near additive property of the trilemma’s variables.



Notes: The vertical lines correspond to the candidate break years.

The shaded areas indicate the 95% confidence interval for $aMI + bERS + cKAOPEN$.

Testing the quadrilemma hypothesis, wherein the goal of financial stability is the fourth policy dimension, remains a work in progress. Unlike testing the trilemma, the quadrilemma hypothesis does not lend itself to an additive specification of policy goals. Increasing financial stability can be done through policies that reduce fragility, thereby mitigating exposure to a bad equilibrium outcome in the intermediate range of fundamentals, in which financial fragility is

⁷ The sum of the three Trilemma variables is hovering around the constant, though in several periods it dips significantly below the constant [see Aizenman, Chinn and Ito (2013) for further details and interpretations]. Though the overall fit of the linear trilemma regression is high, there is no theoretical presumption for the trilemma tradeoffs to be linear overtime, and vertical lines in Figure 4 correspond to the candidate break years.

associated with multiple equilibria. Fragility-reducing policies include a wide menu —hoarding international reserves, hard currency swap lines between central banks, prudential regulations aimed at better balance sheet controls, improving the quality of institutions dealing with monitoring and mitigating financial fragility, and policies improving fiscal space needed to support backstop mechanisms, among others.

An informative proxy for financial instability is the frequency and depth of crises. Yet these financial instability statistics reflect the interaction of the shocks, policies, and factors determining the efficacy of the chosen policies. Considering these factors, testing the quadrilemma may proceed by studying the association between financial instability and policies, as well as controlling for the trilemma policy choices, structural factors and shocks accounting for the ultimate impact of policies on financial stability. Earlier examples of such tests have concluded that that countries with higher reserves/short-term debt ratios are less prone to financial crashes (Rodrik and Velasco (1999)). Studying hoarding reserves in the context of the quadrilemma, Aizenman and Ito (2012) and Aizenman Chinn and Ito (2008, 2013) found that voluminous international reserve holdings allows countries to pursue both a higher level of exchange-rate stability and a higher weighted average of the other two trilemma policies through active foreign exchange interventions. Thereby, high levels of international reserves/short-term debt holding may allow countries to choose a policy combination from a wider range of spectrum of policy combinations, thereby relaxing the trilemma constraints.

Similar logic may apply for macro-prudential regulations. Results from Aizenman, Chinn, and Ito (2017) suggest that macro-prudential policies (MPP) allow EMs to regain policy space for several quarters, thus retaining more monetary independence from the center economies when EMs are the net recipients of capital. This effect is more valuable for fragile economies that are characterized by current account deficits, thereby relying more on capital inflows to meet their financing needs. It is noteworthy that what makes MPP different from conventional capital controls is that MPP are aimed at mitigating balance sheet exposure associated with short-term debt flows, while typical capital controls are blunt instruments that focus more on affecting capital flows and less on mitigating such exposures.

5. Quadrilemma, Trilemma, or Dilemma?

Rey (2015) provides an alternative take on the trilemma, concluding that the economic center's monetary policy influences other countries' national monetary policy. This happens mostly through capital flows, credit growth, and bank leverages, making the types of exchange-rate regime of the non-centers irrelevant. In other words, the non-center countries are all exposed to a “global

financial cycle” irrespective of their exchange-rate regimes. Thereby, the “trilemma” is reduced to an “irreconcilable duo” of monetary independence and capital mobility—that is, “dilemma not trilemma.” Consequently, restricting capital mobility maybe the only way for non-center countries to retain monetary autonomy. Rey’s research concluded that key determinants of the global financial cycle are U.S. policies that strongly affected the leverage of global banks, capital flows, and credit growth in the international financial system. Whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of the exchange-rate regime. While her focus was on the US dollar, all reserve currencies can potentially play this role.

The follow-up literature propagated by Rey’s intriguing “dilemma not trilemma” hypothesis paints a mixed and nuanced view of Rey’s conjecture. Mundell’s trilemma does not argue that countries can insulate themselves from global shocks propagated by large countries. A valid interpretation of Mundell’s (1963) concerns trade-offs and mitigations. Well before the GFC it was widely known that size matters, and that the flexible exchange rate is not a panacea: among n currencies, at most only $n - 1$ are independent (De Grauwe, 1996). In particular, the size of the U.S. matters because the country’s financial size well exceeds its global GDP share. Rey’s findings about the prominent role of shocks propagated from the U.S. before and after the GFC also reflect the large role played by dollar exposure in the balance sheet of countries at times of very low policy interest rates in most OECD countries.

Another methodological concern challenging all the Trilemma empirical literature is that the empirical research is bounded by historical data. To illustrate, had Brazil been under a fixed-exchange rate regime during the turbulent 2010s decade, it would had gone probably a balance of payment crisis, aka collapsing exchange rate (Ghosh, Ostry, & Qureshi, 2015; Reinhart & Rogoff, 2004). Without controlling for this counterfactual, econometric inference about the relevance of the exchange rate regime is limited and should be taken with a grain of salt. These views are in line with Bernanke Mundell-Fleming 2015 lecture at the International Monetary Fund, which put Rey’s conjecture in the context of the evolving debate on the global financial structure (Bernanke, 2017).

A possible avenue to test the viability of the trilemma in the twenty-first century is to verify the degree to which exchange-rate regimes significantly impact the transmissions of shocks from financial center economies. Taking this perspective, Aizenman, Chinn, and Ito (2016) examine how the movements in the center economies—the U.S., Japan, the Eurozone, and China—affect the Trilemma choices and financial conditions of developing and EM countries (dubbed peripheral countries). In 2000s-2010s, the strength of the links with the center economies have been the dominant factor. The movements of the policy interest rate also appear sensitive to global financial

shocks around the EMs' crises of the late 1990s and since the 2008 GFC. The exchange rate regime and financial openness are found to have a direct influence on the sensitivity to the center economies. The weights of major currencies, external debt, and currency debt compositions are significant factors. More specifically, having a higher weight on the dollar (or the euro) makes the response of financial variables more sensitive to a change in key variables in the U.S. (or the euro area, respectively), such as policy interest rates, exchange rate market pressure, and the real exchange rate. Thus, the degree of exchange rate flexibility continues to affect the sensitivity of developing countries to policy changes and shocks in the center economies.

An insightful analysis by Klein and Shambaugh (2015) studies whether partial capital controls and limited exchange-rate flexibility allow for full monetary policy autonomy. They find that partial capital controls do not generally allow for greater monetary control more than open capital accounts, unless capital controls are quite extensive. However, a moderate amount of exchange rate flexibility does allow for some degree of monetary autonomy, especially in emerging and developing economies. Empirically, they observe that while some countries have long-standing, pervasive capital controls, a substantial subset of countries use limited controls on an episodic basis. Their results are in line with Klein (2012), who classified capital control of these regimes into "walls" and "gates," respectively, and shows that walls are more effective than gates in limiting asset price booms and swings in the value of the real exchange rate. In addition, in any given year, there is a wide range of scope with which capital controls are employed, generating an extensive middle ground between open and closed capital markets.

Obstfeld, Ostry, and Qureshi (2017) find that countries with fixed exchange-rate regimes are more likely to experience financial vulnerabilities—faster domestic credit and house price growth, and increases in bank leverage—than those with relatively flexible regimes. The transmission of global financial shocks is likewise magnified under fixed exchange-rate regimes relative to more flexible (though not necessarily fully flexible) regimes. The authors attribute this to both reduced monetary policy autonomy and a greater sensitivity of capital flows to changes in global conditions under fixed rate regimes. Bekaert and Mehler (2017) propose a measure of de-facto financial market integration based on a factor model of monthly equity returns. They find evidence consistent with the Trilemma and inconsistent with the Dilemma hypothesis both throughout history and for recent decades. That is, non-U.S. central banks still exert more control over domestic interest rates in economies open to global finance when their exchange rates are flexible.

Cerutti, Claessens, Rose (2017) quantify the importance of a Global Financial Cycle for capital flows, using capital flow data dis-aggregated by direction and type between 1990-2015 for 85

countries. They report that most variation in capital flows does not seem to be the result of common shocks nor stem from observables in a central country like the United States. Han and Wei (2018) highlighted asymmetric trilemma-dilemma patterns, finding evidence supporting a hypothesis that is between a trilemma and a dilemma. Without capital controls, a flexible exchange-rate regime offers some monetary policy autonomy when the center country tightens its monetary policy, yet fails to do so when the center country lowers its interest rate. Capital controls help to insulate periphery countries from monetary policy shocks from the center country even when the latter lowers its interest rate.

6. Financial stability, swap lines and macro-prudential policies

The GFC and the subsequent eurozone crisis validated that no country is immune from exposure to costly financial instability. However, countries with more mature institutions, and deeper fiscal capabilities, may gain resilience and stability by activating bilateral swaps lines among their central banks. Access to such swap lines may substitute the need to manage costly international reserves buffers. This scenario was vividly illustrated by the willingness of the U.S. Fed to activate practically unlimited swap lines between the Fed and key OECD central banks during the GFC, thus providing the banks with elastic access to dollar liquidity needed to deal with their balance sheet exposure to the dollar. While the benefits of these arrangements are apparent, they hinge on the willingness to activate them, as well as the presence of a fiscal backstop mechanism that addresses the morally hazardous aspects of such insurance.

The unprecedented extension of these swap lines by the U.S. Fed is in line with Gourinchas and Rey (2007) and Gourinchas, Rey, and Govillot (2010)'s insightful *exorbitant privilege and exorbitant duty* interpretation of the role of the U.S. dollar. Accordingly, the center country of the international monetary system enjoys an "exorbitant privilege" that significantly weakens its external constraint. This is reflected in the sizeable excess return of U.S. gross assets over gross liabilities in past decades. In exchange for this "exorbitant privilege," the authors document that the U.S. provides insurance to the rest of the world, especially in times of global stress. This "exorbitant duty" is the other side of the coin. During the 2007–2009 GFC, payments from the U.S. to the rest of the world amounted to 19% of U.S. GDP.

The willingness of the U.S. Fed to extend the swap lines to key OECD countries is also in line with the view that the dollar shortage experienced by the eurozone and several other OECD countries during the GFC put them in the position of "too big and too costly to fail" from the U.S. perspective. Accordingly, U.S. Fed swap lines prevented a massive banking crisis in these countries

that would have cost the U.S. economy dearly. This is in line with Keynes' view on debt: "If you owe your bank manager a thousand pounds, you are at his mercy. If you owe him a million pounds, he is at your mercy." This logic also explains the high selectivity of the U.S. Fed in providing unprecedented access to 30 billion U.S. dollar swap lines to four selected EMs: Brazil, Mexico, South Korea, and Singapore. Aizenman and Pasricha (2010) reported evidence that exposure of U.S. banks to EMs turned out to be the most important selection criterion for explaining these "selected four" swap lines. Of these countries, only Mexico and South Korea activated their swap lines in a limited way. Observers credit the Fed's willingness to extend the swap lines to stopping the financial panic in South Korea from triggering a massive banking crisis during the GFC (Obstfeld et al., 2009; Park, 2011).

Looking ahead, although the benefits of swap line arrangements are clear, they hinge on the presence and credibility of their fiscal backstop mechanisms. The selectivity of the swap lines extended during the GFC suggests that only countries with significant trade and financial linkages can expect access to such ad hoc arrangements on a case-by-case basis. Moral hazard concerns suggest that the applicability of these arrangements to EMs will probably remain limited, and there is no end in sight for the hoarding of reserves by such EMs.⁸

The sudden stop crises of 1990 have been preceded by some form of peg, in line with the trilemma view that exchange-rate stability and independent monetary policy are incompatible with financial integration. Korea and Mexico are prime examples of these concerns during the 1990s (see Ghosh et al. (2014)).⁹ Yet, the experience of Korea and Mexico during and after the GFC illustrates that exchange-rate flexibility buffered with large stock of international reserves does not insulate countries from financial instability associated with balance sheet exposure due to hard currency external borrowing. This explains the post-GFC trend of greater application of macro-prudential regulations. Indeed, Rodrik's 2006 perceptive observation on potential gains from curbing

⁸ Common criticism of sizable hoarding of international reserves pointed out two issues. First, the large opportunity costs of hoarding reserves induced Alfaro & Kanczuk (2009) to conclude that the optimal size of reserves is zero. Second, the tendency of countries to refrain from using such reserves aggressively at times of peril, dubbed as "the fear of using reserves," raises questions about the logic of investing in costly insurance that is not fully activated in perilous times. The Bocola and Lorenzoni (2017) model discussed in Section 2 provides insightful interpretation and explanation of these issues.

⁹ This result is in line with Calvo and Mendoza (1996), who conclude that under a high degree of capital mobility and financial globalization, shifts in foreign capital flows and anticipation of a banking-system bailout may produce large imbalances between stocks of financial assets and foreign reserves, threatening the sustainability of currency pegs.

hard currency external borrowing was validated by a greater willingness after the GFC to apply macro-prudential regulations aimed at mitigating external borrowing in hard currency.

Bruno and Shin (2014a, 2014b) provide a framework linking capital flows, the exchange rate, and domestic bank leverage, as well as a case study of the impact of macro-prudential regulations in South Korea. First, they formulate a model of the international banking system in which global banks interact with local banks, highlighting the bank leverage cycle as the determinant of the transmission of financial conditions across borders through banking sector capital flows. They show conditions under which local currency appreciation is associated with higher leverage of the banking sector, thereby providing a clear link between exchange rates and financial stability. In a panel study of 46 countries, they find support for key predictions of their model. They then focus on South Korea, a country that serves as a bell-weather for financial exposure. In recognition of the sources of Korea's vulnerabilities, since June 2010, South Korea has introduced a series of macro-prudential measures aimed at building resilience against external financial shocks, especially against the country's well-known vulnerability to capital flow reversals in the banking sector and the associated disruptions to domestic financial conditions. Relative to a comparative group of countries, Bruno and Shin find that the sensitivity of capital flows into South Korea to global conditions decreased in the period following the introduction of macro-prudential policies.

7. **Concluding remarks**

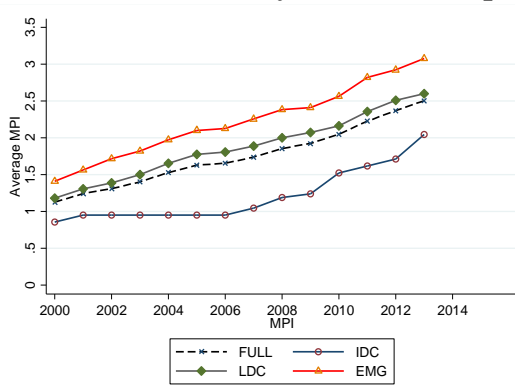
Mundell's trilemma retains its validity for the twenty-first century when it is adjusted for the evolving macro-economic challenges, as well as for the new menu of policy targets and instruments. The key developments of recent decades have included the emergence of financial stability as a new policy target in the era of growing financial integration, thereby modifying the trilemma into the quadrilemma. Unlike the original trilemma, in which Mundell-Fleming's model provides a clear link between policy goals and economic regimes, financial stability may require a complex set of policy tools in order to reduce financial fragility. This reflects the nature of financial fragility, which deals with exposure to multiple equilibria associated with maturity and currency mismatches, and the quality and credibility of backstop mechanisms needed to stabilize speculative runs in bad times. Thus, no configuration of the trilemma (or the quadrilemma) fits all countries at all times. OECD countries with good institutions may deal with financial instability associated with financial integration by maintaining enduring hard currency swap lines among their central banks and upgrading their banking supervision. In contrast, developing countries with limited fiscal and financial capacities are typically exposed less to hot money inflows and may opt for more stringent

capital controls.

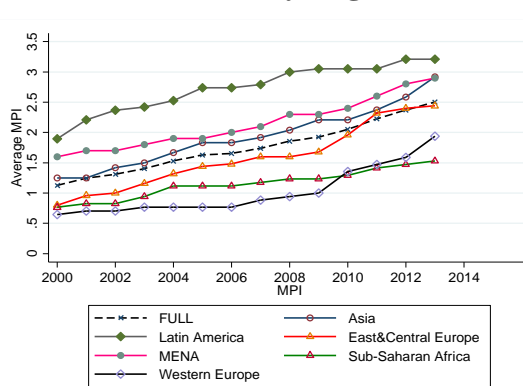
The challenges of dealing with financial instability in the context of the trilemma are more complex for EMs. The sudden stop crises of 1990s vividly showed that a key trilemma prediction holds: greater financial integration is incompatible with exchange-rate stability and pro-active monetary policy. After experiencing sudden stop and capital flight crises Mexico, Korea, Brazil, Russia, and other EMs switched towards greater exchange-rate flexibility, which was buffered and managed by sizable stock of international reserves. Yet, the GFC illustrated that managing buffers such as international reserves does not suffice to prevent financial instability, inducing EMs to supplement buffers with macro-prudential regulations.¹⁰ Figure 5 reports the extensity of applying macro-prudential regulations as summarized by the MPI, the Macro Prudential Index. It clearly shows a higher usage of macro-prudential regulations in the GFC aftermath, and that EMs rely more heavily on such policy tools than the OECD countries. A large regional heterogeneity also exists, in which Latin American countries use macro-prudential policies more intensely than other regions.

Figure 5: Macro prudential regulation extensity Index

(a): MPI by Income Groups



(b) MPI by Regions



Notes: MPI measures the *extensity* of macroprudential policies, using Cerutti et al., (2015) data. See Aizenman, Chinn and Ito (2017) for further details.

The research reviewed in this paper supports the notion that, on average, accomplishing more a given trilemma policy goal is traded-off with reducing the odds of achieving the other policy goals,

¹⁰ Mexico and South Korea are the bellwether countries illustrating this trend. Both were severely impacted by the sudden stops of the 1990s. Although they adopted a managed exchange rate and deeper buffers, they were again exposed to financial instability during the GFC, which tested their backstop capabilities. Both benefited from the provision of the Fed’s swap lines, however, there is no reason to presume that swap lines will be provided to them in the future. Both countries intensified their use of macro-prudential regulations after the GFC.

and that lower financial fragility may improve the trilemma trade-offs. The details of these trade-offs are country- and time-specific, impacted by the country's balance sheet exposure to key hard currencies (dollar, euro, and so forth.), and the exchange-rate regime. During turbulent times, OECD countries rely frequently on activating large swap line arrangements among their central banks. In contrast, most EMs have found that concerns about their sovereign risk and moral hazard have prevented them from benefiting from swap arrangements. Thereby, one expects that EMs will continue to rely on precautionary buffers, such as international reserves and sovereign wealth funds. The greater use of macro-prudential regulations may mitigate the inflows of foreign hot money in "good times," thereby reducing the buffers needed to deal with exposure to lurking capital flight crises, and increasing the scope of monetary independence. Understanding the factors determining these policies' efficacy in reducing the costs of financial instability remains a vibrant future research agenda.

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