PRAMERICA FIXED INCOME

Perspectives

September 2013

Jürgen Odenius, PhD
Chief Economist, Head of Global Macroeconomic Research

Arvind Rajan, PhD
Managing Director, International Chief Investment Officer

Central Bank FX Reserve Adequacy

A Historical Perspective

First In A Three Part Series

Overview

As global foreign exchange (FX) reserves more than quadrupled over the past decade to about $11 trillion, central banks embarked on reserve diversification, mainly to enhance yield. Initial diversification efforts, however, were interrupted by an abrupt flight to safety amidst the 2008-09 global financial crisis. Since then, FX reserves have resumed their growth and yields continued their trend decline, at least until concerns about Federal Reserve ("Fed") tapering emerged in May 2013.

Against this backdrop, we conduct an analysis of central bank FX reserve adequacy and management practices. In this paper, the first in a series of three, we review the evolution of key concepts assessing the adequacy of FX reserves. We find that, despite nearly a decade-long history of economic thought, there is yet no comprehensive measure of FX reserve adequacy. Instead, there are loosely-based but widely accepted guidelines that tend to underpin FX reserve management practices.

Our second paper will explore the adequacy of FX reserves in emerging markets, having absorbed approximately three quarters of the increase of global FX reserves over the past decade. Nevertheless, as Fed tapering is expected to begin and global liquidity is likely to recede, we conduct FX reserve stress tests for most of the countries included in the Emerging Market Bond Index.

The third paper in our series will focus on FX reserve management practices. Specifically, it will consider alternatives for maximizing returns on FX reserves while preserving capital and liquidity.

Early Concepts of International Reserve Adequacy

Economist John Maynard Keynes' perspective is largely informed by themes that remain central to today's policy debate. These include deepening international financial integration, increasing external trade linkages, and destabilizing current account imbalances. Keynes' notion is predominantly one of "external drain" of FX reserves that could result from the aforementioned vulnerabilities.[1]

Concerns over these vulnerabilities culminated at the 1944 Bretton Woods Monetary Conference with Keynes' call for an International Clearing Union (ICU). His proposal was designed to address the risks stemming from global imbalances—the coexistence of large external surpluses in some countries, and offsetting external deficits in others. These imbalances created considerable pressure on FX reserves in deficit countries,

1. *Obstfeld et al. (2009) emphasize that Keynes was largely focused on external vulnerabilities, cited in Keynes 1971, pp. 247-248.*

while spurring rapid reserve accumulation in surplus countries. Although these phenomena were well understood to jeopardize macroeconomic and financial stability, Keynes' ICU proposal was rejected. In particular, the United States, the largest creditor country at that time, was adamantly opposed to the economic sanctions it would have faced for its large-scale external surplus under Keynes' proposal.[2] Nevertheless, the Bretton Woods conference did agree to establish the gold exchange standard, which pegged the currencies of signatory countries against the U.S. dollar. The U.S. dollar in turn, was pegged to gold at $35 per ounce, thus indirectly pegging all currencies to gold. Given the prevalence of capital controls, the perspective on reserve adequacy in the post-war era was heavily informed by trade-related external imbalances.

Following in the direction of Keynes, in 2001 Wijnholds and Kapteyn illustrated that the International Monetary Fund (IMF) increasingly shifted to external trade in its assessment of reserve adequacy.[3] Specifically, discussions at the IMF tended to focus on the appropriate import coverage of reserves. Eventually, these crystallized into the widely used rule of thumb that FX coverage should not fall below a level of three months worth of imports in order to safeguard against external drain of FX reserves.

Regardless of the dominance of the external drain concept, there was nevertheless an early recognition of the risks stemming from *domestic* drain to FX reserves. Economist Henry Thornton was credited by Maurice Obstfeld with spearheading this insight in 1939, thus laying the intellectual foundation for the notion of twin banking and foreign exchange crises, which gained prominence some 50 years after Thornton first explored it.[4]

Reserve Adequacy After the Demise of the Bretton Woods System

With the demise of the Bretton Woods system in the early 1970s, most large industrial countries decided to abandon their dollar pegs. This shift to freely floating or managed currencies was paralleled by far-reaching capital account liberalization. The increasing reliance on market forces to determine exchange rates was perceived as reducing risks of external drain. As a result, interest in the topic of international reserve adequacy waned.

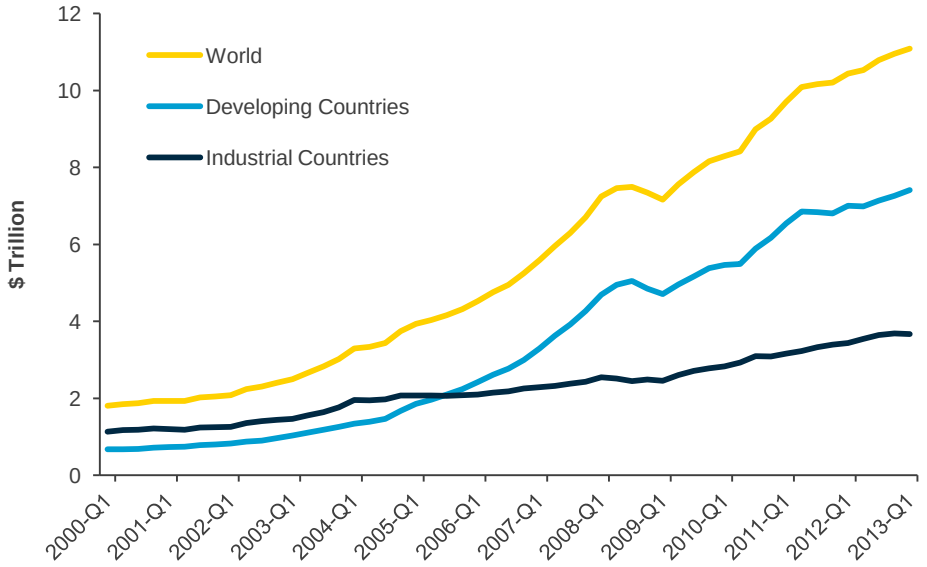
Currency flexibility, combined with financial market access on a large scale, meant that both liquidity needs and funding constraints had eased markedly for large developed economies. However, the experience in emerging markets was considerably different—in Latin America the debt crisis of the 1980s had increased the sensitivity of reserve demand to external deficits and trade openness.[5]

Globalization and Financial Crises

Globalization, in part spurred by the dramatic policy changes in the 1970s and 1980s, had the unintended consequence of triggering sweeping and frequent financial crises. Some of the better known ones include Mexico (1995), East Asia (1997), Russia (1998), Turkey (1994 and 2001), Brazil (1999), and Argentina (2002). These crises ushered in an apparent paradigm shift. International FX reserve accumulation took hold in the mid-1990s and has accelerated since, notwithstanding the global financial crisis in 2008. By end-March 2013, gross reserves in emerging markets reached U.S. $7.4 trillion, a seven-fold increase over the past decade.

2. *The ICU would have issued its own currency, the "bancor," against which the currency of each signatory country was to be pegged. The ICU would provide overdraft facilities to countries based on the relative size of external trade. Upon exhaustion of these facilities, deficit countries would have been obliged to devalue their exchange rate and would have been charged interest. Surplus countries would have been obliged to revalue their currencies, and would have faced considerable financial penalties.*
3. *Wijnholds and Kapteyn (2001).*
4. *Obstfeld et al. (2009) pp.111-112. Thornton (1939).*
5. *Lizondo and Mathieson (1987).*

GLOBAL FX RESERVES SURPASSED $11 TRILLION BY END-MARCH 2013



Source: IMF IFS. Global FX Reserve Growth chart as of March 2013.

The rapid and large build up of reserves is often seen as an attempt by countries to "self-insure" against the risk of a financial crisis as well as to forestall FX appreciation. In 1999, noted economist Martin Feldstein concluded that neither the IMF nor a new international financial architecture would make the world less dangerous. Countries needed to rely on self-protection. He concluded that self-insurance required more than just avoiding bad policies "that make a currency crisis inevitable, for the threat of contagion makes even the virtuous vulnerable to a currency run." [6]

External Drain and the Guidotti-Greenspan Rule

In the wake of the Asian crisis of 1997, the debate on international reserve adequacy shifted in the 2000s with Feldstein's *self-help* concept and Calvo and Reinhart's labeling of capital account crises as "sudden stops." Reserve adequacy needed to be viewed in a broader context—one that would take into account vulnerabilities emanating not only from the *current* account, but from the *capital* account which had previously not been the case.

Initial steps to broaden the concept of international reserve adequacy were in line with Keynes' concern about external drain. In 2001, Wijnholds and Kapteyn noted that following the onset of the Korean crisis, the IMF Executive Board discussed a broader measure of reserve adequacy that would reflect short-term foreign borrowing. This measure would later become known as the Guidotti-Greenspan rule,[7] which prescribed that countries should hold FX reserves equal to their foreign liabilities coming due within the next year. This concept was grounded in the experience of the Asian crisis where, in 1997, FX reserves were insufficient to cover short-term external debt in Indonesia, Thailand, and Korea. Only in Malaysia did FX reserves exceed short-term external liabilities.

However, it is not clear whether the Guidotti-Greenspan rule drove reserve accumulation. A cross-country study performed by the IMF in 2011 concluded that there was little evidence that short-term external debt was a relevant, exclusive indicator to determine the appropriate level of FX reserves. Earlier, in 2006, Jeanne and Rancière, two IMF economists, found that the rapid build-up of international reserves after the financial crisis in Asia exceeded the levels needed to insure against sudden stops. The obvious motivation was the desire by reserve accumulators to avoid currency appreciation.

6. *Feldstein (1999)*
7. *Obstfeld et al (2009)*

Alternative International Reserve Adequacy Concepts Based on Double Drain

In a widely cited 2009 paper, Maurice Obstfeld built on Thornton's notion of a double drain, observing that many balance of payments crises coincide with banking crises. He noted that the external drain—from current account deficits or sudden stops of refinancing flows—could coincide with domestic drain in the form of capital flight. To illustrate this point, he recollected that in just a few weeks, capital flight drained about one eighth of broad money from the banking sector during the 1995 crisis in Argentina. Based on econometric evidence, he concluded: "Reserve adequacy should be judged relative to M2." Building on Thornton's views, both economists appear to favor monetary aggregates to inform international reserve adequacy metrics.

This perspective was supported by other influential economists, including Dani Rodrik, who pointed out that the rapid increase of FX reserves serves to restore the backing of broad money that prevailed during the 1970s, prior to capital account liberalization.[8] Further, in an argument not dissimilar from Obstfeld, economist Charles Wyplosz argued that total external liabilities—and not just short-term debt—should be considered when assessing capital account risks and related precautionary reserve accumulation.[9]

Other Potential Drivers of Reserve Accumulation

The self-insurance hypothesis view was challenged in 2003 by Dooley, et al. These authors argued that large FX reserve accumulation, especially in China, was to be seen as a consequence of export promotion designed to bolster GDP growth and enhance labor absorption. Under such a policy, FX reserve accumulation would be seen as necessary to slow currency appreciation. However, in 2007, Aizenman and Lee found little empirical support for this mercantalist view. According to their econometric specification, the variables associated with this view are statistically significant. Nevertheless, their economic importance is dwarfed by other variables, including trade openness and susceptibility to a potential financial crisis, that are found to drive hoarding of FX reserves.

In 2007 Wyplosz conceded that the prima-facie evidence points to likely undervaluation of the exchange rate during the earlier stages of development in Japan, Korea, and more recently, in Argentina and China. However, he delivered a spirited argument that such a strategy would result in real appreciation and thus would not be sustainable. Separately, in a paper authored in 2000, Calvo and Reinhart questioned the apparent shift to broader exchange rate flexibility. Examining the exchange rates under regimes declared as floating, they found that volatility was relatively limited. They therefore inferred that many of the currencies that are designated as floating are not floating freely in practice. This observation provides another alternative explanation for continued reserve accumulation, given the need for FX market intervention to absorb pressures on the currency.

IMF "Combination Measure"

In 2011, the IMF proposed a new measure for reserve adequacy based on experiences with prominent emerging market crises and the major drains on FX reserves. Such crises include Russia in 1998 where it was predominantly capital flight, Indonesia in 1997, where it was the non-resident sales of equities, and in Brazil in 2002 where it was lower export earnings. These were in addition to other (non-specific) outflows.

In turn, the IMF constructed a new, two-step measure for reserve adequacy. In the first step, a distribution was estimated for each one of these four FX reserve draining variables mentioned above. From these estimated distributions, the Fund derived probabilities at a ten-percentile level. For example, the IMF found that, at the tenth percentile of the cohort, FX pressures were associated with a 7.1 percent decline in broad money resulting from capital

8. *Rodrik (2006)*
9. *Wyplosz (2007)*

flight in countries with floating exchange rates. For each country in the sample, the overall loss of FX reserves was estimated as the sum of the drain resulting from each one of these four variables (at the tenth-percentile level).

Given this metric, in a second step, the IMF considered the adequate level of FX reserves needed to adequately "insure" against possible FX reserve losses. The paper concluded that FX reserves should range between 100-150 percent of this metric to ensure FX reserve adequacy in a "typical" country. However, the paper conceded that, short of any reliable methodology, this policy recommendation was largely based on judgment, as is the case with the standard measures of FX reserve adequacy discussed above.

Cost of Holding FX Reserves

Holding large FX reserves tends to involve considerable financial costs. Countries with structural current account deficits often borrow abroad to fund these deficits and, therefore, bolster FX reserve holdings. However, the cost of borrowing tends to exceed investment returns, given the typically high-liquidity and low-risk characteristics of FX reserve assets. This negative carry spread constitutes the cost of holding FX reserves.

In the following discussion, economist Dani Rodrik (2006) illustrates the costs associated with FX reserves:

> *"Consider a country that lives by the Guidotti-Greenspan-IMF rule. Suppose a domestic private firm or bank takes a short-term loan from abroad of $1 million. The Central Bank now has to increase its reserves by an equivalent amount. The usual strategy that the Central Bank will follow is (a) to purchase foreign currency in domestic financial markets to invest in U.S. government or other foreign short-term securities and (b) to sterilize the effects of its intervention on the money supply by selling domestic government bonds to the private sector. When all these transactions are completed, the domestic private sector ends up holding $1 million of domestic government bonds balancing its foreign liability of $1 million, while the Central Bank has $1 million more in foreign assets and $1 million less in domestic government bonds.*
>
> *Three consequences are noteworthy. First, the application of the Guidotti-Greenspan-IMF rule implies that, even when the process is initiated by borrowing from abroad, the home economy ends up with no net resource transfer from abroad. The increase in the private sector's foreign liability matches the increase in the Central Bank's foreign assets. Second, short-term borrowing abroad does not enhance the private sector's overall capacity to invest. This is because the private sector ends up holding additional government securities equal in magnitude to its borrowing abroad. And third, aggregating the domestic private and public balance sheets, the net effect is that the economy has borrowed short term abroad (at the domestic private sector's cost of foreign borrowing) and has invested the proceeds in short-term foreign assets."*

Rodrik estimates that these costs are significant and could be about 1 percent of GDP. He therefore considers the continued rapid increase in FX reserves as "astonishing," given that most countries refrained from capital controls to curtail foreign borrowing.

Conclusions

The concept of FX reserve adequacy has been considered and written about since the late 1930s, and possibly earlier. The prevailing concepts are typically grounded in the notions of external drain and double drain first introduced by Keynes and Thornton, respectively. Nevertheless, the empirical evidence provides little comfort that any of the standard FX adequacy concepts are guiding today's central bank behavior and FX reserve management.

As a result, there are still no "hard and fast" or comprehensive measures of FX rerserve adequacy to be gleaned from the literature and central bank practices. Instead of attempting to establish such a measure, our forthcoming second paper develops stress tests of FX reserve adequacy across the emerging markets. These tests are designed to identify countries with FX reserve holdings that are large enough to withstand a sudden stop or other prominent shocks. Given prevalent concerns that Fed tapering may usher in a withdrawal of global central bank liquidity, these stress tests are intended to provide a timely input into risk analysis and conservative portfolio management.

REFERENCES

Aizenman, Joshua, and Jaewoo Lee, 2007, "International Reserves: Precautionary Versus Mercantilist Views, Theory and Evidence," *Open Economies Review*, Vol. 18, Pp. 191−214.

Calvo, Guillermo, and Carmen Reinhart, (2000a), "Fear of Floating," NBER Working Paper No. 7993.

Calvo, Guillermo, and Carmen Reinhart, (2000b), "When Capital Flows Come to a Sudden stop: Consequences and Policy," in "Reforming the International Monetary and Financial System," edited by P.B. Kenen and A.K. Swoboda, International Monetary Fund, Washington D.C.

Dooley, M., D., Folkerts-Landau and P. Garber, 2003, "An Essay on the Revived Bretton

Woods System," NBER Working Paper No. 9971, (Cambridge, Massachusetts:

National Bureau of Economic Research).

Feldstein, Martin, 1999, "A Self-Help Guide for Emerging Markets," Foreign Affairs, March-April 1999.

IMF 2011, "Assessing Reserve Adequacy," prepared by Monetary and Capital Markets, Research, and Strategy, Policy, and Review Departments.

Jeanne, O. and R. Rancière, 2006, "The Optimal Level of Reserves For Emerging Markets: Formulas and Applications," IMF Working Paper 06/229, International Monetary Fund, Washington.

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

Keynes, John Maynard, 1971, "A Treatise on Money, Volume 2: The Applied Theory of Money," in The Collected Writings of John Maynard Keynes, Volume VI. London: Macmillan (for the Royal Economic Society).

Lizondo, J.S. and D.J. Mathieson (1987), "The Stability of the Demand for International Reserves," Journal of International Money and Finance, Vol. 6 (September), pp. 251-282.

Obstfeld, Maurice, Jay C. Shambaugh and Alan M. Taylor, 2008, "Financial Stability, The Trilemma, and International Reserves," NBER Working Paper No. 14217.

Rodrick, Dani, 2006, "The Social Costs of Foreign Exchange Reserves," International Economic Journal, 20 (3), 253-266.

Thornton, Henry, 1939, "An Enquiry into the Nature and Effects of the Paper Credit of Great Britain." Edited with an introduction by F. A. von Hayek, London, George Allen and Unwin.

Wijnholds, Onno de Beaufort and Arend Kapteyn, 2001, "Reserve Adequacy in Emerging Market Economies," IMF Working Paper 01/143 (Washington: International Monetary Fund).

Wyplosz, Charles, 2007, "The Foreign Exchange Reserves Buildup: Business as Usual?" Workshop on Debt, Finance and Emerging Issues in Financial Integration, Commonwealth Secretariat, London, UK.

NOTICE

Pramerica Investment Management is a trading name of Prudential Investment Management, Inc., the principal asset management business of Prudential Financial, Inc. ("Pramerica Financial"). Pramerica Investment Management is an indirect subsidiary of Pramerica Financial, a company incorporated and with its principal place of business in the United States. Pramerica Investment Management is an investment adviser registered with the U.S. Securities and Exchange Commission. Pramerica Fixed Income is Pramerica Investment Management's largest public fixed income asset management unit. Prudential Financial, Inc. is not affiliated in any manner with Prudential plc, a company incorporated in the United Kingdom. In the United Kingdom, all Pramerica Fixed Income regulated activities are carried out by representatives of Pramerica Investment Management Limited ("PIML"), an indirect subsidiary of Pramerica Investment Management, which is authorised and regulated by the Financial Conduct Authority (FCA #193418) of the United Kingdom, and duly passported in various jurisdictions in the European Economic Area. Pramerica, the Pramerica logo, and the Rock symbol are service marks of Prudential Financial, Inc. and its related entities, registered in many jurisdictions worldwide.

These materials represent the views, opinions and recommendations of the author(s) regarding the economic conditions, asset classes, securities, issuers or financial instruments referenced herein. Distribution of this information to any person other than the person to whom it was originally delivered and to such person's advisers is unauthorized, and any reproduction of these materials, in whole or in part, or the divulgence of any of the contents hereof, without prior consent of Pramerica Fixed Income is prohibited. Certain information contained herein has been obtained from sources that Pramerica Fixed Income believes to be reliable as of the date presented; however, Pramerica Fixed Income cannot guarantee the accuracy of such information, assure its completeness, or warrant such information will not be changed. The information contained herein is current as of the date of issuance (or such earlier date as referenced herein) and is subject to change without notice. Pramerica Fixed Income has no obligation to update any or all of such information; nor do we make any express or implied warranties or representations as to the completeness or accuracy or accept responsibility for errors. **These materials are not intended as an offer or solicitation with respect to the purchase or sale of any security or other financial instrument or any investment management services and should not be used as the basis for any investment decision. Past performance is not a guarantee or a reliable indicator of future results.** No liability whatsoever is accepted for any loss (whether direct, indirect, or consequential) that may arise from any use of the information contained in or derived from this report. Pramerica Fixed Income and its affiliates may make investment decisions that are inconsistent with the recommendations or views expressed herein, including for proprietary accounts of Pramerica Fixed Income or its affiliates.

The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients or prospects. No determination has been made regarding the suitability of any securities, financial instruments or strategies for particular clients or prospects. For any securities or financial instruments mentioned herein, the recipient(s) of this report must make its own independent decisions.

Conflicts of Interest: Pramerica Fixed Income and its affiliates may have investment advisory or other business relationships with the issuers of securities referenced herein. Pramerica Fixed Income and its affiliates, officers, directors and employees may from time to time have long or short positions in and buy or sell securities or financial instruments referenced herein. Pramerica Fixed Income affiliates may develop and publish research that is independent of, and different than, the recommendations contained herein. Pramerica Fixed Income personnel other than the author(s), such as sales, marketing and trading personnel, may provide oral or written market commentary or ideas to Pramerica Fixed Income's clients or prospects or proprietary investment ideas that differ from the views expressed herein. Additional information regarding actual and potential conflicts of interest is available in Part 2 of Pramerica Investment Management's Form ADV.

2013-2149

Pramerica