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Click the icon below to read Part I
of the three part series on FX
Reserve Adequacy.



Central Bank FX Reserve Adequacy

FX Reserve Adequacy in the Emerging Markets

Second of a Three Part Series

Overview

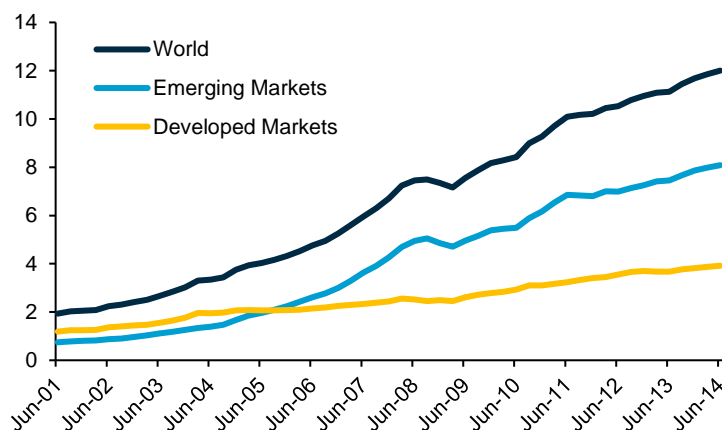
Global foreign exchange (FX) reserves have almost quadrupled over the past decade to \$12 trillion by the end of June, 2014. With more than three quarters of this build up having been absorbed by the emerging markets (EMs), this paper—the second in a series of three—assesses the adequacy of FX reserves across a large and investable universe of EMs.

Building on our earlier paper, we apply key metrics to assess the adequacy of FX reserves. Not surprisingly, after more than a decade-long build up, these metrics indicate that FX reserve holdings are at least adequate in most EMs and more than sufficient in several noteworthy cases. More interestingly, stress tests are devised to simulate three distinct shocks and their impact on FX reserves. In particular, these tests simulate exports shocks, a bank run, and a sudden stop.

With Fed liquidity injections nearing their inevitable end, at least for now, a possible renewed “taper tantrum” and resulting sudden stops pose plausible risks at this juncture. However, our stress tests indicate that many EMs are well positioned to withstand considerable shocks to their FX reserve holdings. Among the positive outliers, Peru, Lebanon, Uruguay, the Philippines, Russia and China rank highly, while Venezuela, the Ukraine, Panama and Argentina rank at the bottom end of the spectrum.

The third paper in our series will discuss alternatives for maximising returns on FX reserves while preserving capital and liquidity.

GLOBAL FX RESERVES (\$Tns) As of 30 June 2014



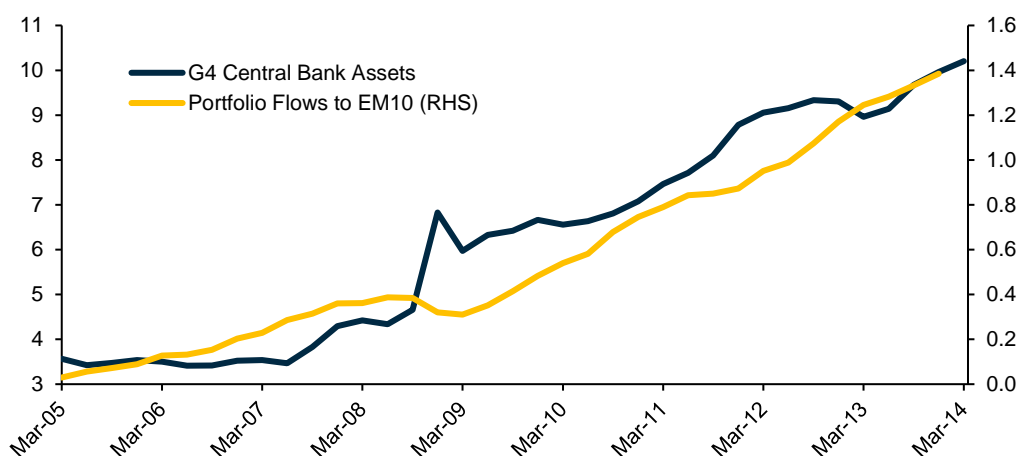
Source: Haver, IMF COFER, and Pramerica Fixed Income.

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Global FX Reserves in the Emerging Markets

Global FX reserves have almost quadrupled over the past decade and reached yet another record high of \$12 trillion by the end of June, 2014. As shown in the chart on the page above, this build up was primarily driven by the emerging markets (EMs), which absorbed \$6.7 trillion of the \$8.6 trillion increase in global FX reserves over the past decade. More recently, these increases were stoked in large part by quantitative easing from the major central banks. In fact, as illustrated in the chart below, portfolio flows to ten of the largest EMs have been closely correlated with the expansion of balance sheets of the central banks in the euro area, Japan, the US and the UK. The EMs therefore seem vulnerable to an unwinding of unorthodox monetary policies and the potential capital outflows that such policy normalisation may eventually trigger.

**CENTRAL BANK
ASSETS vs
EM PORTFOLIO
FLOWS (\$Tns)
As of 31 March 2014**



Source: Haver, IIF, and Pramerica Fixed Income.

Against this background, this paper assesses the adequacy of FX reserves in the EMs. The analysis focuses on the 25 largest constituents of JP Morgan's Emerging Market Bond Index.¹ As we noted in our first paper², the issue of International Reserve Adequacy has received considerable attention in economic literature for nearly a century. However, a comprehensive model prescribing adequate levels for international FX reserves remains yet to be developed. Consequently, practitioners still tend to rely on several simple measures, notwithstanding their inherent limitations.

- **Import coverage ratio.** The import coverage ratio measures the months of imports that could be funded by FX reserves. Import coverage of three months is considered minimal, while six months coverage is deemed comfortable. This measure dates back to the Breton Woods era, when FX demand was largely driven by imports, given the prevalence of fixed exchange rate regimes and capital controls at the time.
- **M2 coverage ratio.** This ratio measures the share of FX reserves in broad money. It is grounded in the experience that financial crises tend to spur currency runs and capital flight. A coverage ratio ranging between 15 to 20 percent is generally deemed sufficient.
- **Short-term debt coverage ratio.** This multiple divides FX reserves by short-term foreign debt. The so-called Guidotti-Greenspan rule suggests FX reserves holdings cover at least 100 percent of short-term debt. In other words, all short-term debts could be repaid out of FX reserves, if a sudden stop persisted for up to one year.

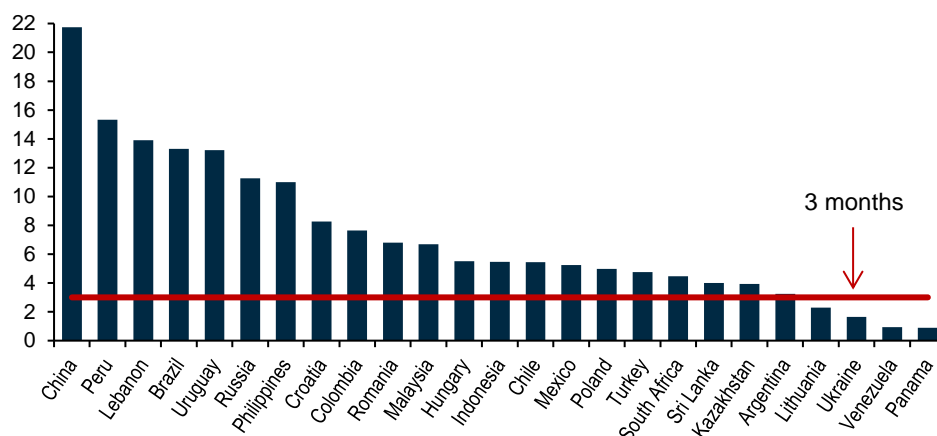
In a first step, we apply these metrics to gauge FX reserve adequacy across 25 EMs, as illustrated in the charts below.

¹ The analysis however is available for more than fifty index constituents.

² Jurgen Odenius and Arvind Rajan "Central Bank FX Reserve Adequacy—A Historical Perspective," September 2013.

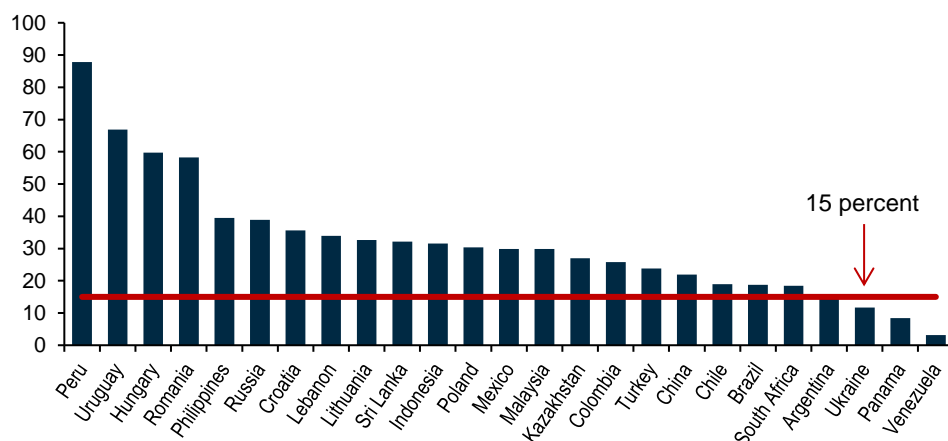
International Reserve Adequacy in Major Emerging Markets

FX RESERVES IN MONTHS OF IMPORTS As of 30 June 2014



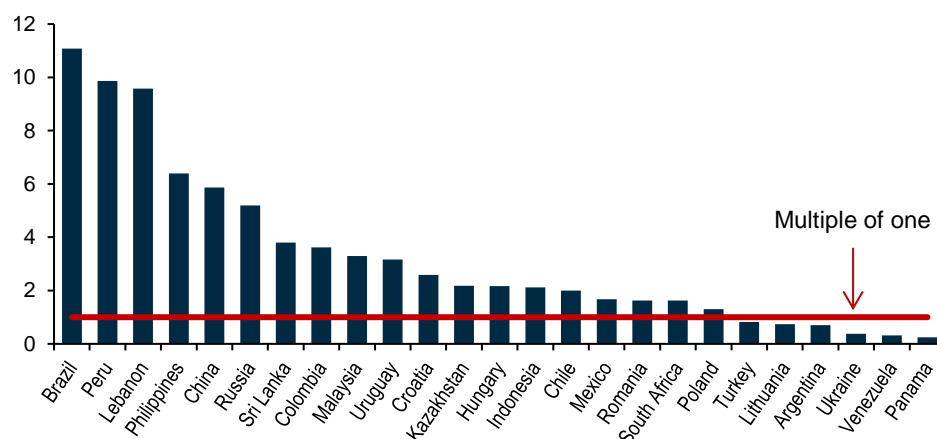
Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

FX RESERVES IN PERCENT OF BROAD MONEY As of 30 June 2014



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

FX RESERVES TO SHORT-TERM DEBT MULTIPLE As of 30 June 2014



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

Based on these simple metrics, FX reserves holdings are solid across most of the EMs in the sample. In fact, the import coverage ratio is less than three months only in three out of twenty-five countries and the FX reserve coverage is less than 15 percent of broad money in only three cases, but the short-term debt coverage falls short of 100 percent in six cases. Prima facie, a sudden stop would therefore weigh more broadly on FX reserves across the EMs than possible trade shocks or bank runs, although such events would be detrimental in their own right.

At the bottom end of the scale, there is a high concentration of outliers. Only the Ukraine, Panama and Venezuela fail to meet all three adequacy tests. Lithuania, which is on its way to joining the euro area in 2015, Argentina, and Turkey fail one or two criteria. In contrast, the group of strong performers is quite diverse.

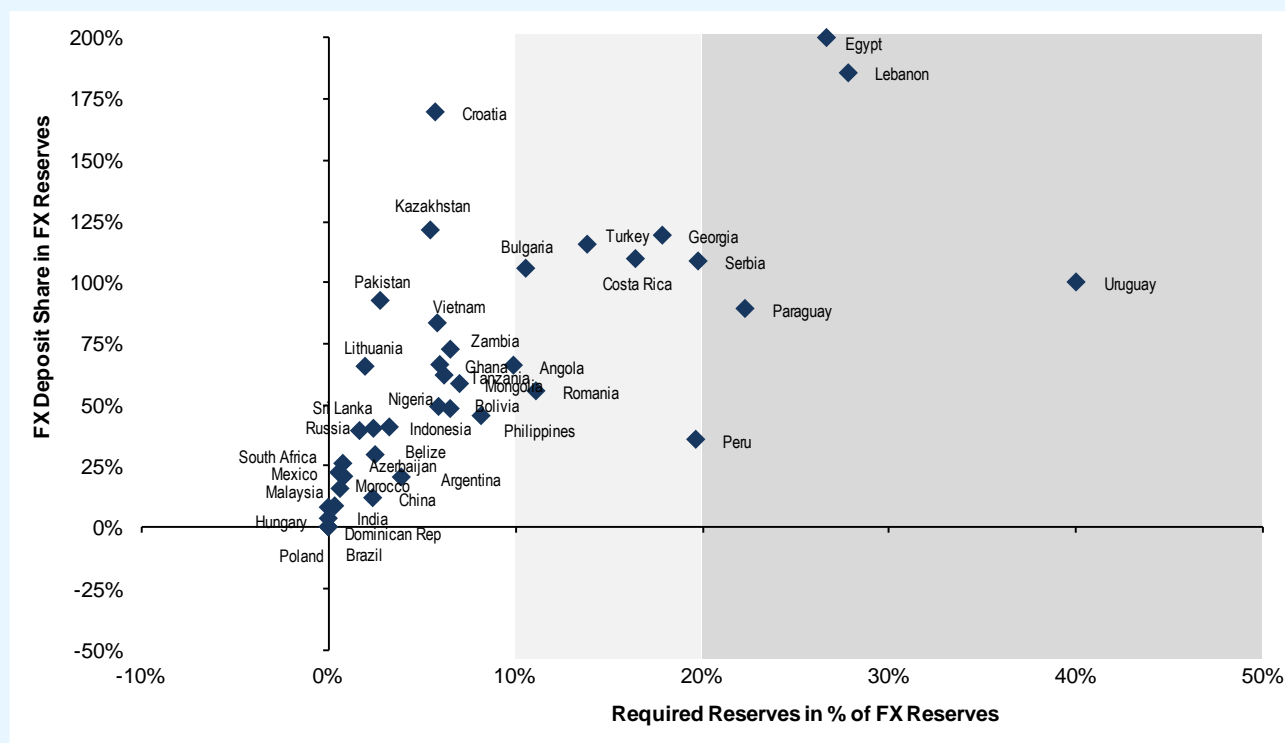
- With an import-coverage ratio of nearly 22 months, China's FX reserve coverage by far exceeds that of all other countries according to this metric. The FX reserve coverage of short-term debt is also strong (almost six times), in large part reflecting capital account restrictions. However, indicative of its high domestic leverage, FX reserve coverage of broad money is just adequate.
- Alongside China, Brazil's FX reserve metrics are strong overall. Its import coverage (13 months) is high, and the coverage of short-term debt is exceptional. However, just as in China, Brazil's coverage of broad money is merely adequate amidst considerable domestic leverage, although distinctly lower than in China.
- Peru is the only country that ranks first or second across all three criteria, and Russia ranks sixth or better across all three criteria.
- The strong results for Peru, Lebanon, and Uruguay are in part an artifact of dollarisation. High foreign currency deposits in the banking system bolster official FX reserves to the extent that central banks impose reserve requirements on FX deposits. The impact of dollarisation is discussed in more detail in the following highlighted section.

DOLLARISATION AND FX RESERVE ADEQUACY

Dollarisation has long been recognised as a symptom of pervasive macroeconomic instability. Reflecting on hyperinflation in post-World War I Europe, as reported by Bernholz (2002), the League of Nations concluded that "...Gresham's Law was reversed: good money tended to drive out bad, and not the other way round..." Despite typically much improved macro policies, dollarisation remains pronounced in parts of Latin America, the Caribbean, and Eastern and Southern Europe.

The chart below assesses the extent of dollarisation and its impact on official FX reserves. Central banks tend to impose reserve requirements on the banking system, including on deposits denominated in foreign currency. Since these required reserves are surrendered to the central bank in foreign currency, they boost official FX reserves. However, these reserves may not be deemed freely available, especially if central banks are concerned that these funds will ultimately need to be returned to domestic depositors.

As can be seen in the following chart, FX deposits in the banking system tend to be quite large in comparison to FX reserves, but only in exceptional cases do the required reserves contribute a significant share to FX reserves. In particular, in Uruguay, Lebanon, Egypt, Paraguay, Peru, Serbia, and Georgia, reserve requirements on FX denominated deposits contribute 20% or more to gross official FX reserves. For the majority of countries, however, they contribute no more than 5% to FX reserves. Given this finding, the analysis in this paper is based on reported FX reserves net of gold, but the data are not adjusted for the impact of dollarisation on FX reserves.



Stress Testing FX Reserve Adequacy

This section simulates the impact of three types of shocks on official FX reserves. First, an export shock that slows the inflow of FX reserves while imports continue to drain reserves. The highlighted section on the next page discusses the experience with export shocks during the financial crisis. Second, a run on banks and a flight to safety, which ends up converting a substantial share of the local currency into US dollars, thereby draining FX reserves. Third, in a sudden stop, foreign lenders do not rollover all of the short-term debt that is falling due. The resulting repayments fuel demand for dollars and drain FX reserves.

The severity of these shocks are varied from “mild,” to “severe” and “extreme.” As illustrated in the table below, in the severe scenario, countries suffer export losses that are comparable to the 2008-2009 crisis; experience a bank run that drains 15 percent of broad money; or suffer a sudden stop that limits rollover financing to 50 percent of short-term debt.

FX Reserve Stress Test Scenarios and Parameters

	Mild	Severe	Extreme
Export Shock: Multiple of 2008-2009 Loss	0.5	1.0	1.5
Bank Run: M2 Drain	10%	15%	20%
Sudden Stop: Roll-over Ratio of Short-term Debt	80%	50%	0%

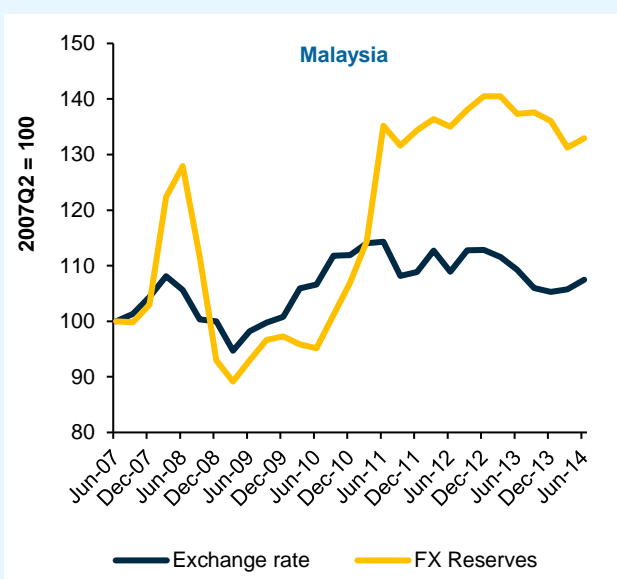
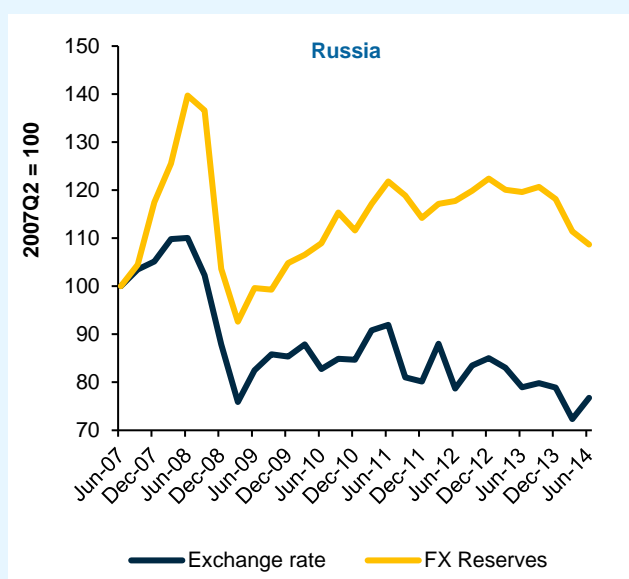
Source: Pramerica Fixed Income.

THE IMPACT OF THE 2008–2009 FINANCIAL CRISIS ON FX RESERVES

Among its many adverse consequences, the 2008–2009 financial crises caused a synchronised global output and trade shock. However, the impact of this shock on external trade was not uniform across countries. The peak-to-trough declines in export revenues were particularly pronounced among oil exporters, especially Russia and Algeria, given their high oil dependence.

Nevertheless, apart from several notable cases, the overall impact on FX reserves holdings was surprisingly limited. Dominguez (2011) observes: “...it is puzzling that the government policy tool that was particularly designed for crisis management, foreign reserves, seems not to have been widely used, even by those countries which had built up high levels of pre-crisis reserve stocks.” Aizenman and Sun (2010) consider whether the “fear of floating” gave way to the “fear of losing international reserves.” They found that about half of the emerging markets in their sample actively used their FX reserves, mainly those countries characterised by a high degree of openness to external trade. Obstfeld et al. (2009) suggested that the reliance on swap lines limited the “visible” impact on reserves of FX interventions. These lines were substantial in the case of Mexico and Hungary, but were largely symbolic in the case of Brazil, South Korea, and Singapore, given large FX reserve holdings of these countries at the beginning of the crisis.

Russia and Malaysia: FX Reserves and Nominal Exchange Rates



The policy response to the trade shock was a key determinant of the impact of the crisis on FX reserves, especially in countries with fixed or “dirty-floating” exchange rate regimes. FX market interventions in support of the domestic currency resulted in considerable declines in FX reserves, especially in Malaysia and Russia, while FX reserve losses in Turkey and Brazil were less pronounced, at least compared to their pre-crisis levels.

Source: Haver, IMF, and Pramerica Fixed Income. As of 30 June 2014.

For each of these three scenarios, the table on the next page indicates the number of countries that still meet FX reserve adequacy criteria after a potentially considerable loss of FX reserves resulting from an initial shock.

- In case of a mild export shock, the import coverage ratio in 19 of the 25 sample countries would still be three months or higher. In addition to the countries that fail to meet the import coverage criterion prior to the stress test—namely Panama, Venezuela, Ukraine, and Lithuania—the FX reserve drain resulting from the shock in the case of Argentina and Kazakhstan would be sufficient to lower their reserve holdings to below the prescribed minimum import coverage. Interestingly, the severity of the export shock matters most to exporters with highly concentrated exports. In particular, as the shock increases from mild to extreme, the export coverage ratio drops considerably for large oil exporters, including Russia, Kazakhstan and Venezuela.

- However, as indicated by the off-diagonal entries, the impact of a bank run would be more pronounced. Only 15 countries would meet the import-coverage criterion in case of a mild bank run. In contrast, 20 countries would still meet the import coverage criterion, in case of a mild sudden stop. Moreover, countries with relatively high short-term debt are exhibiting a high variance in their export coverage ratio, depending on the severity and length of the sudden stop, including Turkey, Argentina and Ukraine.
- Indicative of overall solid FX reserve adequacy across the sample, 15 countries would still meet the import coverage criterion after a severe export shock. In case of an extreme shock, 10 countries would still meet the criterion. As discussed earlier, countries with high leverage are relatively more susceptible to a bank run. First and foremost, China and Brazil experience a sharp drop in their FX reserve coverage, as the severity of the bank run increases. However, Lebanon and some others also exhibit some heightened sensitivity in this regard.

FX Reserve Stress Test: Number of Countries Fulfilling Reserve Adequacy Criteria Post Shock

Nature of Shock	Shocks	Import Coverage Ratio >3 Months	Short-Term Debt Coverage Ratio >100%	M2 Coverage Ratio >15%
Mild	Export shock	19	17	18
	Sudden stop	20	19	21
	Bank run	15	16	16
Severe	Export shock	15	15	18
	Sudden stop	19	18	17
	Bank run	11	14	12
Extreme	Export shock	10	12	11
	Sudden stop	10	14	14
	Bank run	8	10	7

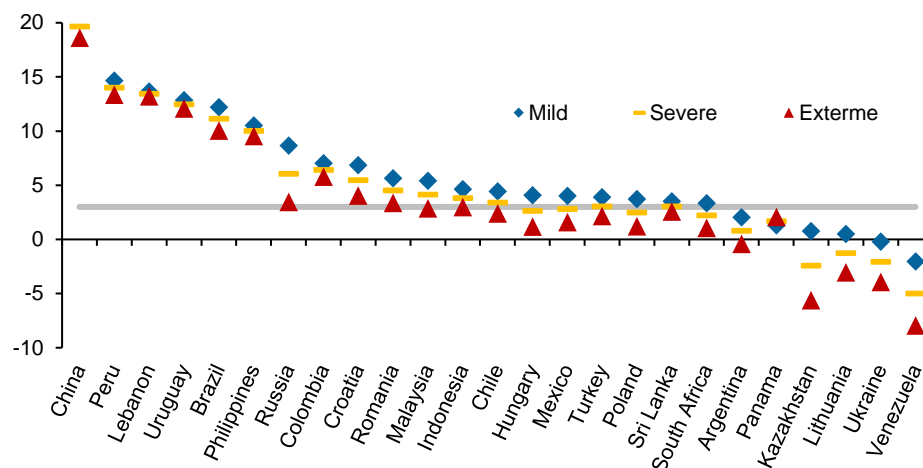
Source: Pramerica Fixed Income.

Moreover, multiple shocks could coincide. It is conceivable, although unlikely, that a global financial crisis could spur simultaneous bank runs, sudden stops, and export shocks. Assuming that each one of these shocks is severe, the post-shock FX reserves still meet all three adequacy criteria in the following four countries: Peru, Philippines, Lebanon and Uruguay.

Stress Test Results: FX Reserves After Shock

FX RESERVES IN MONTHS OF IMPORTS UNDER EXPORT SHOCK

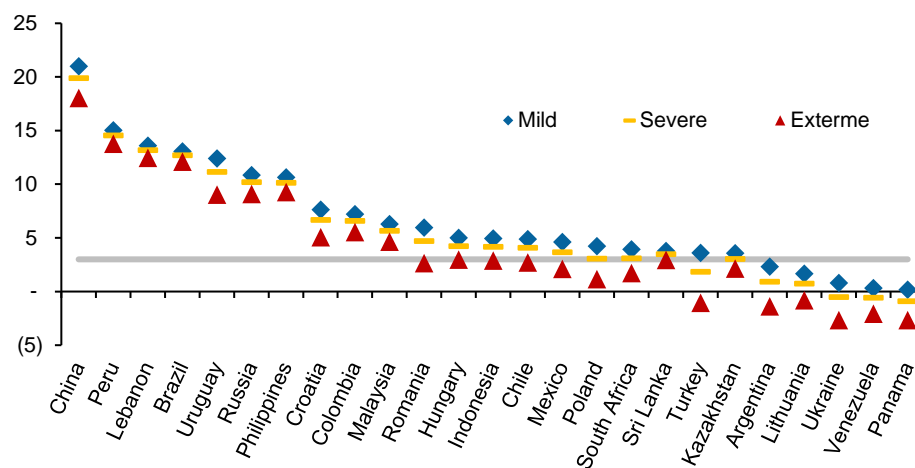
As of 31 March 2014



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

FX RESERVES IN MONTHS OF IMPORTS UNDER SUDDEN STOP

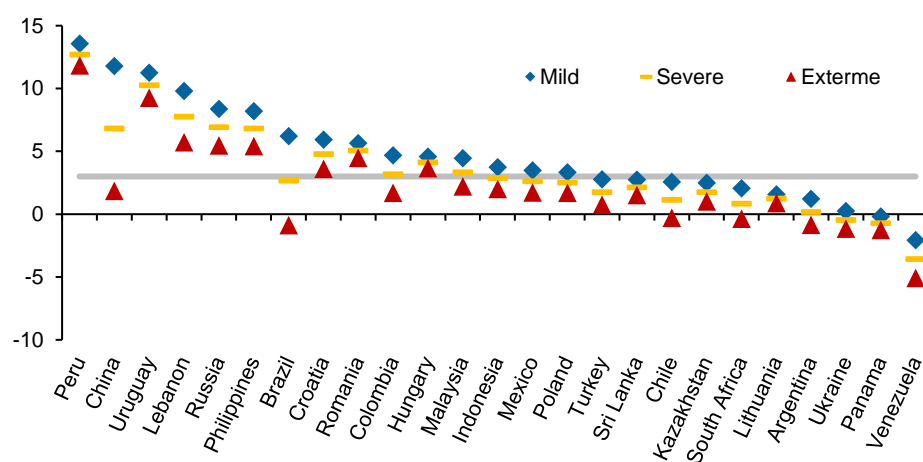
As of 31 March 2014



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

FX RESERVES IN MONTHS OF IMPORTS UNDER BANK RUN

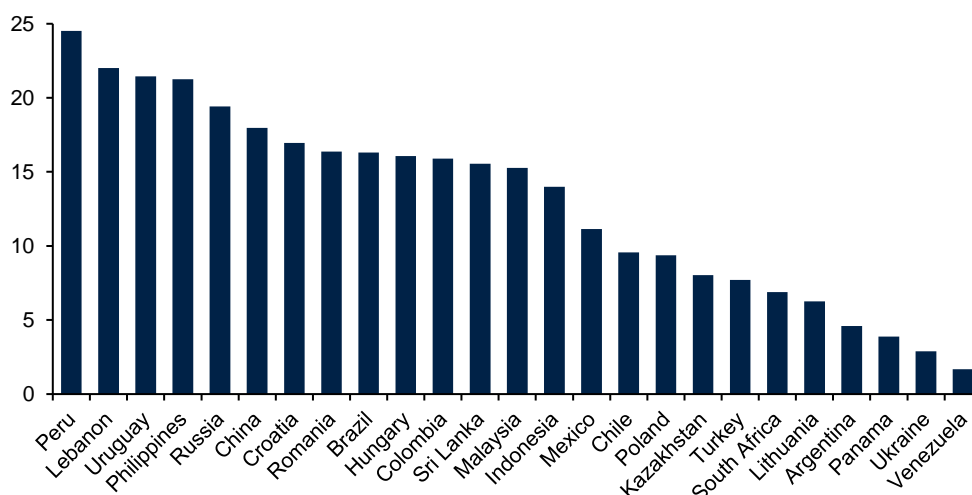
As of 31 March 2014



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

As a useful summary statistic, we construct a rank to measure the strength of FX reserves post stress test. Every country in the sample is subjected to three shocks (and the shocks are varied mild, severe, extreme). The reserve coverage resulting from these shocks is used to rank countries. A country's rank is determined by calculating the average over the three shocks. If a country is ranked consistently highest, its rank is 25; if it is consistently ranked lowest, its rank would be 1.

**FX RESERVE
COVERAGE RANKING-
POST STRESS
(HIGHEST = 25)
As of 30 June 2014**



Source: Haver, IMF IFS, BIS, and Pramerica Fixed Income.

The results are illustrated in the chart above. Peru, Lebanon, and Uruguay rank highest. All three of these countries are highly dollarised, as discussed previously in “DOLLARISATION AND FX RESERVE ADEQUACY” on page 5. However, even when adjusting their FX reserves for dollarisation (by subtracting from FX reserves banks' required reserves on dollar deposits), these countries still rank highly.³ It is interesting that China ranks on par with Russia, in large part reflecting its high leverage and risks to FX reserves stemming from a potential bank run. Similarly, Brazil ranks closer to the middle of the spectrum, also reflecting risks of a potential bank run. FX reserves in Turkey and South Africa are weak, while those of Argentina, Panama, Ukraine, and Venezuela rank at the bottom of the spectrum.

The simulations for a sudden stop—which could ensue as a result of a sudden halt of central bank liquidity injections—are illustrated in the following table. In particular, the Ukraine, Venezuela, and Panama would run out of FX reserves, in case of a severe sudden stop that would limit refinancing and would allow to rollover only half of short-term external debt. In the case of an extreme shock that would prevent the rollover of the entire stock of short-term debt, Argentina, Lithuania and Turkey would run out of FX reserves as well, while the FX reserves of Mexico, Poland, and South Africa would seem low.

³ Adjusting FX reserves of countries with a share of 10 percent or more of bank's required reserves in FX reserves shows that Peru would still rank first, Lebanon would move from 2nd to 4th rank; Uruguay 3rd to 6th rank; Romania 8th to 13th; Turkey 19th to 21; and the Ukraine would remain at rank 24.

Stress Test: FX Reserves in Months of Imports After A Sudden Stop

	Mild	Severe	Extreme
China	21.0	19.9	18.0
Peru	15.0	14.5	13.8
Lebanon	13.6	13.2	12.4
Brazil	13.1	12.7	12.1
Uruguay	12.4	11.1	9.0
Russia	10.8	10.2	9.1
Philippines	10.6	10.1	9.3
Croatia	7.6	6.7	5.1
Colombia	7.2	6.6	5.5
Malaysia	6.3	5.7	4.7
Romania	6.0	4.7	2.6
Hungary	5.0	4.2	3.0
Indonesia	4.9	4.2	2.9
Chile	4.9	4.1	2.7
Mexico	4.6	3.7	2.1
Poland	4.2	3.1	1.2
South Africa	3.9	3.1	1.7
Sri Lanka	3.8	3.5	2.9
Turkey	3.6	1.9	-1.0
Kazakhstan	3.6	3.0	2.1
Argentina	2.3	0.9	-1.4
Lithuania	1.7	0.7	-0.8
Ukraine	0.8	-0.5	-2.7
Venezuela	0.3	-0.6	-2.1
Panama	0.2	-0.9	-2.7

Source: Pramerica Fixed Income.

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