



# Central bank foreign currency reserves management

## White paper series

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#### **Abstract**

Central banks with large foreign currency positions have increasingly come under financial pressure as they face diminished or negative returns on traditional reserve assets. In emerging market central banks, foreign currency reserves typically dominate central bank balance sheets and are invested in conservative asset classes—short duration USD, EUR and JPY government bonds. The low returns on these assets over the past several years have depleted income and capital and current yields, many in negative territory, do not bode better for the future. Some central banks have taken the opportunity of stronger reserves positions to seek to improve risk-adjusted returns potential through diversification and extending investment horizons. As high-grade government bonds with negative yields may not meet capital preservation requirements, the focus on portfolio diversification has taken on more urgency.

This white paper approaches this topic from the somewhat atypical intersect between macroeconomics and portfolio management and argues for greater differentiation in central banks' investment strategies based on reserves adequacy considerations rather than short-term accounting concerns. Over the past 15 years, global reserves more than quadrupled and the level of reserves today represents 15% of GDP on average with the level in some countries exceeding GDP.<sup>1</sup> Such large pools of foreign currency assets have the potential to generate significant income but the return objective has typically been treated as a residual in formulating the strategic asset allocation. Foreign currency reserves portfolios are typically constrained by highly restrictive guidelines and risk limits, which can reflect historical antecedents or perceived political constraints rather than actual market risk tolerances. By basing the investment horizon on reserves adequacy considerations, central banks with ample reserves can seek to generate higher investment returns to build reserves buffers during good times, enhance financial stability and contribute positively to national income.

## I. Shifting foreign currency reserve dynamics

The state and practice of central bank reserves management has undergone a sea-change from 2000-2015. During the second half of the 20th century, countries generally pegged their exchange rate to the USD or a currency basket. Central bank reserves were held to defend a system of fixed exchange rates, which periodically came under pressure due to unsustainable external deficits and, at times, speculative attacks. During this period, virtually all of a country's reserves could be called upon to defend the currency regime at any time. Consequently, the bulk of reserves were held in risk-free assets denominated in the currency or currency basket underpinning the peg.

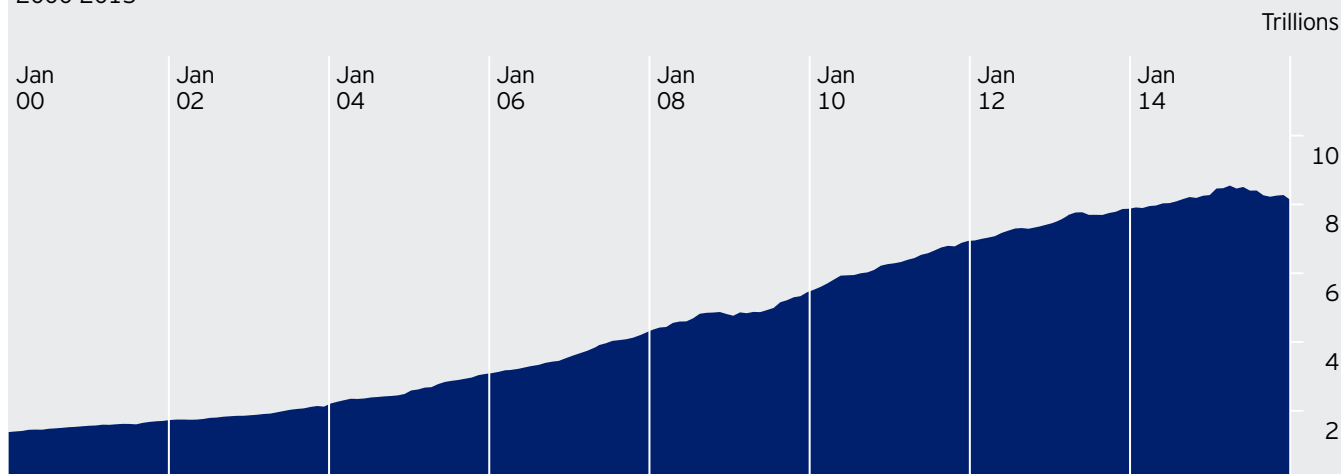
Since 2000, several factors have contributed to a broadening spectrum of reserves management practices so that today reserves management ranges from short-term liquidity management to multi-asset class investment portfolios. This evolution can be attributed to changes in the role and level of central bank reserves, central bankers' level of portfolio management expertise and, most recently, global trade and market developments.

The most striking change over the past 15 years has been the outright increase in foreign currency reserves, which more than quadrupled to \$8.3 trillion as of the third quarter of 2015.<sup>2</sup> (See Figure 1) While this increase is often ascribed to a deliberate building of precautionary reserves, in many instances, the increase was simply the by-product of export-oriented growth strategies, the commodity super-boom and better management of revenues from natural resources. With the reversal of the commodity super-boom, oil producing

countries have drawn down on sovereign wealth funds (SWF) for domestic budgetary support, resulting, in the first instance, in a transfer of foreign currency balances from the SWF to central bank reserves. While a few vulnerable countries have lost substantial reserves, global reserves have remained fairly constant despite external shocks, reflecting a general trend towards more flexibility in the execution of exchange rate policy (see Appendix).

The strengthening of reserves positions over this period can be seen not only in levels but also with respect to reserves adequacy, a measure of external financial vulnerability. Following the emerging market crises of the 1990's, governments sought to reduce external vulnerability by improving financial sector management. Reserves adequacy levels improved as governments reduced their reliance on foreign borrowing, developed domestic capital markets, limited domestic banks' open foreign currency positions and made headway in protecting the value of the currency through fighting inflation. Today, in the face of the rising USD, emerging market concerns are more focused on the rapid increase in open foreign currency positions in the corporate sector rather than at the national balance sheet level. And, as authorities increasingly question the wisdom of spending reserves to defend a currency peg, pressure on the balance of payments has generally had more of an impact on the level of the exchange rate rather than reserves. Despite record capital outflows from emerging markets in 2015, emerging market reserves declined by only 2% if one excludes China and Saudi Arabia, both of which lost substantial reserves defending a target currency rate.<sup>2</sup>

Figure 1  
Increase in global foreign currency reserves  
2000-2015



Data: IMF International Financial Statistics (IFS): Central Bank Foreign currency reserves in USD, ex-SDR and Gold. As at 31 December 2015.

In theory, this metric would suggest a reallocation of about \$750bn into RMB assets. In practice however, the actual level is likely to be much less. Global reserves today have remained overweighted to the USD relative to its trade weight, due to its importance as an invoice currency, role in global finance and depth of its capital markets.

Central banks seek to hold sufficient reserves to buffer disruptive exchange rate volatility during crisis periods. As exchange rates regimes have shifted from hard pegs towards managed floating rate regimes, central banks have gained flexibility to balance exchange rate and reserves adequacy considerations. Moreover, the shift has reduced speculative attacks on the currency. Few central banks now offer currency speculators the one-sided bet to force a devaluation by shorting the currency beyond the central bank's ability to defend it. The greater stability of reserves over this period is illustrated in the Appendix, which compares the level and evolution over time of the worst case declines in reserves during crisis periods.

Over the period 2000-15, central banks and sovereign wealth funds developed a professional cadre of public sector portfolio managers. In 2000, reserves management was effectively treated as a cash management function and, in part, outsourced to other official institutions or, to a lesser extent, private sector asset managers. But this had to change as the size of the reserves ballooned, and reserves dynamics evolved. Central banks, long the domain of economists, invested substantial resources in training staff in finance and portfolio management and developed more robust governance structures for risk and performance oversight. Meanwhile, reserves began to be invested differently based on discrete objectives. Central banks with ample reserves set up long-term investment tranches and those with revenues from extractive industries hived off their management either within the central bank or to a separate sovereign wealth fund, which enjoyed greater degrees of freedom with respect to investments.

Despite enhanced skills and reserves adequacy positions, central bank reserves generally remained invested within the traditional universe of high-grade government fixed income securities. Central bankers sought to increase returns by modestly extending duration rather than significant diversification into credit or

equity markets. And the strategy paid off. During the period, 2000-2009, the 15 year rally in US government securities continued, with US Treasury bonds with a remaining maturity of 1-3 years returning nearly 4% annually. Following the culmination of quantitative easing, however, returns sank to only 0.70% per annum on the same strategy from 2010-15.<sup>3</sup> And, current yields offer little respite as can be seen in Figure 2.

With respect to currency composition, reserves managers diversified moderately away from the USD and this trend is likely to continue, albeit modestly, with the recent inclusion of the Renimbi (RMB) in the IMF's Special Drawing Rights (SDR) basket. The SDR is often used as a proxy for the optimal currency mix of reserves as its composition reflects countries' relative shares of global trade—a factor that contributes to the investment objective of protecting the value of reserves in terms of purchasing power. As of October 1, 2016, the RMB will be incorporated into the SDR basket at a weight of 10.92%, reflecting China's share of global trade of 13%-up from 3% over the last 15 years. In theory, this metric would suggest a reallocation of about \$750bn into RMB assets. In practice however, the actual level is likely to be much less. Global reserves today have remained overweighted to the USD relative to its trade weight, due to its importance as an invoice currency, role in global finance and depth of its capital markets.<sup>4</sup>

Finally, techniques for assessing reserves adequacy are becoming more sophisticated. With more complex global linkages, reserves adequacy can no longer be reduced to simple rules of thumb such as three months import and 12 months short-term debt coverage. Simulation of a country's balance of payments dynamics provides a more refined approach and the IMF is increasingly encouraging countries to engage in their own analysis, incorporating multiple parameters and sensitivity analysis to determine optimal reserves levels for financial stability.<sup>5</sup> A more refined approach to assessing reserves adequacy can provide a stronger foundation for formulating the optimal strategic asset allocation.

With more complex global linkages, reserves adequacy can no longer be reduced to simple rules of thumb such as three months import and 12 months short-term debt coverage.

Figure 2  
Yields on government securities in reserve currencies (%)

	6 months	1 year	3 years	5 years
Germany	-0.45	-0.48	-0.44	-0.25
US	0.42	0.52	0.87	1.23
Japan	-0.10	-0.18	-0.19	-0.15
Switzerland	-0.99	-0.88	-0.93	-0.75
UK	0.48	0.35	0.50	0.87

Data: Bloomberg L.P., as at 4 February 2016.

## II. Aligning policy objectives, investment objectives and guidelines

Central banks' policy objectives inform investment objectives, which in turn inform investment guidelines. High level policy objectives for holding foreign exchange reserves include to:

- provide foreign exchange to the government to meet external payments;
- execute exchange rate policy by holding financial assets denominated in relevant currencies to support a currency peg or manage undesirable exchange rate volatility;
- improve financial stability by providing backing against external open foreign currency positions or exposures, which may include short-term foreign currency borrowings, unstable capital market inflows and, most recently, a large international banking sector relative to a country's economy.
- instill confidence in the ability of the central bank to undertake effective monetary and exchange rate policy and meet future external obligations; and,
- provide a store of value that does not represent claims on the national government for periods of war, natural disasters or other unforeseeable crises.

Today, foreign currency reserves continue to fulfill their traditional objectives as a financial bulwark against external stress. While the sources of stress and the role of reserves, have evolved in tandem with the evolution of the global financial system, in most cases, investment guidelines have remained remarkably constant. While central banks differ with respect to specific policy goals, their investment objectives are remarkably uniform and are nearly universally cited as capital preservation, liquidity and return, in that order.

*Capital preservation:* While most sovereign asset managers rank capital preservation as the primary investment objective, the interpretation of what constitutes capital preservation varies dramatically across and even within the same institution. To elaborate, the concept of capital preservation can be understood in accounting or in financial terms; over accounting cycles or over investment horizons; in nominal or in real terms; in local currency or in foreign currency; and, finally, at the single asset level or at the consolidated portfolio level. Each interpretation leads to vastly different perceptions of risk and, ultimately, the optimal strategic asset allocation. The lack of a common framework for understanding what constitutes capital preservation is often at the root of overly restrictive and sub-optimal investment guidelines, which ultimately may subvert policy objectives as discussed further below.

With respect to central bank policy objectives, the most relevant measurement of capital preservation would be at the portfolio level and over an investment horizon determined by an individual assessment of reserves adequacy. For reasons more related to "reputational risk", however, credit risk guidelines are often formulated so as to preserve capital at the single asset level rather than at portfolio level by restricting the universe of eligible asset classes to those with the highest credit quality-typically AA government or above. While this lowers the risk of credit impairment at the single asset level, it may imply lower total returns on average at the portfolio level and a higher risk of not achieving capital preservation in real terms. Moreover, the capital preservation objective tends to be measured over short-term accounting cycles rather than over the appropriate investment horizon, further constraining risk and returns.

These "reputational risk" constraints have driven reserves into a mix of cash equivalents and short to medium-duration, high-grade government bond portfolios. Given the low to negative yields, these positions not only have a substantial risk of negative returns-thereby violating

capital preservation objectives- but also represent a systemic concentration that could negatively affect liquidity if a preponderance of central banks were to sell. While such portfolios were compatible with policy and investment objectives over the past 25 years, the existing low and negative yields on government debt all but ensure capital losses in real and possibly also in nominal terms going forward.

*Liquidity* is a critical investment objective to enable central banks to intervene during economic downturns or crises to buffer destabilizing exchange rate volatility. For this purpose, investments should be of the highest credit quality and facility to transact without affecting price levels, particularly during crisis periods. US Treasuries and other "safe haven" government obligations are optimal for this purpose as they typically are well bid during periods of crisis-exactly the time when central banks may need to support the currency. Given the low risk and desirable liquidity characteristics, however, such securities are generally also the most expensive or, inversely, lowest yielding. The optimal level of liquidity should thus be calibrated to the level of potential outflows over various periods to prevent a drain on earnings. Looking back over the past 25 years, the level of liquidity required to meet draw-downs in the worst cases was only a fraction of total reserves for the large majority of central banks (see appendix).

*Investment return* has become increasingly important as negative yields on traditional reserve investments violate capital preservation objectives and impair earnings. Whilst often treated as a residual, investment return is an important factor in achieving multiple policy objectives, including: building countercyclical buffers during periods of economic strength to reduce financial vulnerability; providing a government "dividend" for budgetary purposes; reducing the cost of carry of reserves from sterilization; and, protecting central bank capital.

In assessing the potential of returns to enhance reserves levels, it is worth considering the cumulative returns of two USD denominated portfolios (gross of any investment fees) invested from 1 January 2000 to 31 December 2015, a period that included two major equity declines in 2000-01 and 2007-08.

- Portfolio A: the 3 month US Treasury Bill (3M US T-Bill), which represents the highest quality, most liquid asset class
- Portfolio B: a conservative, diversified portfolio based on the following fixed weights: 30% short-durations treasury bills/50% global bonds/20% global equities<sup>6</sup>

While the sources of stress and the role of reserves, have evolved in tandem with the evolution of the global financial system, in most cases, investment guidelines have remained remarkably constant.



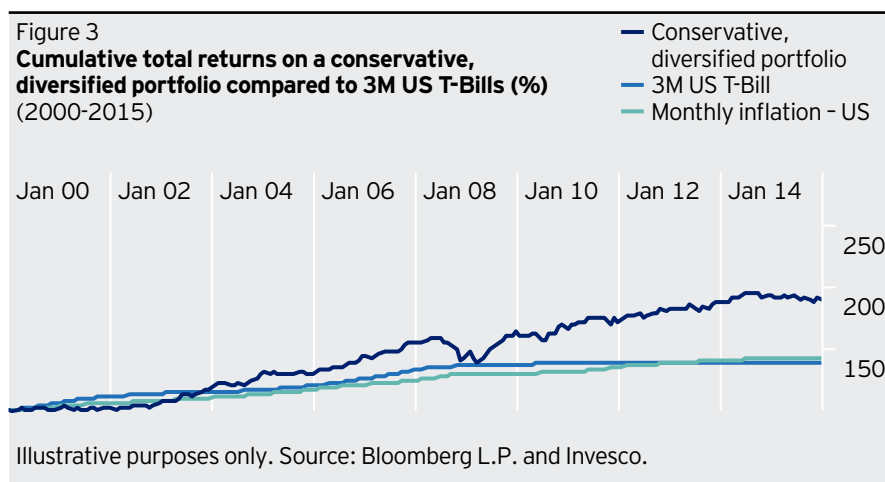
As can be seen in Figure 3, the higher cumulative return of the conservative, diversified portfolio, would have created a sufficient reserves buffer whereby its cumulative value would not have dropped below the market value of the 3M US T-Bill portfolio even after one of the sharpest market sell-offs of credit during the financial crisis of 2007-08. Moreover, by the end of the period, the conservative, diversified portfolio would have been worth nearly double its starting value while the 3M US T-Bill portfolio would have increased by about one-third, not even compensating for inflation. Reserves adequacy permitting, a central bank with the conservative, diversified portfolio would have entered the 2014-15 emerging market crisis with a stronger reserves position. Alternatively, part of the earnings would have been contributed to the national budget depending on the central's profit remittance rules and policy trade-offs.

If one compares the two portfolios from the objective of capital preservation in real terms, the conservative, diversified portfolio appears to have been less risky, even over short time horizons. As illustrated in Figure 4, the instances of not achieving capital preservation in real terms was higher for the 3M US T-Bill portfolio and the risk increased substantially over longer investment horizons as the return did not compensate for inflation. Conversely, the risk of not achieving capital preservation in real terms for the diversified portfolio decreased substantially over time due to higher investment return.

For countries with ample reserves, why is the investment return often treated as a residual? The answer lies in three complicating factors, which together often drive central bank policy makers into formulating highly restrictive investment guidelines. Firstly, central bankers seek stability and this view is all pervasive, affecting not only domestic monetary policy but also the construction of investment guidelines and strategy. In

particular, credit risk is highly constrained to avoid any "headline" or "reputational" risk from a credit impairment event. The second complicating factor relates to accounting standards and can be referred to as "presentation risk". Following the 1997-98 emerging market crisis, central banks were encouraged to report based on International Financial Reporting Standards (IFRS), which required that securities be reflected on the balance sheet at fair market value-or "marked to market". Broadly speaking, this standard contributed to greater conservatism and the risk profile for reserves driven more by short-term accounting constraints than reserves adequacy considerations. Finally, legal risks exist in some countries where sovereign asset managers do not enjoy a "safe harbor" or clear standards of care with respect to fiduciary investment decisions. Where such protections do not exist, it is inevitable that sovereign asset managers-whether central banks or sovereign wealth funds-- will likely behave conservatively regardless of the opportunity cost at the national level in terms of foregone income and reserves.

Reserves adequacy permitting, a central bank with the conservative, diversified portfolio would have entered the 2014-15 emerging market crisis with a stronger reserves position.



### III. Achieving greater degrees of freedom to meet policy objectives while seeking to enhance investment returns

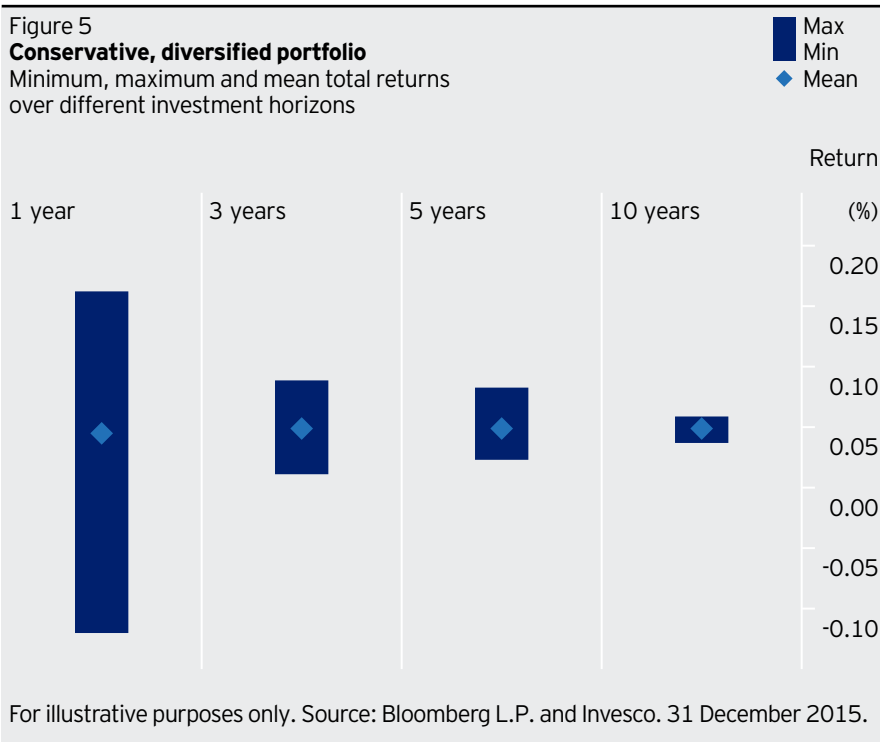
Foreign currency reserves represent a substantial pool of capital, which can be invested profitably to the benefit of public finances or to further build reserves to help mitigate the risk of a financial crisis. While central banks are not profit-seeking institutions, the negligible returns on traditional reserve assets are putting central bank finances—both net income and capital—under pressure and forcing some central banks to seek government support. Lack of financial independence can beget lack of political independence. There is thus a considerable incentive for central banks to reconsider traditional constraints and explore options for potentially improving returns while still meeting policy objectives.

Central banks could seek to improve returns by: (a) Extending the investment horizon for the investment tranche; (b) optimising the level of the liquidity tranche and rebalancing the relative sizes of the investment and liquidity tranche to reflect changing economic conditions; (c) assessing the restrictions and limits in the investment guidelines in particular with respect to the universe of eligible assets and diversification; and, (d) mitigating constraints arising from reputational or presentation risk.

#### a. Extending the investment horizon for the investment tranche

For countries with ample reserves, an investment tranche with a longer investment horizon provides leeway to pursue potentially higher returns while still respecting capital preservation constraints. Figure 5 illustrates the mean return and risk (dispersion of returns) of the conservative, diversified portfolio when measured over one, three, five and ten year periods. As described earlier in Figure 3, this portfolio is diversified across US bills, bonds and equities. Over a short investment horizon of one year, the portfolio would have violated capital preservation constraints, as can be seen by the instances of negative total returns. When one extends the measurement period, the dispersion of returns would have diminished because of the positive impact of higher returns over time; and the portfolio would have conformed to central bank's capital preservation objective.

Figure 5  
**Conservative, diversified portfolio**  
Minimum, maximum and mean total returns over different investment horizons



Moreover, reserve draw-downs appear to be attenuating as central bankers become more adverse to spending reserves to defend, often futilely, unrealistic exchange rates.

**b. Optimising the size of the liquidity tranche to minimize its cost.**

Tranching reserves into liquidity and investment tranches can help reconcile multiple policy objectives for reserves. Assets exhibiting the highest liquidity and best credit are generally the most expensive or, inversely, would have the lowest return. An analysis of the optimal level of liquidity required to meet potential draw-downs can be based on historical analysis and balance of payments simulation. Core reserves, which are typically able to absorb short-term market fluctuations, can thus be invested in more diversified strategies with a potential for higher expected return. The relative size of the tranches can be rebalanced as economic conditions change.

Central bank's precautionary liquidity requirements are driven by the level of expected potential draw-downs during periods of crisis, when central banks may be required to intervene to support the level of the currency. Reserve draw-downs have become less accentuated as reserve levels have increased and countries have shifted from pegged to managed exchange rate regimes. Adverse balance of payments dynamics, which also negatively impact the level of reserves, occur more

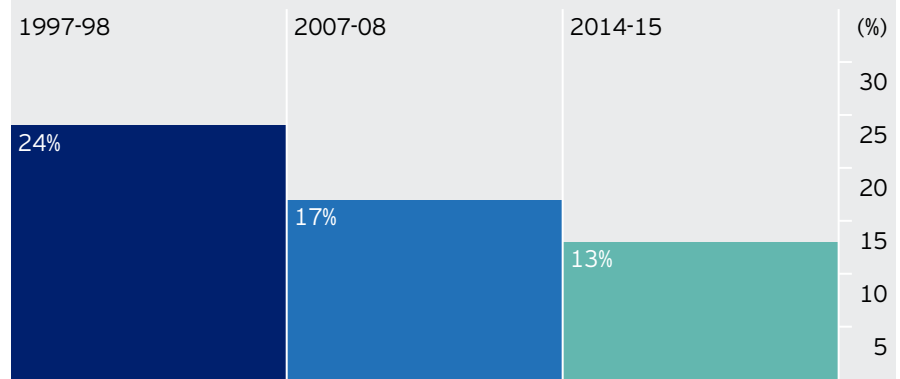
slowly giving central bank policy makers an opportunity to "de-risk" or rebalance the relative size of the investment and liquidity tranches. As illustrated in Figure 6, most countries did not lose more than 30% of reserves during the worst crisis period—as measured by the peak-to-trough intra-period declines. Moreover, reserve draw-downs appear to be attenuating as central bankers become more adverse to spending reserves to defend, often futilely, unrealistic exchange rates.

Credit, equity markets and emerging market currencies typically all fare poorly during global crises as investors de-risk and seek "safe haven" assets. In other words, central bank may need to sell part of the reserves at the same time as credit markets are under pressure. It is thus illustrative to examine the performance of the conservative, diversified portfolio during crises (see Figure 7) to answer the question: would interim capital losses have impeded central bank's policy objectives in intervening to support the currency? For the majority of central banks, the worst case interim capital loss of 11% would have been manageable as the bulk (70% or higher) of reserves would have been available for currency intervention purposes without a "fire sale" of risk assets.

Figure 6

**Severity of reserves draw-downs during crisis periods has lessened**

Countries with a peak to trough decline in reserves >30% during crisis periods



Data Source: IMF International Financial Statistics: central bank reserves excluding gold and SDRs ; Universe comprising central banks with reserves >\$250MM and excluding the five countries that joined the EUR during these periods.

Figure 7

**Conservative, diversified portfolio (Annualised returns)**

Total return and maximum draw-down during crisis periods

	1997-98	2007-08	2014-15
Total return	+9.86	+1.37	+0.27
Worst draw-down	-1.48	-11.18	-3.86

Source: Bloomberg L.P. For illustrative purposes only.

**c. Diversifying for risk/return benefits**

Diversifying across historically uncorrelated assets can improve expected risk-adjusted returns and lessen the liquidity risk associated with systemic concentration amongst central banks to a single market sector. Diversification of central bank reserves has many facets: at a macroeconomic level, diversifying the precautionary portfolio away from a country's "business risk" or macro-economic exposures; at a currency level, across a basket of currencies to protect the country's purchasing power; and, at the portfolio level, across assets with a historically low correlation or covariance to potentially achieve better risk-adjusted returns.

Portfolio diversification across assets has the potential to generate higher expected returns at the same level of risk. Or conversely, lower risk at a given level of expected return. The ability to construct a portfolio with a diverse set of assets is therefore an important degree of freedom in seeking to achieve both central banks' investment and policy objectives. In considering diversification away from government bonds, the minimum level of liquidity should be established to maintain precautionary balances for crisis periods. Stable reserves, however, can be invested in more diversified strategies in an investment tranche. Figure 8 shows the impact on return of adding different asset classes to 3M US T-Bills in equal risk weights. As can be seen, the greatest impact on return come from diversification across asset classes rather than by expanding fixed income.

Given the concentration of the \$8.3 tn in global reserves to short duration US government securities, diversification can

also contribute to liquidity were there to be a systemic crisis in the US government debt markets. The US Treasury debt crisis of 2013, which resulted in a ratings downgrade, foreshadowed what could occur in the face of continued negative fiscal dynamics and political paralysis.

**d. Mitigating reputational and "presentation" risk**

Accounting considerations should reflect the central bank's risk tolerance, as defined by its assessment of reserves adequacy, not drive it. For central banks required to carry fixed income investments at market or "fair value", however, this relationship can be inverted when investment strategies are designed to avoid short term accounting losses rather than generate sustainable income. The International Accounting Board recently changed its rules for accounting for financial assets (IFRS<sup>9</sup>), giving more leeway to account for debt securities at historical, amortized cost rather than on a mark to market basis (fair value). This should alleviate some of the concerns with long duration debt securities due to their short-term market volatility. During normal market conditions, when prices are not distorted by quantitative easing, long duration bonds can be ideal assets for foreign currency reserves. From a balance sheet perspective, they more closely match long duration liabilities (money supply and commercial bank deposits). And, such assets have tended to do well during periods of crisis as yields on reserve currencies have tended to decline during periods of "risk-off" and flight to quality. The average return has tended to be higher over time due to the term structure of interest rates, thus better preserving capital in real terms. And,

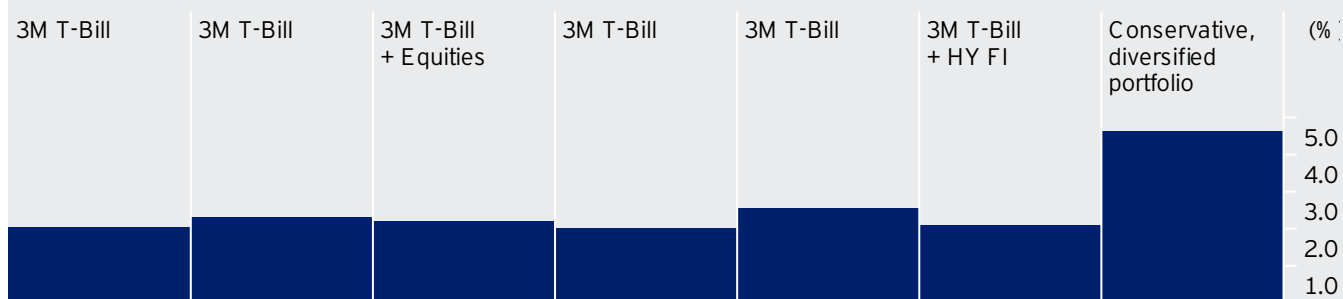
finally, investments that are spread along the yield curve, rather than concentrated in the short to medium end, may mitigate systemic liquidity risk in the case where official institutions acted simultaneously to sell reserve assets.

Investment guidelines are typically constructed to minimize credit risk at the single asset level, independent of considerations relating to risk-adjusted returns and the impact on the portfolio as a whole. This bias reflects a concern that a credit impairment event could become headline risk. If capital preservation measures are applied at the portfolio level, the behaviour of individual assets should be irrelevant as long as the total capital value is maintained over the appropriate horizon.

Over the past decade, the universe of investment products has expanded to provide central bankers with a greater range of alternatives in seeking asset class returns without the reputational or headline risk associated with an individual credit event. The development of the market in exchange-traded funds (ETFs) offers access to exposure to the major asset classes. Managed funds, which are carried at net asset value, are another alternative.

Finally, communication strategies with external stakeholders (government, civil society and academia) can be an effective and, in fact, essential factor in aiming to mitigate reputational risk. Central banks that have successfully diversified into credit have done so only with ex ante communication with external stakeholders regarding the investment strategy-its basis, rationale and risk profile- to mitigate the reputational or headline risk of any surprises from a credit impairment event.

Figure 8  
**Risk parity portfolios**  
Impact of diversification on total return (annualised)<sup>8</sup>



<sup>8</sup> For illustrative purposes only.  
Source: Bloomberg L.P. and Invesco. 2000 to 2015. Weights are adjusted that both asset classes have the same risk contribution, based on historical volatility. Government: BofA Merrill Lynch 0-3 Year US Treasury Index, Bloomberg Ticker: G1QA Index. Equities: MSCI World Net Return USD Index, Bloomberg Ticker: M1WO Index. IG FI: Bloomberg US Corporate Bond Index, Bloomberg Ticker: BUSC Index EM FI: JP Morgan EMBI Global Core, Bloomberg Ticker: JPEICORE Index HYFI: Bloomberg USD High Yield Corporate Bond Index, Bloomberg Ticker: BUHY Index.

In order to improve investment return potential, central banks require both the ability and the willingness to assume risk. Over the past 15 years, the ability to take on more risk has improved with the increase in the level of reserves, reserves adequacy and development of the requisite governance structure and staff skills. The willingness to take risk to potentially improve returns, however, has lagged given both individual and institutional asymmetric incentives. With today's traditional reserve assets eroding central bank's financial and, potentially, political strength, the investment return objective has taken on greater importance and offers the possibility of better long term returns on pools of capital that are substantial relative to the size of a country's economy.

Market conditions are currently volatile and many emerging market countries are under pressure. Adding risk to a portfolio during a time when a country's own risk profile has increased may not be advisable. For those countries, who did follow more diversified longer-term strategies, however, they are going into this period of global financial weakness with higher bulwarks and more resiliency. Linking a central bank's investment horizon to its reserves adequacy position is a strategic not a tactical decision and takes time. But, over time, such a strategy can be rewarded.

#### Aiming to mitigate headline risk from issuer-specific events

There are several ways in which official institutions can gain access to broad asset class exposure (beta) without incurring headline risk from issuer-specific events. Pooled fund structures offer central banks the ability to gain diversified exposure to an asset class without incurring potential reputational risk from issuer-specific events. Exchange-Traded Funds (ETFs), often passively managed, can provide a cost-effective<sup>10</sup>, transparent and liquid<sup>11</sup> means to gain exposure to a wide range of asset classes, markets or risk factors. ETFs based on market capitalization weighted indices provide investors with the risk and return of the broad index. In addition to indexed products, ETFs are also offered with specific tilts, sometimes known as "smart beta"<sup>12</sup>, which provide the risk and return of a diversified basket of shares with desired characteristics, such as high dividends or low volatility. For Central Banks seeking diversified market exposures with intra-day liquidity, ETFs can offer an efficient and transparent solution potentially mitigating the risk associated with holding individual "names".

For central banks with more customized requirements, we have observed the use of private, wholly-owned, closed-end funds as an innovative solution. Set up in-line with relevant local regulations, a private, wholly owned closed-end fund can offer a central bank many benefits, including total control of investment parameters, the ability to receive a daily single valuation, full transparency of underlying holdings and clear attribution of risks and returns. This is similar to a dedicated segregated portfolio but results are reported on a consolidated net asset value basis, again mitigating the potential headline risk from exposures at the single issuer level. Using private wholly owned, closed-end funds for external reserve management additionally provides clear separation between the central bank's own reserve management activities and those of its third party reserve managers.

#### Aiming to avoid undesirable outcomes

Forward-looking risk measurement tools provide a significantly different perspective than models based on historical returns, particularly when yields approach zero following a 25 year bull market and may turn up. Forward-looking measures of investment risk can greatly help the iterative process between the central bank and its third party investment manager to define appropriate investment parameters. With reputational risk often equated to downside risks or the risk of an absolute loss, a combination of simulation and Value-at-Risk (VaR) based methods can have an important role in seeking to ensure risks are in-line with the central bank's risk tolerance.

Forward looking scenario and sensitivity analysis can illuminate the potential downside exposure to particular risk factors for a given portfolio specification. The output from sensitivity analysis offers a recognizable format to central banks' own forecasting/signalling techniques by providing a range of possible outcomes across different probabilities. In the case of fixed income mandates, sensitivity analysis enables adjustments to permitted duration and credit spread exposures to be evaluated in terms of their impact on downside risk. Such analysis can be tied in to absolute loss tolerances and describe for the Central Bank the potential circumstances under which a maximum loss limit might be crossed.

Clearly though, the objective for both the central bank and its third party investment manager is to avoid reaching a point where unpalatable loss outcomes are reached. Developing loss management protocols, which set progressive levels of interaction and eventually intervention between both sides, can be usefully informed by such scenario analysis. Following implementation, the loss management protocol becomes one component of an overall risk management framework that is informed by realized loss measures (ex post) and estimates of potential downside risk such as scenario analysis (hypothetical and historic) and VaR.

#### Notes

<sup>1</sup> IMF and World Bank data 22.3.16.

<sup>2</sup> IMF: International Financial Statistics (IFS): Foreign currency reserves ex-SDR and gold in USD.

<sup>3</sup> Source: Barclay's UST Fixed Income Indices. Total return in USD.

<sup>4</sup> IMF: IFS Central Bank Reserves ex SDR, ex gold in USD and excluding China.

<sup>5</sup> IMF as at 4 February 2016.

<sup>6</sup> Bonds: JP Morgan Global Aggregate Bond Index Total Return Unhedged USD, Bloomberg Ticker: JGAGGUSD Index. Equities: MSCI World Net Return USD Index, Bloomberg Ticker: M1WO Index. Cash: US TBill 3-6M Total Return, Bloomberg Ticker: SPBDUB6T.

<sup>9</sup> IMF International Financial Statistics: Central Bank Reserves in USD ex-gold and SDR; Universe of central banks with peak reserves > \$250 MM.

<sup>10</sup> Cost effective - Since ordinary brokerage commissions apply for each buy and sell transaction, frequent trading activity may increase the cost of the ETFs.

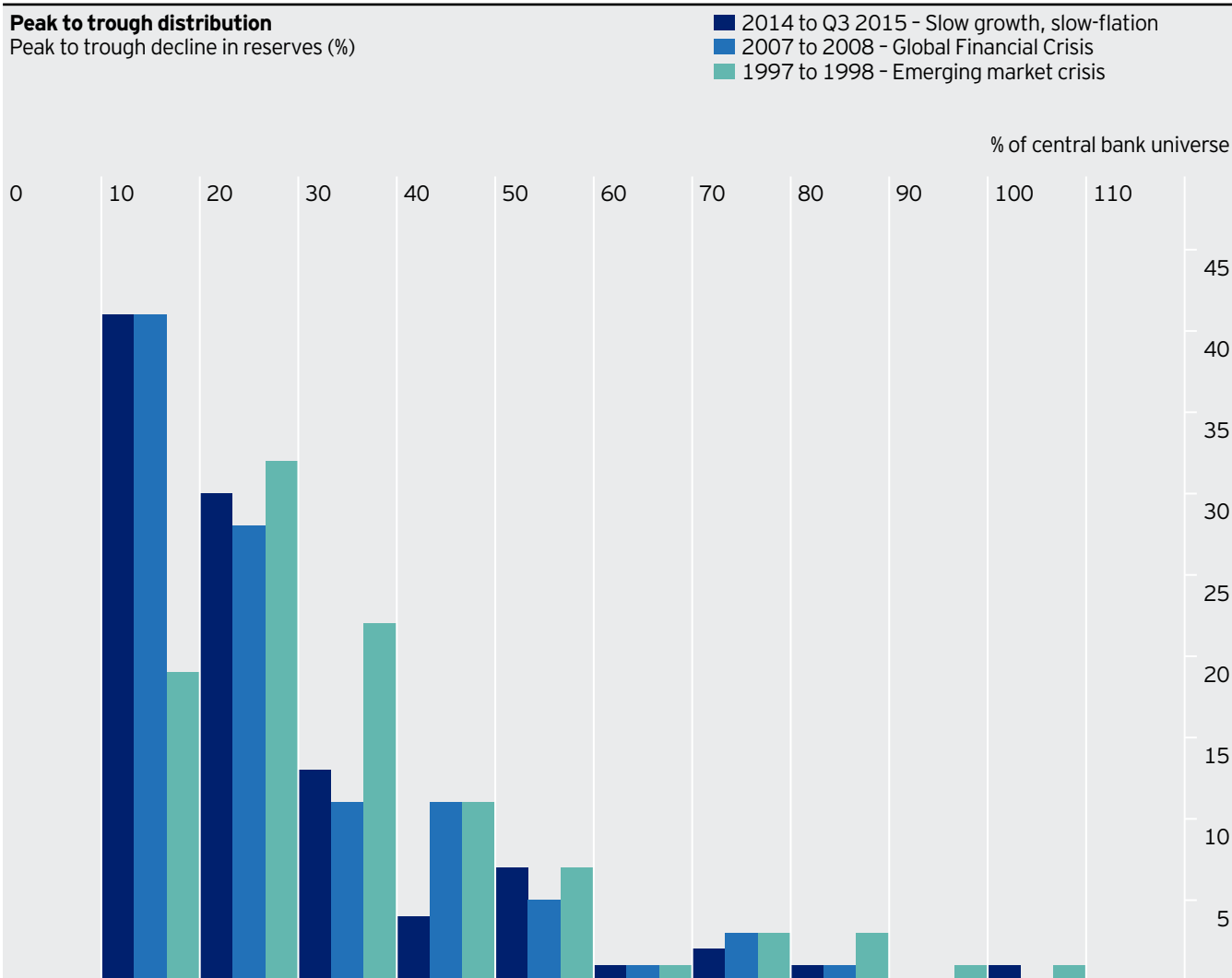
<sup>11</sup> Transparent - ETFs disclose their holdings daily;

<sup>12</sup> Liquid - Shares are not individually redeemable and owners of the Shares may acquire those Shares from the Funds and tender those shares for redemption to the Funds in Creation Unit aggregations only, typically consisting of 50,000, 75,000, 100,000 or 200,000 Shares.

### Central bank reserves

Level of peak to trough declines, during crisis periods, for central banks experiencing decline in reserves

■ 2014 to Q3 2015 Slow growth, slow-flation		■ 2007 to 2008 Global Financial Crisis		■ 1997 to 1998 Emerging market crisis	
>30% drop	(%)	>30% drop	(%)	>30% drop	(%)
South Sudan	75	Pakistan	67	Gabon	96
Ukraine	68	United Arab Emirates	59	Zimbabwe	87
Burkina Faso	67	Mongolia	46	Angola	78
Tajikistan	67	Montenegro	46	Ukraine	74
Timor-Leste, Dem. Rep. of	65	Ethiopia	45	Pakistan	72
Equatorial Guinea	56	Kuwait	44	Papua New Guinea	68
Zimbabwe	53	Bahamas, The	40	Moldova	65
Mongolia	50	Georgia	39	Seychelles	64
Ecuador	49	Sudan	39	Russian Federation	63
Chad	49	Sri Lanka	38	Ethiopia	50
Suriname	49	Fiji	38	Ghana	49
Congo, Republic of	47	Ecuador	36	Panama	49
Azerbaijan, Republic of	47	Belarus	35	Italy	49
Mali	46	France	34	Brazil	48
Burundi	46	Qatar	33	Sweden	44
Greece	44	Norway	32	Mauritius	42
Armenia, Republic of	35	Senegal	31	Norway	41
Benin	35	Burkina Faso	30	Cote d'Ivoire	41
Gabon	34	Kazakhstan	30	Romania	39
Belarus	34	Bahrain, Kingdom of	30	Kenya	38
Gambia, The	32			Finland	38
Moldova	32			Denmark	37
Denmark	31			Venezuela, Republica Bolivariana de	35
				Bolivia	34
				Kazakhstan	34
				Thailand	33
				Ecuador	31
				Costa Rica	31
				Bahrain, Kingdom of	31
				Turkey	30



**2014 to Q3 2015:** Central bank universe represents central banks that had foreign currency reserves greater than \$250MM (164 central banks) and that experienced a decline in reserves over this period (145 central banks = 88%).

**2007 to 2008:** Central bank universe represents central banks that had foreign currency reserves greater than \$250MM (152 central banks) and that experienced a decline in reserves over this period (127 central banks = 83%).

**1997 to 1998:** Central bank universe represents central banks that had foreign currency reserves greater than \$250MM (124 central banks) and that experienced a decline in reserves over this period (113 central banks = 91%).

02



### Abstract

- Central bank reserves are held both as a store of value and for precautionary purposes. In portfolio terms, this means seeking to generate a positive real rate of return to achieve capital preservation, while maintaining sufficient liquidity to meet unpredictable future drawdowns.
- The proportion of precautionary reserves, typically held in the form of high quality government bills, is the key driver of portfolio risk and return: the higher the level of short-term, high quality liquidity, the lower the expected portfolio risk and return.
- In today's world, the risk/return trade-off has been accentuated by low yields on highly rated government bonds, which reduces the chance of capital preservation in both real and nominal terms and undermines central bank income.
- Meanwhile, the potential liquidity needs for emerging market central banks to defend their currency have evolved. Shifts in FX and monetary policies have reduced the likelihood and scale of reserve drawdowns during crisis periods, with implications for the appropriate size of short term liquidity.
- For emerging market countries, the appropriate risk profile of the foreign currency reserves should be related to the country's external vulnerability. The greater its external vulnerability, the greater the potential need for short-term liquidity.
- Conversely, emerging market countries with ample reserves, have the resources to build a diversified investment tranche for the purpose of capital preservation and strengthening reserves through investment return during good times

This paper builds on empirical research underlying the IMF's Reserves Adequacy Metric (RAM) to provide a framework for linking a country's external risk profile to its strategic asset allocation (SAA). By doing so, emerging market countries with ample reserves coverage can invest more efficiently to achieve the portfolio objectives of capital preservation, liquidity and return.

## I. The evolution and current status of foreign currency reserves portfolios

In emerging market countries (EMs), foreign currency reserves are both a country's war chest for unforeseeable events and a liquidity buffer for smoothing market instability during periods of domestic or global crisis. As EMs expanded their role in global trade and cross-border capital flows, their demand for reserves increased dramatically, as can be seen in Figure 1. In many EMs, central bank foreign exchange reserves represent the largest financial portfolios in the country. With a median size equal to 15% of GDP, the investment profile of the reserves can move the needle both with respect to GDP growth as well as public finances.

Advanced market (AM) central banks retained relatively low levels of reserves based on the presumption that governments and private sector players had virtually unlimited access to USD liquidity within the global foreign exchange market. This proved not to be true during the Global Financial Crisis (GFC) when large financial intermediaries in advanced economies were shut out of USD funding markets. As can be seen in Figure 1, AM central banks responded by deliberately building up their foreign currency reserves, which nearly doubled between 2008 and 2015.

The portfolio composition of reserves has been inextricably linked to the evolution of the international monetary system. Under both the pre-World War 1 classical gold standard and inter-war gold-exchange standard, central banks held the largest share of reserves in gold to back their currency. During the Bretton-Woods gold-dollar exchange standard, the USD became the de facto reserve currency, taking over from sterling. Reserves were invested mainly in Treasury bills as the dominant reserve asset, though regional reserve assets persisted in sterling, Deutsche marks and French franc areas. Exchange rate and interest rate risk were relatively modest given the prevalence of capital controls and the fixed parity of the dollar to gold, and the fixed (if adjustable) parities of regional reserve currencies to the dollar. These arrangements enabled intervention to defend pegs at a time when terms of trade shocks were the main risk.

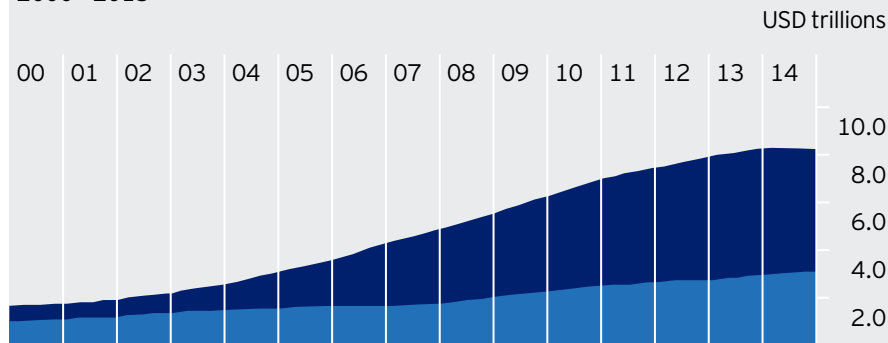
After the suspension of the Bretton Woods system of fixed exchange rates, both domestic capital markets and exchange controls were liberalized, combining a fiat currency system with increasingly integrated and sophisticated global capital markets. Deregulation and integration went hand in hand first in AMs starting in the 1970s and 1980s, then spreading to EMs in the 1990s-2000s. Looser currency arrangements from free floats to currency managed against a basket gave rise to moderate currency diversification mainly to EUR, replacing legacy DEM, FRF and other pre-euro assets, GBP and JPY and to a lesser degree CHF.

The Global Financial Crisis and the ensuing Eurozone and US fiscal crises, however, triggered a partial shift back into gold due to a loss of confidence in the US financial system and concerns about the fiat-currency based global monetary system, including: the impact of quantitative easing on government bond yields fears of ensuing high inflation; the emergence of unprecedented peacetime fiscal deficits in the US and Europe; and

political polarization in the US resulting in gamesmanship around raising of the US debt ceiling. Furthermore, the collapse of several Eurozone banks, Brexit and political threats to the integration of the Eurozone have reduced confidence in EUR and GBP as fiat-currency alternatives to the USD.

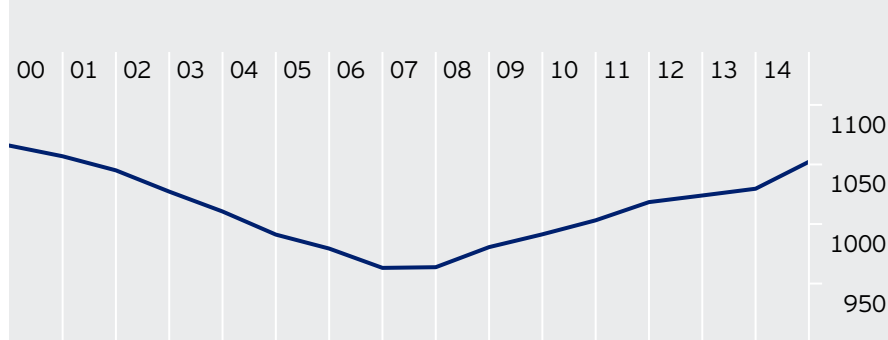
Since the surge in China's global economic weight and, in November 2016, the IMF's inclusion of the RMB in SDR basket, central banks are increasingly accepting the RMB as a reserve currency. The RMB's current SDR basket weight of 11% comes mainly at the expense of sterling and yen, pointing toward a three-currency global reserve currency system with substantial shares for the US, EUR and China. Going forward, three fiat reserve currencies should be expected to co-exist and hold the lion's share of global FX reserves; to do so with distinct, independent monetary policies; and with exchange rates floating against each other. This multiplicity of reserve assets and currencies, reacting to distinct monetary policies and growth/inflation trajectories, also points to greater variability in reserve portfolios going forward.

Figure 1  
**Central bank reserves (ex gold and SDR)**  
2000 - 2015



Source: IMF International Financial Statistics (IFS), 31 December 1999 to 31 December 2015.

Figure 2  
**Central bank holdings of gold (millions troy oz)**  
2000 - 2015



Source: IFS; 31 December 1999 to 31 December 2015.

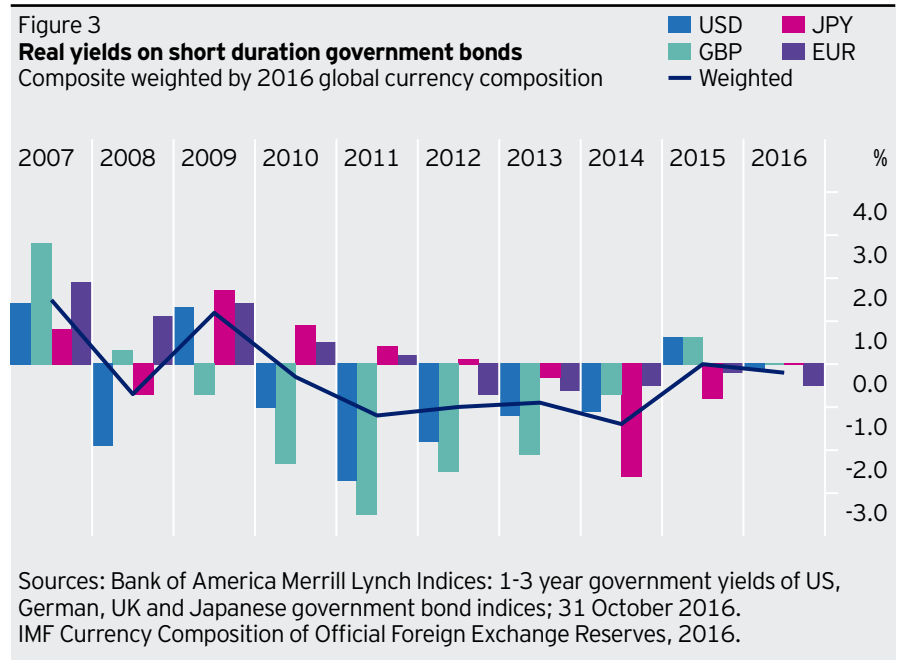
## II. Recent and current foreign currency reserves management practices

Until 2010 central bank reserves were generally invested in a barbell strategy with a small percentage of gold as a store of value and the bulk in short term liquid assets. As USD reserves accumulated, central banks adopted a portfolio management approach to the investment of financial assets and were able to achieve both liquidity and preservation of value by extending duration of the fixed income portfolio, taking advantage of the most recent leg of the 30 year bull market in fixed income assets. As seen in Figure 3, the efficacy of this investment strategy came to an end in 2009 when real yields on traditional reserve assets turned negative and government bonds could no longer meet the objective of capital preservation, absent deflation.

As discussed in the 2016 Invesco Global Sovereign Asset Management Study (see Appendix), central banks have begun and are accelerating diversification, where possible, within an investment tranche. Over the past five years, concerns over reputational risks appear to have been overtaken by concerns over financial risks both to central bank income and the public purse. Moreover, the increased stability of reserves and, in some cases, ample reserves adequacy have given emerging market central banks more degrees of freedom in defining a liquidity tranche to meet precautionary purposes and an investment tranche for preservation of value and return. While the Invesco study showed a clear trend towards diversification of assets amongst emerging market central banks, the interviews revealed some lack of clarity with respect to the relative sizing of the two tranches, risk profile of the investment tranche and asset allocation.

In principle, the liquidity tranche should be sized to meet both contractual near term payments and potential drawdowns during crisis periods. The latter, however, requires a framework for estimating the potential likelihood and size of such drawdowns based on a country's unique risk factors. Traditionally, central banks have not been well equipped to forecast the potential call on reserves. First, under a fixed rate peg, central banks had no discretion with respect to the timing and size of intervention. Second, assessing reserves adequacy was in a fairly primitive state with single rules of thumb applied to all countries regardless of their economic circumstances.

Two recent changes represent a break with the past, enabling self-assessments of potential liquidity requirements and tranching for investment purposes. First, central banks assumed responsibility for financial stability following the GFC. Over the interim years, they have built up institutional capacity to assess financial vulnerability, and thus potential future calls on reserves. Second, following four years' of empirical research, the International Monetary Fund (IMF) released new Guidance<sup>1</sup> for assessing reserves adequacy (ARA) based on a country's unique risk factors and made available online through the ARA model and database. For emerging market economies, this may provide a missing link in relating the strategic asset allocation and structure of a country's reserves to its external risk profile.



### III. Linking reserves adequacy to the strategic asset allocation

The irony inherent in the build up of reserves is that the higher the reserves, relative to country risk factors, the lower the likelihood that they will be used. After all, private economic agents with relatively atomized balance sheets and finite investment horizons are less likely to test a central bank, which can mobilize a substantial share of resources. As illustrated by the IMF in "Assessing Reserves Adequacy (2013)", other things being equal, a higher level of reserves adequacy reduces vulnerability and the probability of crisis<sup>2</sup>. And, reserves adequacy has been increasing for many emerging market countries over the last decade alongside the general build-up in reserves.

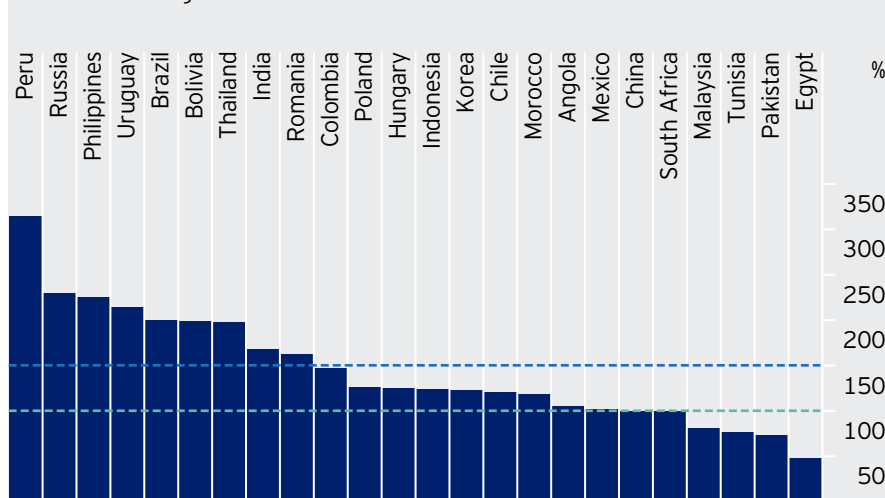
Even so, central banks have generally expressed a preference for the most liquid and, conversely, lowest yielding securities independent of absolute reserves levels or reserves adequacy. In the absence of a clear framework for determining the appropriate risk profile for the reserves, the default position was simply to invest the bulk of reserves in high-grade government securities and cash equivalents and define the acceptable level of risk in annual accounting terms.

For the past 25 years, the world relied on two simple rules of thumb to assess reserves adequacy across countries with vastly different macroeconomic and financial conditions. In a world of restricted access to external financing, three months import coverage was deemed a sufficient level of reserves to smooth domestic spending during crises. The 1997-98 emerging market crisis starkly revealed the extent of large short-term foreign

borrowings, and policy makers responded by introducing a second metric of 12 months short-term debt coverage. Both metrics are one-size-fits-all, and crucially assume that domestic absorption is linked through the balance of payments only to external financing of imports and foreign debt repayments. Neither provided a safety margin for capital flight, whether by residents or foreign investors, nor reversal of portfolio capital flows in from domestic bond and equity markets.

In June 2016, the IMF issued new guidance for assessing reserves adequacy (ARA) based on specific risk factors underpinning countries' demand for reserves.<sup>3</sup> This guidance differentiates between advanced market, emerging market and low income countries (LIC)<sup>4</sup>, reflecting their different rationales for holding reserves. It also applies different risk weights depending on the exchange rate regime, economic reliance on commodity exports, the openness of the economy both with respect to trade and capital flows and the size of the national financial system. The ARA framework, does not lend itself to general rules of thumb. Rather it is based on an online analytical tool and the database populated with individual country's risk factors. The tool can be used as a model with standard risk weights, based on empirical research, or customized as desired to account for particular country-specific factors not fully captured in the standard metric. Figure 4 illustrates a cross-country comparison of reserves adequacy as measured by the IMF's Reserves Adequacy Metric (RAM). The estimated optimal level for RAM is in the range of 100% and 150% coverages, as indicated in Figure 4.

Figure 4  
**Assessing Reserves Adequacy (ARA)**  
Reserves coverage of the ARA metric



Sources: IFS, World Economic Outlook (WEO). Data as of 31 March 2016. Calculations based on the IMF's ARA Template at <http://www.imf.org/external/np/spr/ara/index.htm>

### Assessing liquidity requirements during crisis periods

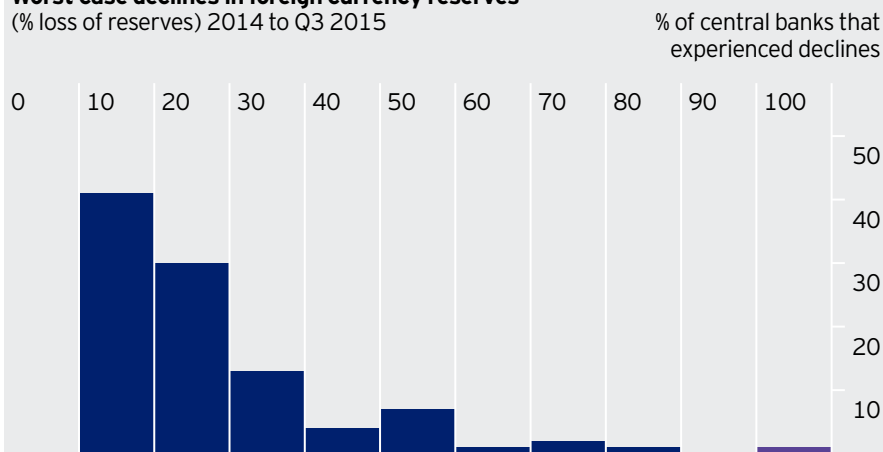
What a central bank may need in reserves liquidity differs from its reserves adequacy position. In fact, for emerging market economies, the two are conversely related: the higher the level of reserves adequacy, other things being equal, the lower the crisis potential and likely need for immediate liquidity. Generally speaking, the most liquid and highest quality fixed income investments are also the most expensive or lowest yielding. It thus behooves central bank reserves managers to relate the level of high quality liquidity, or the size of the liquidity tranche, to the size and likelihood of potential drawdowns.

In order to assess how much liquidity is actually required, one can start by looking back at the empirical evidence of worst-case reserves drawdowns during periods of global crisis and financial stress.<sup>5</sup> Over the past twenty years, three periods of heightened systemic risk stand out. The 1997-98 emerging market crisis hurt not only EMs with fundamental imbalances but spread to others through financial contagion, the actions of hedge funds and reversals of portfolio flows. In the

2007-08 global financial crisis, some advanced market central banks drew on their USD reserves to provide liquidity to an overextended banking sector shut out of overseas funding markets. And, while not the source of imbalances, emerging markets again suffered as investors exited in a general flight to safety. And, finally, the 2014-15 period of slow growth hit many EMs through a sharp decline in the terms of trade, collapse of exports and a record reversal of portfolio capital flows. During all of these periods, most central banks were forced or elected to intervene by selling reserves either to maintain fixed exchange rate pegs or manage undesirable volatility in the exchange rate.

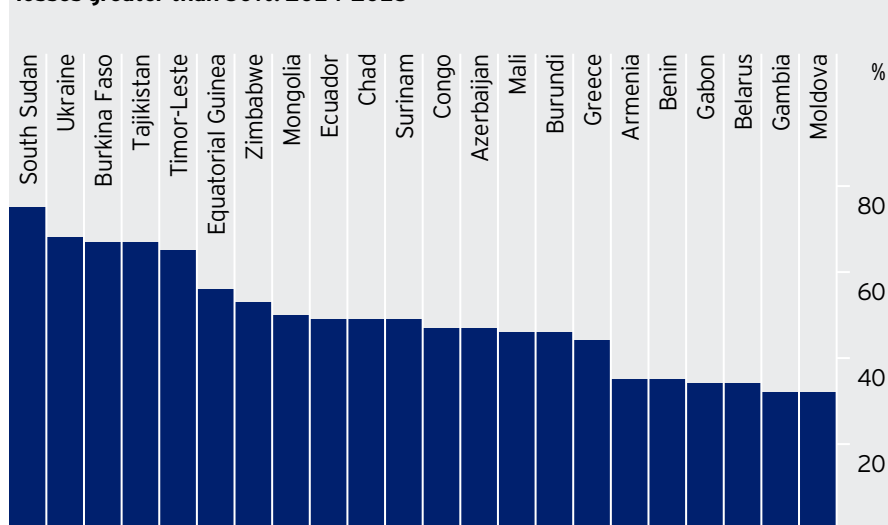
During the most recent period of global stress from 2014-2015, most central bank reserves declined and the scale of the worst case foreign currency losses can be seen in Figure 5. Of those central banks experiencing drawdowns, the median worst case decline was 17%. Only 13% of central banks exhibited extreme declines of greater than 30%. Of these outliers, shown in Figure 6, the large drawdowns can to a great extent be explained because of the economy's dependence on commodity exports, and/or a fixed exchange rate. In the ARA model, both of these factors empirically contribute to greater volatility and thus the need for higher reserves, which would be captured by the ARA framework.

Figure 5  
**Worst case declines in foreign currency reserves**  
(% loss of reserves) 2014 to Q3 2015



Source: IFS; Internal calculations as of 31 December 2015. Central bank universe represents central banks that had foreign currency reserves greater than \$250m (164 central banks) and that experienced a decline in reserves over this period.

Figure 6  
**Outlier countries exhibiting interim peak to trough foreign currency losses greater than 30%: 2014-2015**

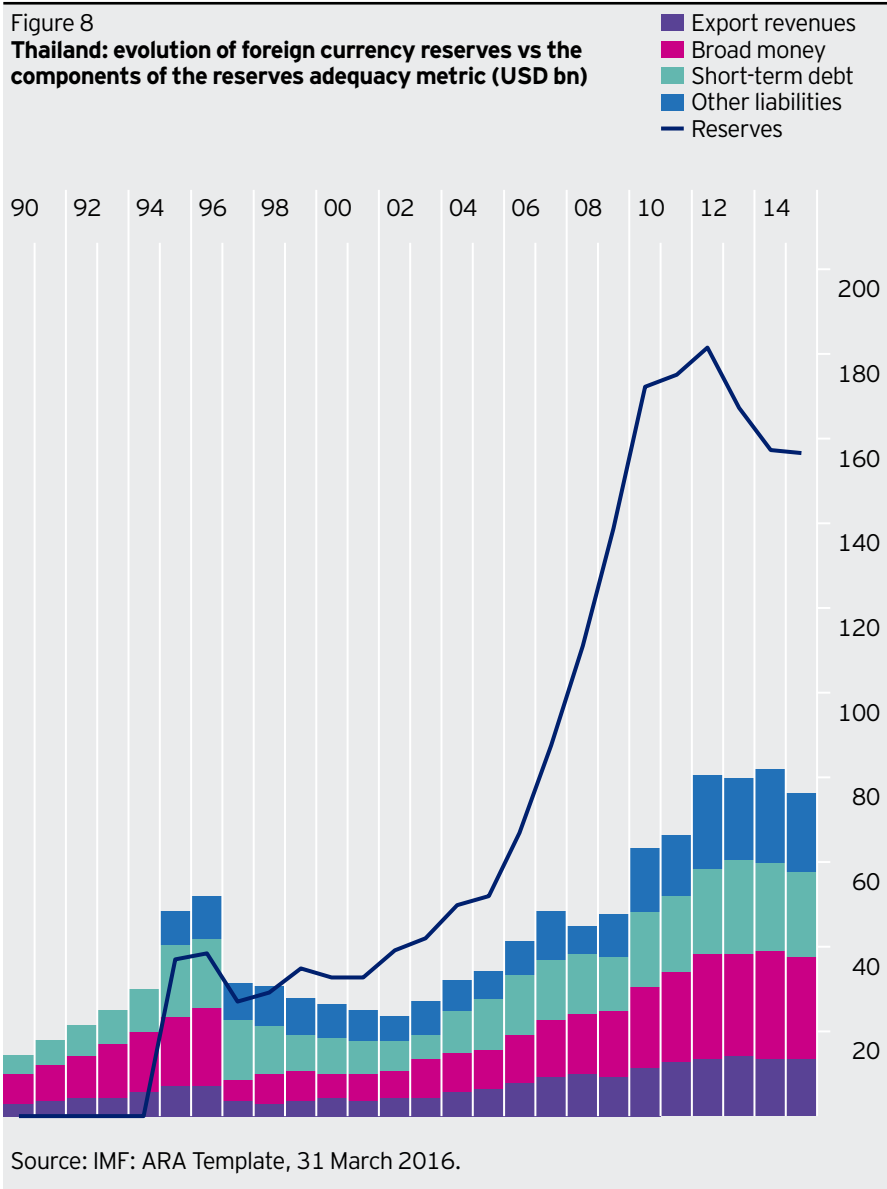
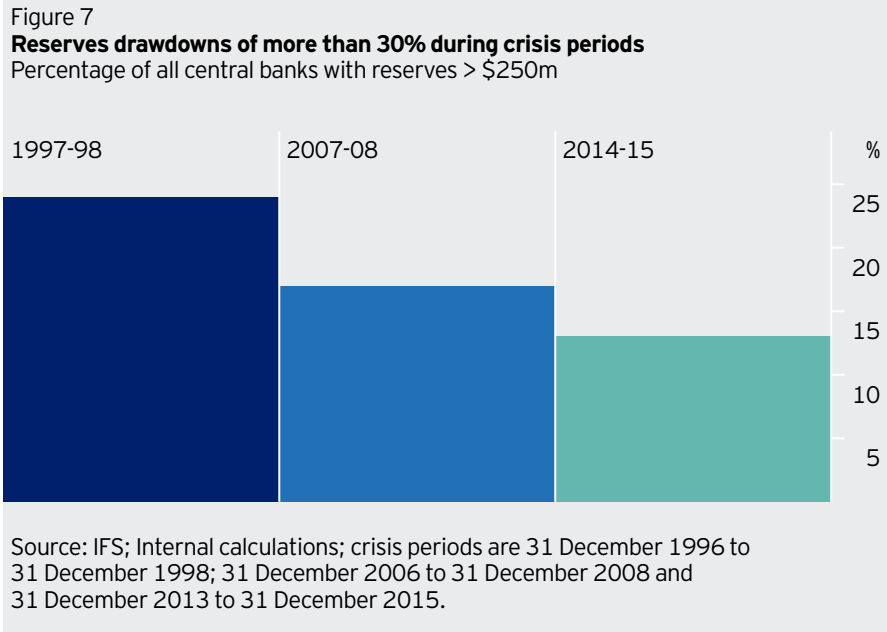


Source: IFS; Internal calculations as of 31 December 2015.

Looking back over the last three periods of global financial stress, there appears also to be a trend towards greater stability of reserves as seen in Figure 7. In the emerging market crisis of 1997-98, nearly a quarter of all central banks lost reserves in excess of 30%. This share declined to 17% during the GFC (2007-2008). And, most recently to 13% during the 2014-2015 crisis, where the exchange rate rather than the level of reserves tended to take the brunt of balance of payments pressures due to slow growth and the collapse in commodity prices.

The lower actual use of reserves may be attributable to stronger reserves adequacy, a related trend from fixed to managed and floating exchange rate arrangements and better policy frameworks generally, as well as secular structural improvements such as development of deeper domestic bond markets and more successful monetary policy outcomes through inflation targeting. Looking back one can thus conclude that many central banks held substantially greater liquidity than required by actual drawdowns.

The IMF's reserves adequacy metric (RAM) quantifies the drivers of reserve demand relative to the actual level. Figure 8 provides a backwards-looking example. In Thailand, the drivers of the demand exceeded the actual level of reserves prior to the emerging market crisis of 1997-98 due to excessively high foreign imbalances. Since then, however, reserves adequacy improved as reserves increased faster than the underlying factors driving reserves demand. By periodically reviewing the strategic asset allocation, central banks can rebalance the portfolio to reflect changes in external vulnerability.



## IV. Dynamic rebalancing of liquidity and investment tranches based on forward looking analysis

As discussed earlier, central banks often separate reserves into a high quality liquidity and investment tranche. The former is invested in cash equivalents to meet potential drawdowns while the investment tranche is typically more diversified to provide investment return potential. In many cases, however, the liquidity tranche dominates the portfolio (See Figure 15 in the Appendix). In the absence of an analytical framework to link the strategic asset allocation of the portfolio to country risk, most central banks defaulted to the most conservative stance, with the risk profile of the reserves driven by accounting considerations rather than the risk profile of the country. As can be seen by Figure 8, such a stance significantly overestimated the actual level of liquidity needed during crisis periods over the last twenty years.

The size of the liquidity tranche drives the risk and thus the expected return of the portfolio: Increasing the size of the liquidity tranche will “derisk” the portfolio and ratchet down the expected return; decrease its size and the expected return increases, as does the volatility of return. Figure 9 illustrates the past risk and return of a model liquidity tranche comprising US Treasuries with a portfolio

duration of around 1.3 years and a model investment tranche comprising 70% USD hedged global investment grade fixed income securities and 30% equities of advanced economies. The portfolio with the relatively larger investment tranche exhibited comparatively higher average returns over time, and in 95% of observations, exhibits positive annual returns and no worse than -1.1% in monthly investment decline. These measurements illustrate relative risks based on every 12 month period over the past 20 years but are not a predictor of future performance.

As a country's external risk evolves over time, so should the relative sizes of the liquidity and investment tranche. The IMF's ARA tool describes the evolution of the macroeconomic drivers of reserves demand over time. Importantly, central banks can use this framework to conduct a forward-looking analysis using World Economic Outlook (WEO) projections. It is thus a useful analytical tool to inform a periodic review of the reserves portfolio structure. While the tool is not intended to be applied in a mechanical fashion, it does provide insight into balance of payments dynamics that affect the future probability of reserves drawdowns.

Figure 9  
**Model liquidity and investment tranches %**  
Risk/return profile over rolling 12 month periods (1995 - 2016)

1995 - 2016	Liquidity tranche	Investment tranche	90% Liquidity: 10% Investment	40% Liquidity: 60% Investment
Average annual total return (USD)	3.52	6.56	3.83	5.36
Volatility	1.18	4.87	1.20	3.00
Worst monthly return (95% confidence interval)	-0.16	-1.86	-0.21	-1.09
Worst yearly return (95% confidence interval)	0.34	-1.92	0.84	0.49

Source: Liquidity tranche: BofA Merrill Lynch 0-3 Year US Treasury Index; Investment Tranche: 70% Barclays/Bloomberg Global Aggregate Bond Index Return Hedged to USD; 30% MSCI World Equities Index; Internal monthly calculations. From 31 December 1994 to 31 December 2015

In figures 10 to 12, we provide examples of the evolution of reserves adequacy for three countries reflecting different paths relative to the IMF's estimated optimal range for the Reserves Adequacy Metric (RAM). These examples illustrate the changes that can occur within a ten year period, which should be factored into periodic reviews of the strategic asset allocation and the portfolio structure. The size of the investment tranche could be periodically increased for central banks

where reserves adequacy is strong and improving while the converse could be the case for countries with declining reserves coverage of the ARA metric. When reviews are carried out periodically, rebalancing can be carried out during normal market conditions rather than those of crisis when market dislocations impede liquidity of higher risk assets. The estimated optimal level for RAM is in the range of 100% and 150% coverage.

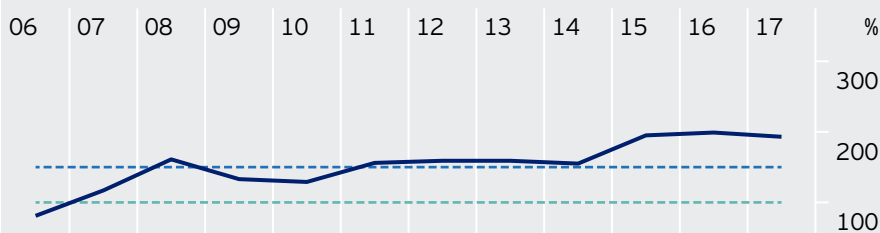
### Institutional considerations

While central banks have made considerable advances in assessing financial stability and vulnerability, in many cases this analysis still does not drive the strategic asset allocation or portfolio structure of the foreign currency reserves. In part this is due to historical antecedents as well as concerns over reputational risk in the absence of a macroeconomic framework to inform the strategic asset allocation. To some extent, the vertical silos existing in the organization of central bank functions may also impede linkages between reserves adequacy and reserves strategy. In many cases, foreign currency reserves management is within the financial management services of the central bank, along with payments and accounting; while financial vulnerability and assessing reserves adequacy is grouped with macroeconomic research and statistics. To the extent that the head of financial stability participates in investment committee meetings, these two perspectives - external country risk and the risk profile of the reserves - can be integrated.

With the development of the Fund's ARA tool, central banks have the capacity to reframe the strategic asset allocation with respect to both the rationale for holding reserves and, in the case of emerging markets, its reserve adequacy assessment. For those countries with ample reserves, this can unlock their earnings potential and help to build higher levels of reserves during good times to minimize risks during bad.

Figure 10  
**Reserves adequacy over time: coverage of the reserves adequacy metric**

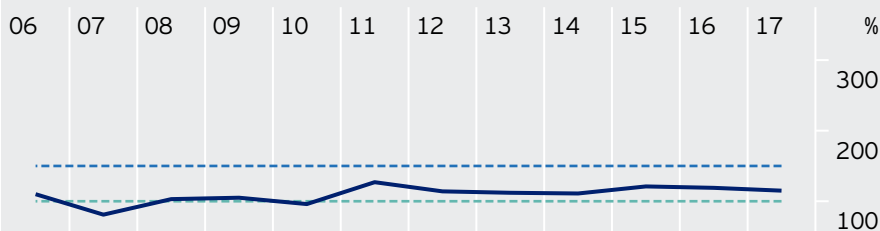
Improving reserves coverage: Brazil 2006 to 2017 (projected)



Source: IFS. Date as at 31 March 2016. Calculations based on the ARA EM tool at <http://www.imf.org/external/np/spr/ara/index.htm>

Figure 11  
**Reserves adequacy over time: coverage of the reserves adequacy metric**

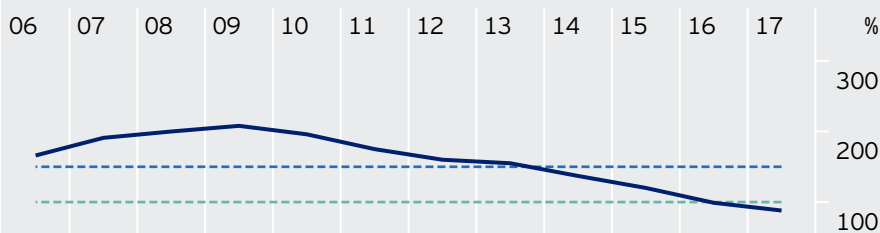
Stable reserves coverage: Chile 2006 to 2017 (projected)



Source: IFS. Date as at 31 March 2016. Calculations based on the ARA EM tool at <http://www.imf.org/external/np/spr/ara/index.htm>

Figure 12  
**Reserves adequacy over time: coverage of the reserves adequacy metric**

Declining Reserves Coverage: China 2006 to 2017 (projected)



Source: IFS. Data as at 31 March 2016. Calculations based on the ARA EM tool at <http://www.imf.org/external/np/spr/ara/index.htm>



## Appendix

### Trends in Central Bank reserves management: 2016 Invesco Global Sovereign Asset Management Study<sup>6</sup>

In June 2016, Invesco released the results of its latest study of investment practices of official institutions - sovereign wealth funds, central banks and other official investors. The survey, which was conducted by a third-party independent consulting firm based on a confidential questionnaire and face-to-face interviews, sampled 18 central banks from all geographic areas with total foreign currency reserves of \$2.1 trillion. The 2016 study confirmed the investment challenges facing central banks to enhance income and the trend towards diversification within an investment tranche. The main findings of the study and central bank responses to the questionnaire follow below.

#### “Central banks are struggling to meet their capital preservation objectives”

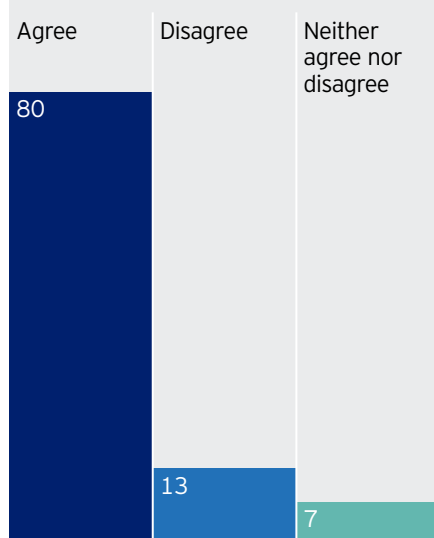
As central bank reserve adequacy positions improved, central banks have become more confident in their ability to meet stabilisation objectives. However, central banks are struggling to meet their capital preservation objectives in the current low return environment. In figure 13, for example, 80% of central banks agree that low returns on traditional government bonds are a key driver of increasing diversification into other assets. Given the current negative yields on certain Eurozone government bonds this challenge is particularly acute for central banks where the currency composition of reserves is heavily weighted towards the Euro. Where central banks measure capital preservation in real terms, the hurdle is even higher given the negative real returns on US\$ and Euro government debt.

Capital preservation was a major challenge for central banks in emerging markets managing a currency peg because of the higher level of short-term liquidity required to meet intervention requirements. [For oil-exporting countries], the combination of the US dollar's strength and the negative outlook for oil placed a strain on the currency pegs, forcing intervention to maintain the value of the currency within the bands of the peg. The high level of liquidity negatively affected their ability to meet capital preservation objectives.

#### Capital preservation challenges increase the importance of investment return

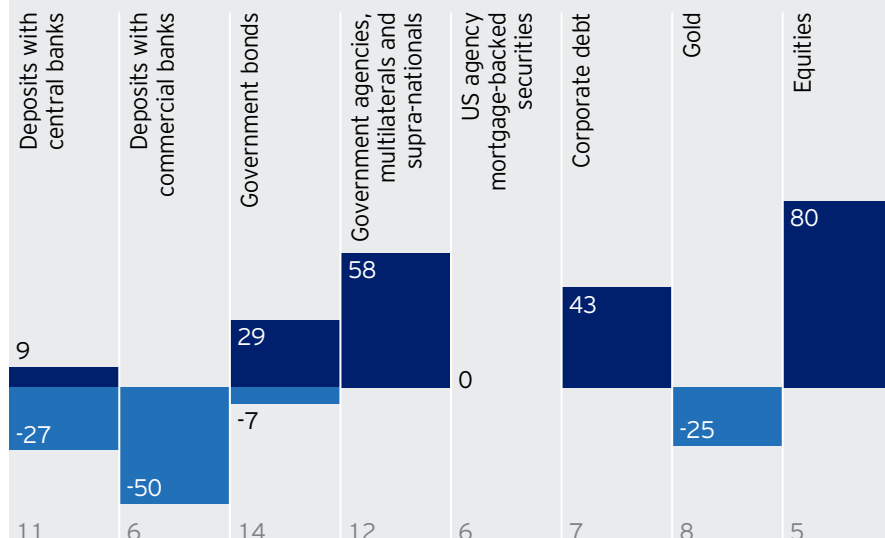
Central banks are increasing [the importance of] investment return objectives to ensure they meet and exceed their capital preservation objectives. Central banks explained that the rationale for promoting investment return objectives were twofold: first to deliver on investment return objectives and second to minimise volatility through diversification into new asset classes. Many central banks focused more on diversification and reduced volatility than on investment returns and yields. The desire to diversify and seek higher returns is illustrated in figure 14 by a number of central banks expecting to shift assets from low yielding deposits to increased allocations to corporate debt and equities in the future. In some cases, central banks explained that they are continuing to sell off gold reserves and these assets would be redeployed into higher risk fixed income and equity investment.

Figure 13  
**Low government bond returns are driving diversification of central bank portfolios**  
(% of central bank citations), Q1 2016



Sample: 15. Sample comprises of central banks only.

Figure 14  
**Central bank views on future change in asset allocation**  
(% of central bank citations), Q1 2016



Sample comprises of central banks only. Sample size shown in grey.

**The development of investment tranches within central bank portfolios**

Allocations to new asset classes have forced central banks to reconsider the structure of their reserves. Central banks now manage multiple objectives and there is clearly scope for conflict between stabilisation and investment return objectives. As a result central banks have split reserves into tranches. Figure 15 shows that central banks in our study operate up to four tranches: liquidity tranche, hold to maturity tranche, cash or working capital tranche and investment tranche. This dynamic is very different to other sovereign investors who do not generally split their portfolio into formal tranches with different objectives.

The liquidity tranche is typically the largest tranche of reserves, comprised of low risk assets (typically AAA-rated,

short duration government bonds) and primarily responsible for stabilisation objectives. The hold to maturity tranche is a tranche of longer term fixed income which is held to maturity with an objective of generating return and guaranteeing capital preservation. The cash or working capital tranche represents cash balances required for operational purposes. The investment tranche tends to hold riskier assets such as corporate bonds and equities. The investment tranche is typically smaller than the liquidity tranche with a primary objective of investment return. The differences in asset allocation for liquidity and investment tranches are set out in figure 16. While there are higher allocations to corporate bonds (18%) and equities (18%) in the investment tranche we note that a significant percentage of these assets remain allocated to sovereign debt.

**Uncertainty over size and asset allocation within the investment tranche**

While every central bank in our study had an investment tranche, the creation of these tranches is a relatively new phenomenon. Many interviewees were in the process of designing or testing their allocations and there was no clear consensus on the target size for the investment tranche or the underlying asset allocation. Furthermore, there was also a lack of clarity on how these allocations related to risk-adjusted returns and volatility. Many respondents emphasised that this was an experimental stage. Limited allocations to corporate bonds and equities were frequently attributed to inexperience rather than an evidence-based view of strategic asset allocation.

Figure 15  
**Central bank views on future change in asset allocation**  
(% of central bank citations), Q1 2016

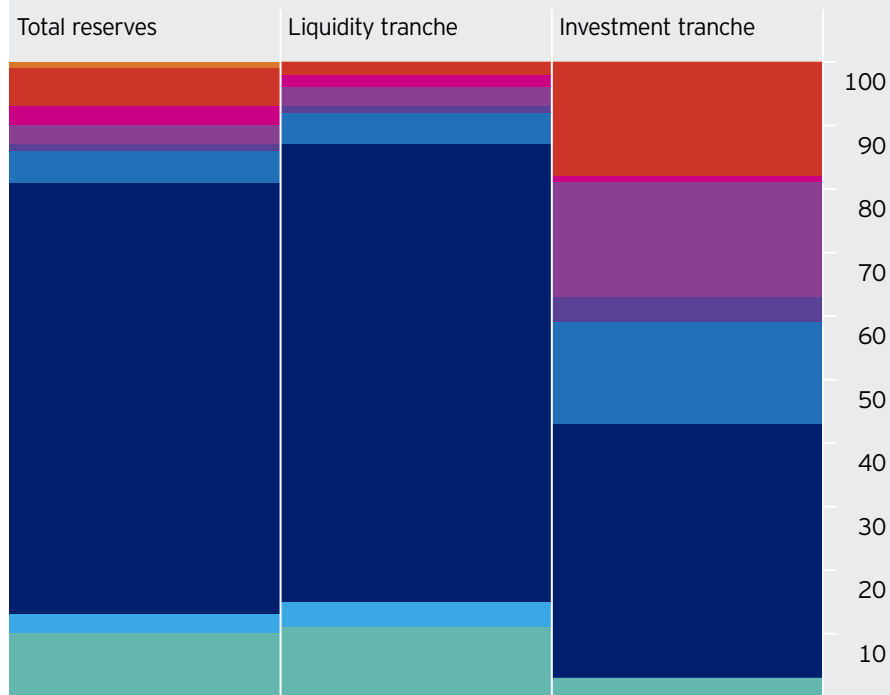
- Liquidity tranche
- Investment tranche
- Hold to maturity tranche
- Cash/working capital tranche



Sample: 13. Sample comprises of central banks only. Data is not weighted by AUM.

Figure 16  
**Central bank allocations by tranche**  
(% of central bank assets), full year 2015

- Deposits with central banks
- Deposits with commercial banks
- Government bonds
- Agencies, Multi-Lats, Supra-Nats
- US Agency MBS
- Corporate bonds
- Gold
- Equities
- IMF reserve



Sample: 15. IMF = International Monetary Fund, MBS = Mortgage-backed securities, Multi-lats = Multi-laterals, Supranats = Supra-nationals, CBs = central banks. Sample comprises of central banks only. Data is not weighted by AUM.

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## Notes

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- <sup>1</sup> For the IMF Guidance Note policy papers and Reserves Adequacy Metric template, see [www.imf.org/external/np/spr/ara](http://www.imf.org/external/np/spr/ara).
- <sup>2</sup> "Assessing Reserves Adequacy, Further Considerations", 13 November, 2013, p 8.
- <sup>3</sup> IMF, "Guidance Note on the Assessment of Reserves Adequacy and Related Considerations", 2 June, 2016, pp 13-16; Available at [www.imf.org/external/np/pp/eng/2016/060316.pdf](http://www.imf.org/external/np/pp/eng/2016/060316.pdf)
- <sup>4</sup> IMF Policy Paper, "Proposed new grouping in WEO country classifications: Low income developing countries", 4 June, 2014, pp 3; Available at [www.imf.org/external/np/pp/eng/2014/060314.pdf](http://www.imf.org/external/np/pp/eng/2014/060314.pdf)
- <sup>5</sup> For a more complete discussion, see Invesco: Central Bank Reserves Management, Opportunities to Expand Investment Horizons, April 2016.
- <sup>6</sup> To download the full Invesco Global Sovereign Asset Management Study please visit [www.igsams.invesco.com](http://www.igsams.invesco.com) or speak with your usual Invesco representative.

03



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### **Abstract**

Market liquidity can be defined as the capacity to transact in adequate quantities over short timeframes without materially affecting asset prices. A decline in market liquidity poses several challenges for central banks with ample reserves, heightening the importance of strategic asset allocation, dynamic rebalancing across liquidity and investment tranches and the effective management of liquidity risk.

In our previous white paper we explored the relationships between a country's reserves adequacy, strategic asset allocation and dynamic rebalancing.<sup>1</sup> In this paper we turn our attention to the remaining consideration of managing liquidity risk, examining the issue in the setting of a market environment characterised by innovation, changing regulation and - not least with quantitative easing reversing course - potentially tighter global liquidity.

Crucially, we argue that central banks' management of liquidity risk, like their approach to strategic asset allocation, should not be rooted in a "set and forget" philosophy. Instead we advocate a framework based on defining eligible asset classes for discrete portfolio tranches and using alternative tools to "right-size" liquidity for potential intervention needs.

## I. Understanding liquidity risk

### Objectives and challenges

Broadly speaking, central bank reserves managers have three investment objectives: capital preservation, return and liquidity. The effective management of the last of these aims to maintain sufficient liquidity to meet potential drawdowns during both normal and crisis periods.

As reserves managers know only too well, market liquidity is not consistent. It shifts with market conditions and with the size, time interval and price of the position to be sold. Even if nothing else changes, a position may become less liquid as central bank reserves increase relative to the underlying market. A corporate bond portfolio may be liquid over seven days but not one. The price of liquidity can rise or fall as bond issues age, as investment banks close for the fiscal year and even as market-makers go on holiday. In over-the-counter (OTC) markets, at least during the most intense periods of financial crisis, liquidity can sometimes temporarily disappear altogether.

Reserves managers therefore need to pay close and constant attention to the underlying drivers of market liquidity. They also need to understand the potential liquidity dynamics within their own portfolios, the bulk of which consist of high-grade government bonds and gold – assets favoured not only for their deep liquidity but for their low credit risk and their ability to deliver countercyclical returns.

### Drawdowns, responses and the cost of liquidity

Unanticipated drawdowns on reserves are usually at their highest during periods of financial crisis, whether domestic or systemic. At such times, in a “flight to safety”, risk-averse investors tend to migrate away from emerging markets and other more risky assets and into

government bonds; in tandem, reserve currency central banks tend to respond by lowering interest rates – thus raising the price of government bonds just when other central banks may need to sell such assets.

As figure 1 shows, the combined impact of the flight to safety and the lowering of interest rates resulted in positive returns on US government bonds during nearly every systemic crisis over the past two decades. The “taper tantrum” of 2013, when rising rates in the US triggered outflows from emerging markets and simultaneous declines in US Treasuries, provided an exception – one that invites notice at a time when the central banks of the major reserve currencies (the US Federal Reserve, the Bank of England, the European Central Bank and the Bank of Japan) are again signalling their intent to lower or unwind their bond-purchasing activities.

Yet liquidity has a cost, and the real yield on reserve currency government bonds can be negative during long periods.<sup>2</sup> Moreover, the returns available from the 35-year bull run in bonds have come to an end as reserve currency central banks look to the eventual normalisation of monetary policy. Investments solely in government bonds can thus run foul of central banks’ other investment objectives: capital preservation and return.

One means that central banks with ample reserves can employ to achieve higher returns is to tier reserves into different tranches and define the universe of eligible asset classes based on the liquidity horizon. We touched on this practice in both of the earlier white papers in this series.<sup>3</sup> Here, beginning in the following section, we focus more specifically on how tranching and other financial instruments can be used to manage liquidity risk.<sup>4</sup>

Figure 1  
US government bonds: reaction to crisis periods

Scenario	Peak to trough periods		US Treasury return by maturity (USD, %)				EMBI return (USD, %)
	From	Until	3-mth	1-3 yr	10-15 yr	All	
Commodity fall	20/06/14	15/01/15	0.01	0.82	10.42	5.72	-3.12
Taper tantrum	01/05/13	25/06/13	0.01	-0.35	-7.81	-4.02	-11.08
Lehman collapse	28/08/08	09/03/09	0.57	3.16	7.02	6.38	-13.90
September 11	10/09/01	21/09/01	0.29	1.10	0.91	0.69	-3.53
Russian crisis	20/07/98	10/09/98	0.77	2.07	4.90	4.23	-32.08
Asia crisis	06/10/97	15/01/98	1.41	2.20	4.30	4.09	-8.35

Source: Bloomberg L.P., Bank of America Merrill Lynch, JPMorgan, internal calculations. Past performance is not a guarantee of future results.

### Tranching and other tools

Reserves are typically tiered into two main tranches: (i) a liquidity tranche, which is invested in highly liquid and countercyclical assets for intervention in currency markets or to support the financial system; and (ii) an investment tranche, which is invested in more pro-cyclical assets but with ample liquidity to replenish the liquidity tranche as and when needed.

The eligible investment universe for each tranche is defined by the liquidity time horizon for that asset class - i.e. the time required to liquidate an asset in the desired size in both normal and crisis market conditions. While foreign currency reserve assets must be liquid by definition,<sup>5</sup> the degree of liquidity varies based on the liquidity horizon of the portfolio tranche. Figure 2 shows an example of the liquidity tiering of assets in USD markets, based on the criteria of asset-class size, turnover in OTC markets and the existence of exchange-traded contracts.

As illustrated in figure 3, the widespread adoption of this approach was confirmed by the Invesco Global Sovereign Asset Management Study 2016, in which the majority of the central banks surveyed tiered reserves. Here we see the asset allocation of each tier on a combined basis. Government bonds dominate the liquidity tranche, while the investment tranche is diversified across assets with potentially lower liquidity - including government agencies/multilaterals and supranationals, equities, corporate bonds and US Agency mortgage-backed securities.

Beyond tranching, central banks can augment liquidity on a short-term basis through repo transactions, gold swaps and domestic currency swaps. Repo transactions allow central banks to raise liquidity by lending bonds against cash; gold held as London Good Delivery bars can be swapped for cash; and currency swaps can be used both to manage short-term exchange-rate pressure and to provide liquidity to the banking system. Futures contracts can also be used to enhance the management of liquidity risk, as we will discuss in more detail in the next chapter.

Figure 2  
Illustration of liquidity tiers in the US

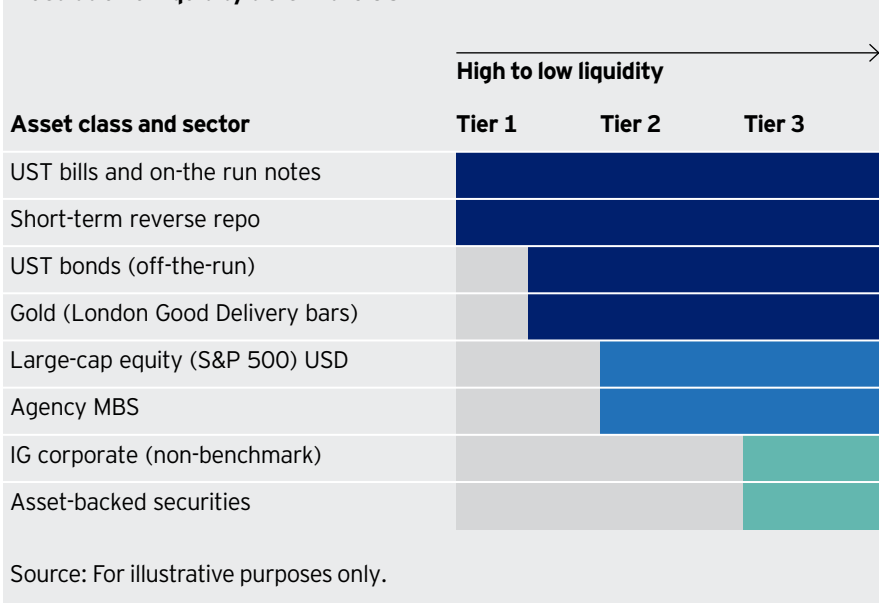
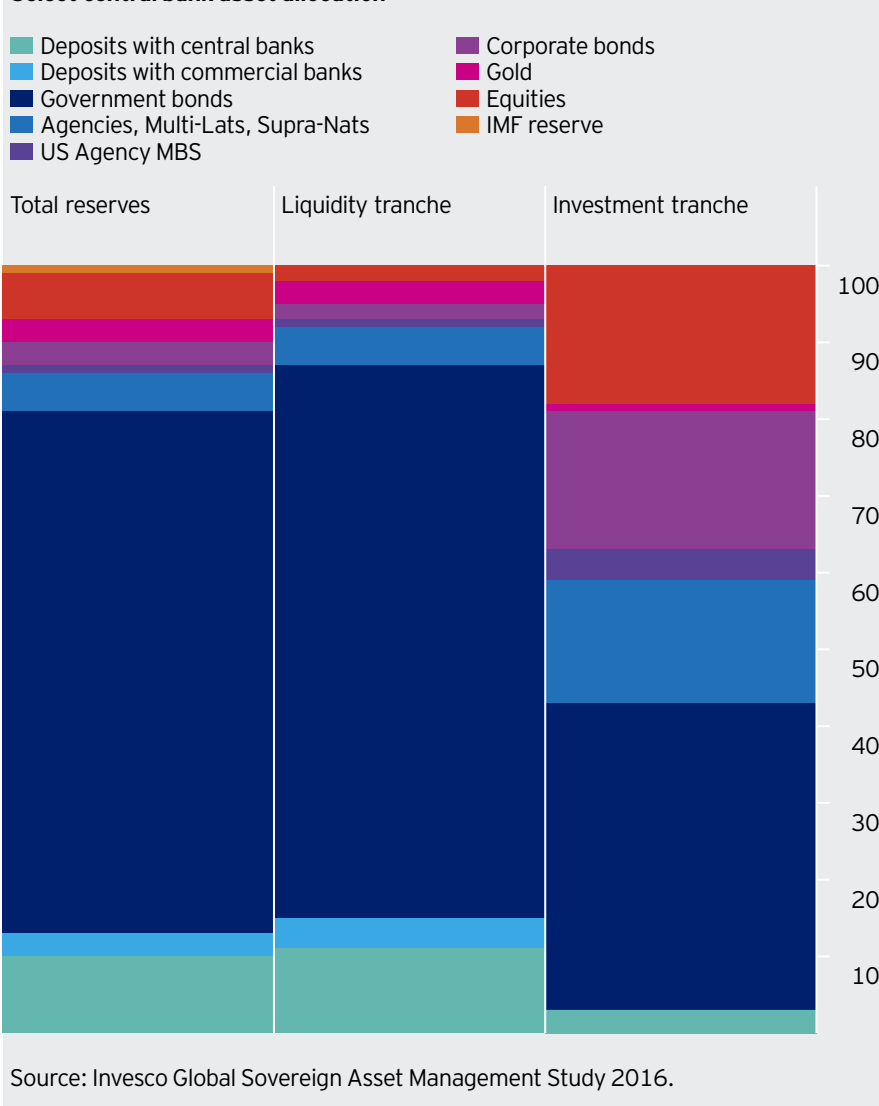


Figure 3  
Select central bank asset allocation



## II. Understanding market structure and liquidity dynamics

### Size matters

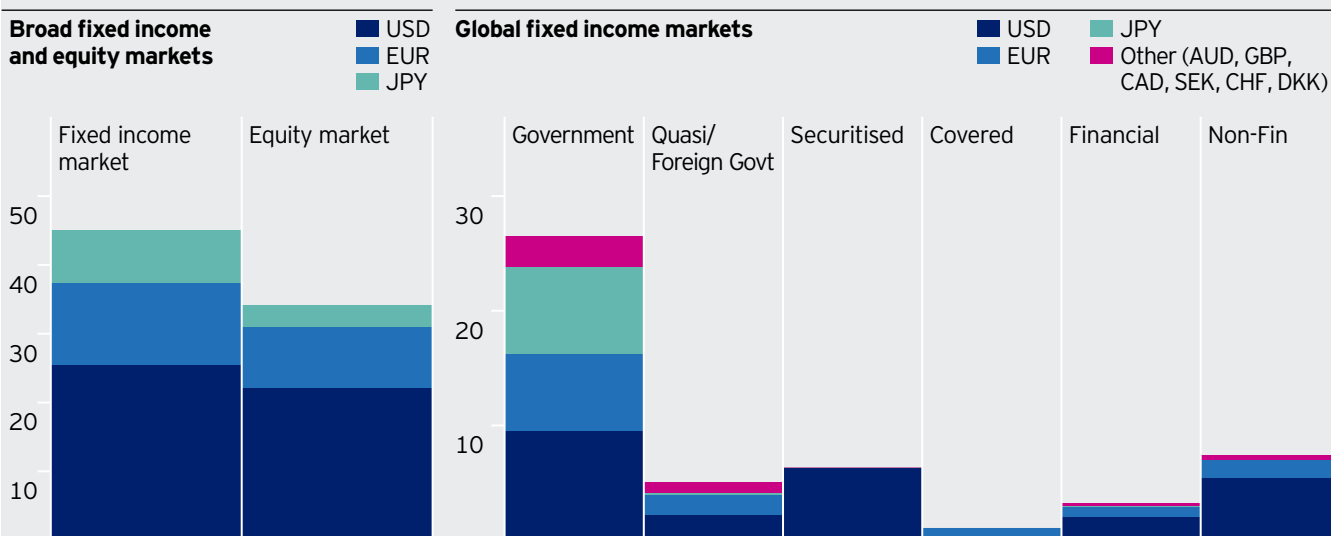
In this chapter we analyse numerous traditional indicators of liquidity. This will allow us to develop a richer picture of the myriad considerations that reserves managers must take into account when managing liquidity risk. An obvious starting point for such an analysis, at least for our purposes here, is the size of central bank reserves relative to the size of the traded market.

Each of the 10 central banks with the largest reserves holds more than \$370 billion in global financial assets, of which approximately 60% are USD-denominated. Each of the 10 central banks with the smallest reserves holds less than \$170 million. Figure 4 shows the relative size of global fixed income and equity markets based on broad market indices. Equity markets are nearly as large as fixed income markets within the US and Europe; within fixed income, government obligations dominate across the three major reserve currencies and comprise nearly the entire market in Europe and Japan.

As already acknowledged, though, market size offers only a starting point. Daily trading volumes serve as a better indicator of the size of a position that can be easily absorbed by the market without adversely affecting price. With this in mind, let us drill into the market liquidity of USD fixed income sectors.

Here, as figure 5 shows, the average trading volume reveals significant differences, with government bonds and mortgage-backed securities (MBS) the most liquid asset classes. The MBS market further splintered during the global financial crisis, with US Agency MBS retaining market liquidity while liquidity in so-called "private-label" issues disappeared. This illustrates another important feature of market liquidity: more standardised assets tend to be more liquid, as they are more likely to trade on futures exchanges and so benefit from an additional pool of underlying liquidity.

Figure 4  
Market capitalisation - USD trillion (based on broad market indices)<sup>6</sup>



Source: Bloomberg L.P., Bank of America Merrill Lynch, MSCI. Data as at 30 June 2017.

Source: Bank of America Merrill Lynch Global Fixed Income Markets Index Bloomberg, Bank of America Merrill Lynch, MSCI. Data as at 30 June 2017.

Figure 5  
Market liquidity of USD fixed income sectors

	Treasury	MBS	Agencies	ABS	Corporates	S&P 500
Outstanding bond debt (\$bn)	13,908	8,921	1,972	1,337	8,517	18,879
Average daily trading volume (\$bn)	512.5	212.4	5.3	1.3	29.6	35.2
Daily trading volume/market cap (%)	3.7	2.4	0.3	0.1	0.3	0.2

Source: SIFMA, as at end of 2016.

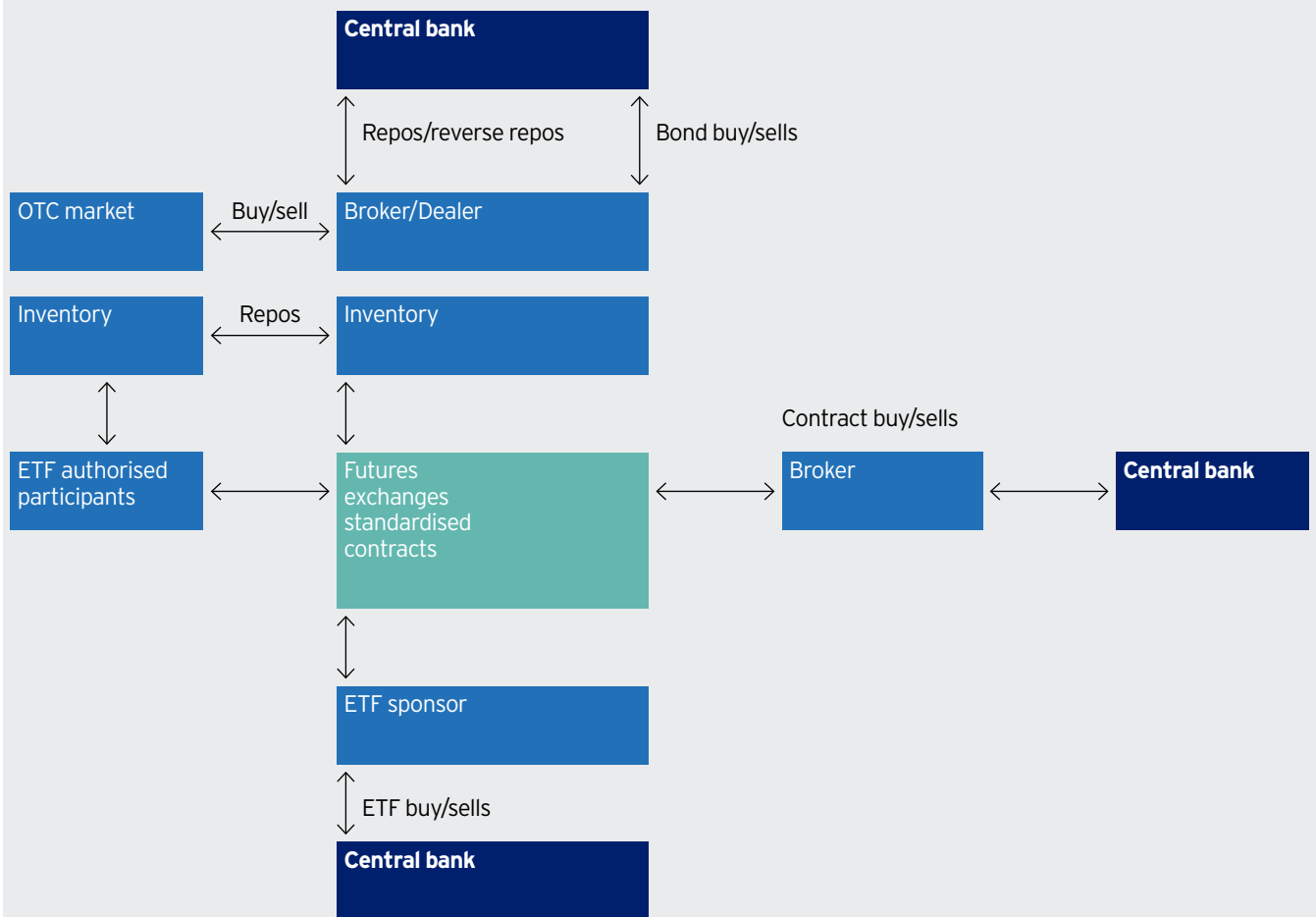


**A market of multiple agents**

The list of providers of liquidity in any market encompasses multiple agents. Relatedly, the degree of liquidity in any single asset class depends on the level of inventory in OTC markets and the depth of repo and exchange-traded markets. In this section we examine more closely the various dynamics at play, including the impact of innovation and regulatory change, using as our model the market structure for US financial assets shown in figure 6.

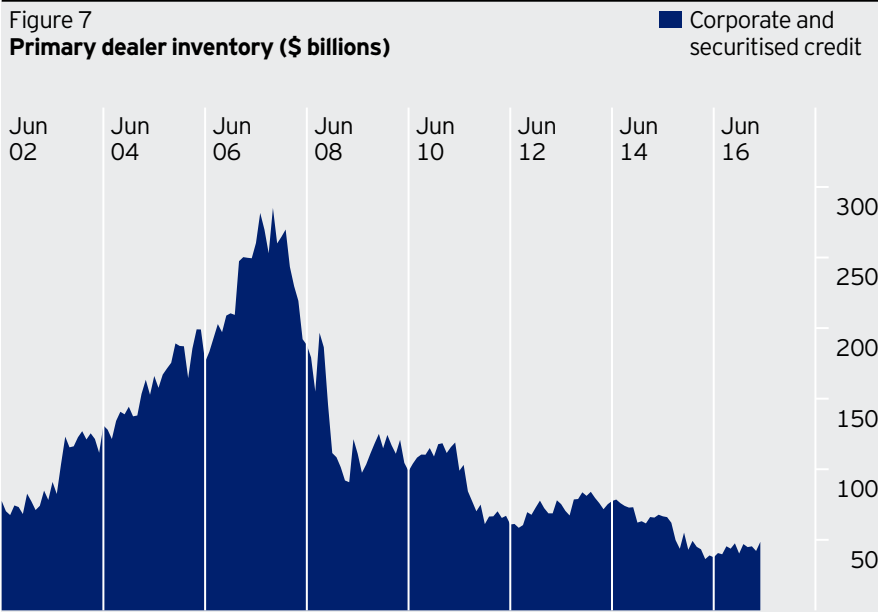
The primary providers of liquidity for central banks are brokers/dealers. These make markets between buyers and sellers of securities in OTC markets and hold positions on their own books. Although some central banks may also use electronic trading platforms, relationships with brokers/dealers have long been seen as key - not just to ensuring liquidity during periods of market stress but to obtaining market information.

Figure 6  
**Market structure**



Source: For illustrative purposes only.

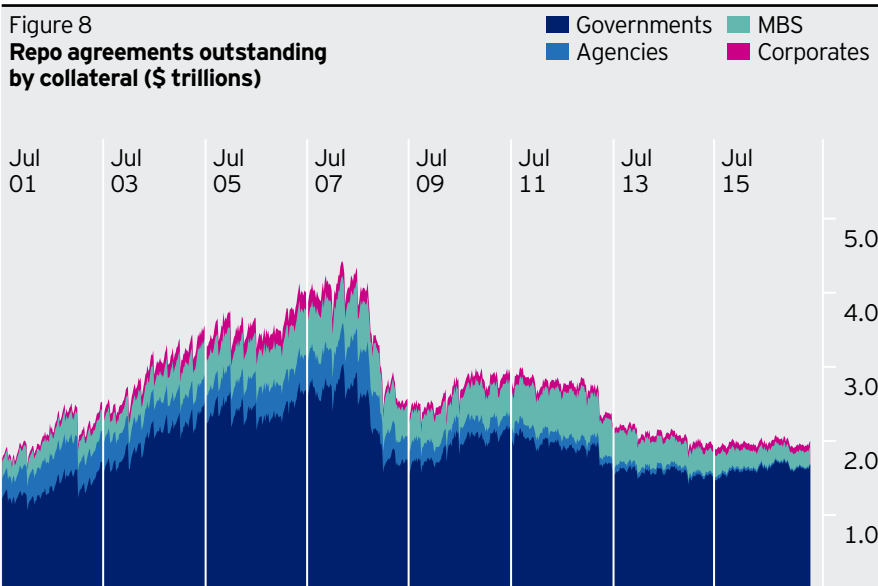
It is worth noting, however, that regulatory changes have negatively affected the willingness and ability of brokers/dealers to hold inventory. Dodd-Frank capital requirements have made it more expensive for banks to hold securities in inventory, and the Volcker Rule – which is currently under review – prohibits commercial banks from proprietary trading, which is defined as holding assets beyond a threshold time period. As figure 7 shows, this has resulted in a precipitous decline in inventories in OTC markets.



Source: Federal Reserve Bank of New York. As at 31 May 2017.

Repo markets are another important driver of market liquidity. They allow dealers to source bonds to cover sales and to finance inventory. However, the size of the repo market has mirrored the decline in dealer inventory, further depressing liquidity.

In addition, collateral has become more concentrated in US Treasuries, with a small fraction of outstanding agreements backed by Agency MBS and only negligible amounts in US Agency and corporate bonds. As figure 8 shows, this essentially limits additional liquidity from repo transactions to the size of government bond holdings.



Source: SIMFA, Federal Reserve Bank of New York. As at 24 May 2017.

Financial exchanges provide OTC markets with an underlying layer of liquidity. Exchange-traded markets offer real-time liquidity in standardised contracts across Eurodollars, government bonds and equity markets. Brokers/dealers are more willing to make markets in cash securities when they can hedge the market risk on an exchange.

For the purposes of portfolio management, exchange-traded contracts allow reserves managers to separate market risk from liquidity risk. Specifically, central banks can enter into “overlay” positions by buying futures contracts and investing cash on a short-term basis. Reserves managers can also use futures contracts to separate liquidity, credit risk and market risk - for example, by locking in six-month deposit rates by purchasing a strip of Eurodollar futures contracts and investing cash overnight. Finally, reserves managers can hedge the market risk of investments during periods of dislocation in the cash market. Despite the appearance of “flash crashes”, futures exchanges still offer more continuous trading than OTC markets and are an important component of managing liquidity.

Exchange-traded funds (ETFs) bridge OTC and exchange-traded markets. They allow reserves managers to access a diversified investment in an asset class or a sub-sector at a relatively low cost and with real-time liquidity. Investment in an ETF represents a share in an underlying pool of securities or gold, managed by an “Authorised Participant” able to create/redeem shares through purchases/sales in the underlying market.

ETFs enjoy a dual layer of liquidity. They benefit both from transactions on the exchange between buyers and sellers and from transactions in OTC markets as shares are created or redeemed. Under healthy market conditions they represent a convenient means of investing in an asset class and achieving diversification with good liquidity. That said, because ETFs did not emerge as a significant investment vehicle until 2010, it should be noted that the market has not yet been tested during a serious liquidity crisis.

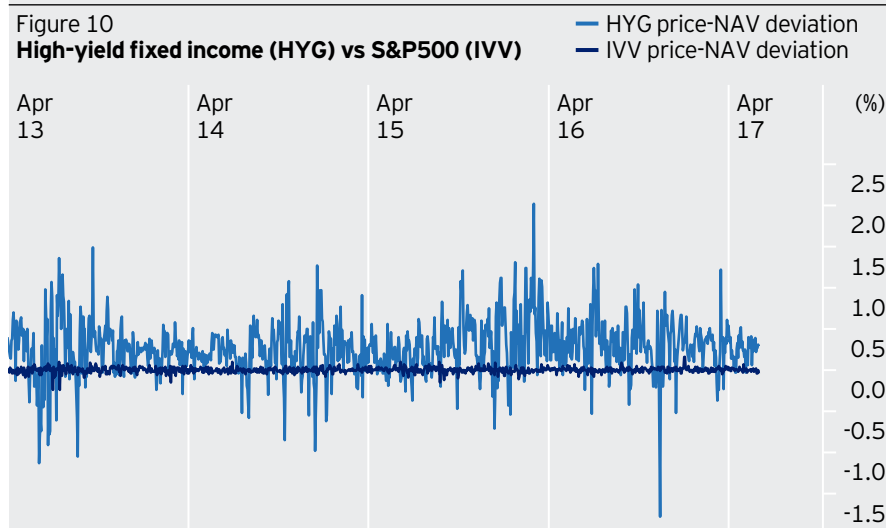
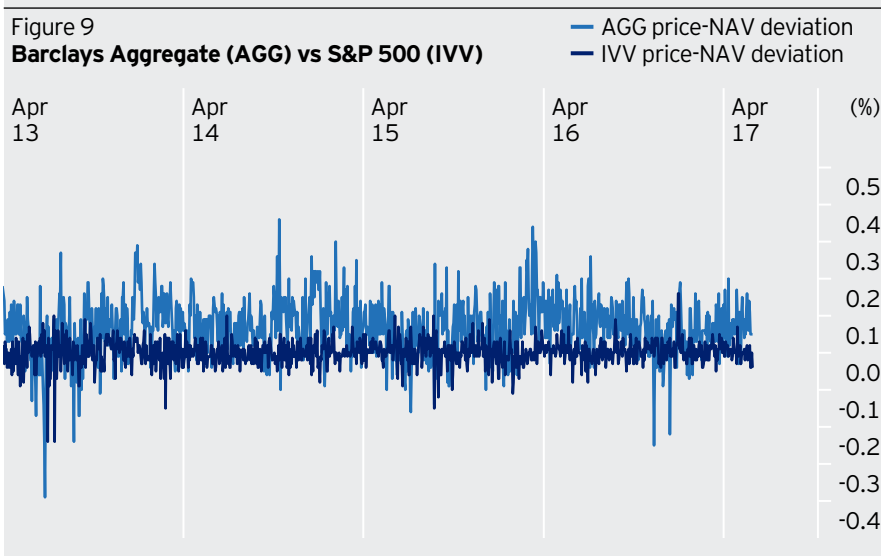
#### A brief note about volatility

Market volatility negatively affects market liquidity, with its impact varying across underlying asset classes. The effect is passed through to the ETF market. By way of illustration, figures 9 and 10 show the differential between the market price of an ETF and the net asset value of the underlying securities.

In completely liquid markets, thanks to the arbitrage activities of Authorised Participants, this difference should be negligible. In reality, however, the differential spikes during periods of market volatility, as demonstrated by the taper tantrum of 2013.

The differential is higher in less liquid asset classes. As shown in figure 9, it is relatively small and quickly disappears in highly liquid markets such as the S&P 500; in the high-grade fixed income market (Barclays Aggregate) it is moderately greater. Substantial and persistent spikes occur in the less liquid high-yield fixed income market, as can be seen in figure 10.

Figure 9 and 10  
**Volatility in the ETF market: historical differential between market price and net asset value, 31 March 2013 to 30 April 2017**



Source: Bloomberg: “AGG”-- iShares ETF tracking the Bloomberg Barclays U.S. Aggregate index; “IVV”-- iShares ETF tracking the S&P 500 index; “HYG”--iShares iBoxx \$ High Yield Corporate Bond ETF that seeks to track the investment results of an index composed of U.S. dollar-denominated, high yield corporate bonds. This is not to be construed as an offer to buy or sell any financial instruments and should not be relied upon as the sole factor in an investment making decision.

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### III. Concluding remarks

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With central banks pumping liquidity into the global market as part of quantitative easing, liquidity conditions since the financial crisis of 2007 and 2008 have been relatively benign. As a result, notwithstanding the twin declines in broker/dealer inventories and daily turnover during the past decade, asset-class liquidity has not emerged as a problem.

In a world of risk-on/risk-off trades, however, the winding down of quantitative easing could trigger greater market volatility and lead to tightened liquidity conditions in certain asset classes. Major reserve currency central banks have signalled the potential for the tapering or reversal of their government bond-purchasing programmes as the worldwide economy picks up speed, and another taper tantrum - or even a tremble - could negatively affect the prices of government securities and emerging market assets. Should such a situation be realised, central banks may rely on some of the alternative tools discussed here to manage liquidity risk and deliver short-term market stability.

As we have seen, liquidity tranches invested in government bonds can provide a further liquidity bulwark in a risk-off scenario. In a risk-on scenario, meanwhile, investment tranches can provide positive real returns over time and may also be used to rebalance liquidity tranches in response to shifts in a country's external risk position. In other words, flexibility and foresight are key; inertia and inattentiveness are ill advised. Ultimately, in a highly dynamic environment shaped by multiple agents and influences, "set and forget" is not an option.

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## Notes

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- <sup>1</sup> See Central Bank Foreign Currency Reserves Management: Balancing Stability and Return, Invesco, 2017.
- <sup>2</sup> This point is discussed in more detail in Central Bank Foreign Currency Reserves Management: Balancing Stability and Return, Invesco, 2017.
- <sup>3</sup> See Central Bank Foreign Currency Reserves Management: Opportunities to Expand Investment Horizons, Invesco, 2017, and Central Bank Foreign Currency Reserves Management: Balancing Stability and Return, Invesco, 2017
- <sup>4</sup> Although related, liquidity risk and market risk should not be conflated. They are distinct and need to be managed separately.
- <sup>5</sup> The IMF has published extensive guidelines for the management of foreign currency reserves. See, for example, [www.imf.org/en/Publications/Manuals-Guides](http://www.imf.org/en/Publications/Manuals-Guides).
- <sup>6</sup> Source: MSCI Inc. Neither MSCI nor any other party involved in or related to compiling, computing or creating the MSCI data makes any express or implied warranties or representations with respect to such data (or the results to be obtained by the use thereof), and all such parties hereby expressly disclaim all warranties of originality, accuracy, completeness, merchantability or fitness for a particular purpose with respect to any of such data. Without limiting any of the foregoing, in no event shall MSCI, any of its affiliates or any third party involved in or related to compiling, computing or creating the data have any liability for any direct, indirect, special, punitive, consequential or any other damages (including lost profits) even if notified of the possibility of such damages. No further distribution or dissemination of the MSCI data is permitted without MSCI's express written consent.

04

#### **Abstract**

In this fourth white paper of our central bank reserve management series, we explore the question of active management in the context of central bank reserves management. Drawing on empirical studies and behavioural finance, we assess the potential outcomes and pitfalls of passive vs active management at each stage of the investment management process: the strategic asset allocation, tactical asset allocation and active management vs a market benchmark.

Central banks as an investor segment face common advantages as well as disadvantages in seeking to enhance portfolio returns through active management. In addition, each central bank faces unique policy and institutional constraints. We find it important for a central bank to articulate its investment beliefs regarding its ability to add value through active management at each stage of the investment management process. Such beliefs should inform the formulation of rules, risk limits and guidelines governing central bank portfolio managers and their agents.

At the policy level, we argue that a rules-based approach is superior and investment returns can suffer when decision-makers seek to time market turns. At the portfolio manager level, however, our empirical studies indicate that active portfolio managers tend to beat market benchmarks, before costs, but outcomes differ across asset classes and time.

Active management can contribute to the role of financial markets in allocating credit and capital as buyers and sellers are driven by their views of market valuation as well as the cyclical and structural trend outlook for growth, inflation and relative price performance across the global economy, national economies, economic sectors and even individual firms. This stands in direct contrast to passive index replication strategies, which effectively follow market momentum and market capitalization, inducing pro-cyclicality in asset and instrument selection. In addition, central bank reserve managers can play an important role in stabilizing financial market conditions by behaving counter-cyclically when called for by their economic or financial stability mandates.

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## I. Central bank reserves management and the active vs passive debate

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Since the introduction of Modern Portfolio Theory<sup>1</sup> (MPT), investors and academics have debated whether astute portfolio managers can beat the market through active management. MPT was built on assumptions that markets are efficient and investors rational. Under this construct, market prices incorporate all public information and active management is a loser's game. A generation later, behavioural finance theorists countered that investment decisions are not purely rational and fall prey to common traps including emotions, the actions of others, mental accounting, anchoring and risk aversion – just to name a few.<sup>2</sup> Behavioural finance proponents argued that some active managers could beat the herd through intellectual rigor, superior research and mindfulness. Over the last decade, the pendulum swung back in favour of “passive” investing, partly due to a number of high systemic risk events and ensuing central bank responses, which caused risk assets to move in tandem. And, the emergence of ETFs provided a cost-effective vehicle for investors to simply replicate the market. Despite a record ten years of new net inflows from active into passively managed strategies, however, substantially more assets are still actively managed, indicating that the jury is still out on this debate in the minds of many investors.<sup>3</sup>

Indeed, it is possible that further increases in passive index strategies may occur as the market rebalances from active to passive; this would not necessarily imply that active management is an outmoded investment style, even if it did indicate that passive has considerable room to grow relative to active assets under management. Finally, the shift towards passive may even increase the opportunities for active strategies because of the diminishing role of contrarian investing based on diverging views on economic prospects, valuations or firm-level performance.

This white paper addresses the following questions, which central banks encounter at each stage of the investment management process.

- Should a central bank simply invest in a market-neutral strategic asset allocation (SAA) or seek to enhance returns by incorporating market views?
- Should an investment committee engage in tactical asset allocation?
- Does it “pay” for portfolio managers to actively manage versus market benchmarks and, if so, how to effectively limit the downside?
- Is diversification across multiple, independent portfolio managers worth the additional cost?



## II. Rebalancing to the SAA as a potential source of return

For reserves managers, risk is an investment return below a specified minimum threshold. To meet the investment objective of capital preservation, this threshold is normally expressed as a positive total return with a high degree of probability over the appropriate horizon.<sup>4</sup> This objective is then embodied in a strategic asset allocation, designed to maximize return while respecting capital preservation and other policy constraints. In theory, the strategic asset allocation would be devoid of “market views” and, as such, is the ultimate “passive” portfolio. In reality, modelling relies on assumptions regarding future risk, returns and correlations amongst asset classes. Market views seep into expected returns, the future can differ from the past and actual returns may fall below the minimum threshold. Nevertheless, from the perspective of the central bank, the strategic asset allocation is deemed “the risk free portfolio” and any deviation represents risk. When returns fall below the minimum threshold, central banks typically either accept the occasional negative “outlier”, or may dynamically hedge through an overlay when the minimum is approached. A few central banks are experimenting with an explicitly market neutral approach by adopting a risk parity portfolio to achieve diversification without any bias with respect to market direction and expected returns.

While the SAA, or risk parity approach, is a passive strategy, periodic rebalancing is required to keep the actual portfolio aligned with the policy portfolio. This raises the question of whether to allow decision makers to “time” the rebalancing based on market views or rather to do so “automatically” based on a set of rules. Behavioural finance and practitioners would argue for the latter.<sup>5</sup> Rules set in advance counter the behavioural tendency to delay buying during periods of market sell-offs, when fear dominates, and to avoid selling when the market is rallying. Rule-based adjustments represent a contrarian action and potentially powerful source of return. The SAA has fixed weights associated with each portfolio component—whether currency, asset class or sector allocation. Rebalancing is by definition counter-cyclical as it requires selling assets that have done relatively better, and are thus overweight. Inversely, rebalancing requires buying assets that have performed relatively more poorly.

The strategic asset allocation typically includes a “risk envelope” for active management or tracking error. The total risk envelope may be expressed as a nominal amount or in terms of basis points of portfolio return. This risk envelope is then allocated downstream to decision-makers—investment committees and portfolio managers—giving allowances for both tracking error and, where deemed appropriate, active management within a set of limits and guidelines.

Figure 1

### Hierarchy of portfolio risks

Policy portfolio



Tactical asset allocation



Portfolio management

Source: For illustrative purposes only.

## III. The investment committee and tactical asset allocation pitfalls

In formulating the strategic asset allocation, analysts seek to create a long-term “neutral” policy portfolio, devoid of market views. The shortcoming of this approach is that actual market levels and valuations are not taken into account. The Chief Investment Officer, or an investment committee, may subsequently overlay a tactical asset allocation based on a set of investment beliefs. This level of active risk taking, however, can be fraught with difficulties, particularly when undertaken by committee. First, outperformance by definition requires a contrarian view from the “market”, difficult for a committee. Second, even when the view on relative valuations is correct, the markets may not revert until well beyond the committee’s horizon and ability to hold the position. And, when that is the case, the closing of losing positions may be done at extenuated adverse levels.

Empirical studies in behavioural finance suggest that investment committees are particularly challenged in seeking to take contrarian market views for reasons embedded in human biases. These behavioural pitfalls include herd behaviour, which results in “chasing performance”, loss aversion and “group-think”. Loss aversion is the well-documented human tendency to “take profits” too early and to hold or double down on losing positions. And, empirical studies on decision-making in committees reveal a strong tendency towards “group-think”, whereby individuals conform to what they perceive to be the prevailing view of the group. In a hierarchical setting, a variant can occur when an investment committee is headed by a superior and participants shy from disagreeing with his or her view.

An investment committee, however, can add substantial value to the investment process by: (i) articulating investment beliefs regarding the potential for the central bank to outperform specific market segments; and (ii) incorporating such beliefs in a set of corresponding market risk limits and guidelines specific to each tranche and asset class.

“The best way of investing counter-cyclically is to institutionalize contrarian investment behaviour. A strict rebalancing rule is a robust way of doing this.”

**Knut Kjaer**

Former CEO of the Norges Global Pension Fund

## IV. Prospects for actively managing vs market indices

### Central bank strategic advantages and disadvantages relative to the market

"Investment beliefs" articulate an institutional investor's beliefs regarding active management in general and the investor's specific advantages relative to other market participants. While central banks differ amongst themselves, they do share some common characteristics that can give central banks an advantage at times. First, central banks tend to be "long" countercyclical assets and are not "leveraged" in the traditional sense. They thus can benefit by buying during periods of elevated risk aversion and short-term mis-pricings when others are forced to sell. Second, central banks are generally "long" the reserve currency, the USD, and can also benefit from providing USD to markets during periods of USD shortages when such conditions are reflected in the forward foreign exchange prices ("points"). Specifically, such shortages translate into favourable rates on USD short term foreign currency swaps and central banks can often outperform by investing in short term foreign government bills and swapping them back into USD investments at yields higher than those available in domestic markets.

A longer term investment portfolio or tranche also provides central banks with opportunities to outperform market indices. First, central bank reserves tend to be invested mainly in fixed income assets, which generally offer greater opportunities for outperformance as discussed in more detail below. Second, central bank reserves are not leveraged, which allows reserve managers to profit from periods of elevated risk aversion and short-term mispricings that arise during liquidity crises (this counter-cyclical investing also helps stabilize markets). Central banks with high levels of reserves adequacy can also reap the "liquidity premium" in their longer-term reserves by accepting short-term volatility for higher long-term investment returns.

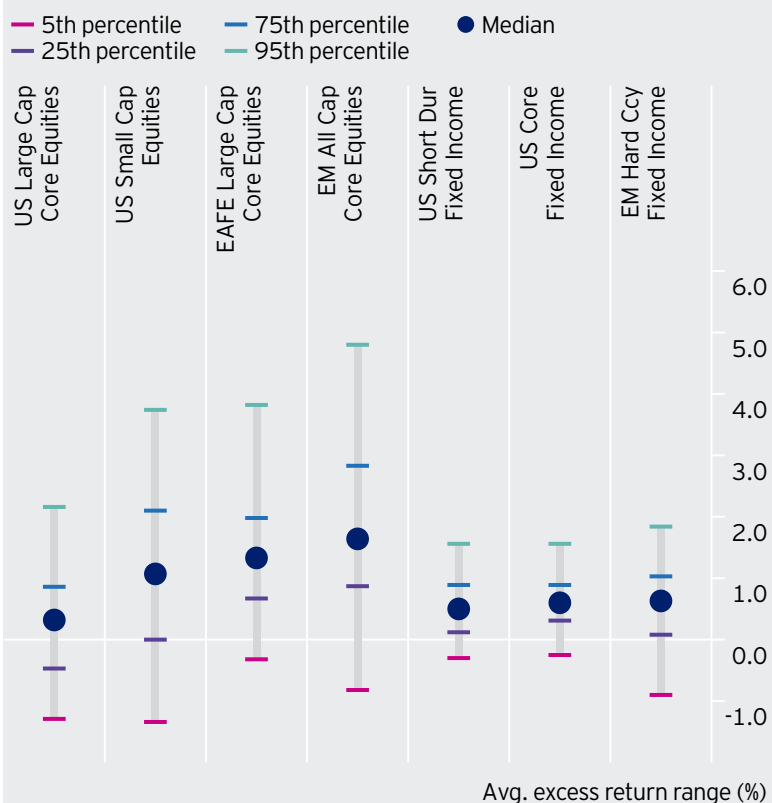
Disadvantages include the central bank's primary mission of monetary policy and fostering confidence in markets, which can present conflicts of interest when managing large global portfolios of financial securities. Central banks need to tread carefully in their portfolio actions to avoid "tainting" their reputation by holding securities of issuers that may be troubled and not "signalling" to the market by selling the same. Following from the central bank's financial stability objectives, reserves managers need also to avoid destabilising markets through "herd" behaviour during periods of financial stress. A recent IMF study attributed central bank pro-cyclical portfolio actions to contributing to the severity of the Great Financial crisis as reserves managers joined private investors and simultaneously reduced portfolio risk.<sup>6</sup>

Other disadvantages relate to a central bank's public service structure and human resource regime, which does not incentivise "risk taking" by rewarding financial performance. This can constrain the level of excess return achievable through internal management and is the reason why many central banks favour "enhanced indexation" as an investment style. For these reasons and others, reserves managers often seek external agents or investment products to generate alpha, diversify the sources of return, or create a reputational buffer between the central bank and its potentially market-moving actions with the investment tranche of its portfolio, thereby helping to mitigate or avoid communication or signalling issues.

### Prospect for outperformance of market indices across asset classes

Our empirical studies indicate room for outperformance through active management. As illustrated in figure 2, the typical active managers outperformed market capitalization weighted indices before fees, with significant differences across and within each asset class. Within fixed income, at least three-quarters of active managers outperformed the index across the three sectors shown. And, within USD fixed income short duration and core, underperformance was quite contained at less than 50 basis points. Active management vs equity indices differed substantially both relative to fixed income and within the sector. Equity managers were most challenged when seeking to outperform large cap stocks. Consistent with the Efficient Markets Hypothesis, about half of the managers reported outperforming the index and the other half underperformed. Market segments characterized by relatively lower levels of liquidity fared better with over three quarters of managers outperforming indices including small cap, international and emerging market indices.

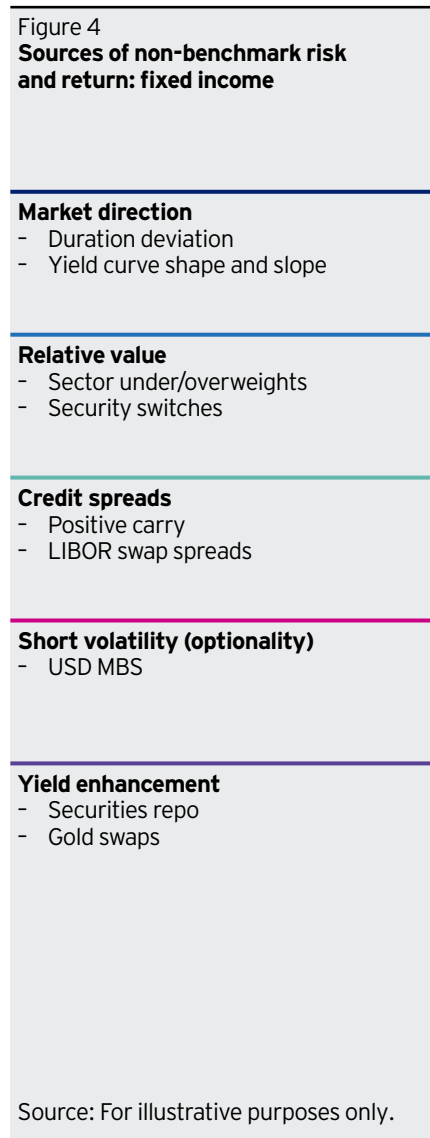
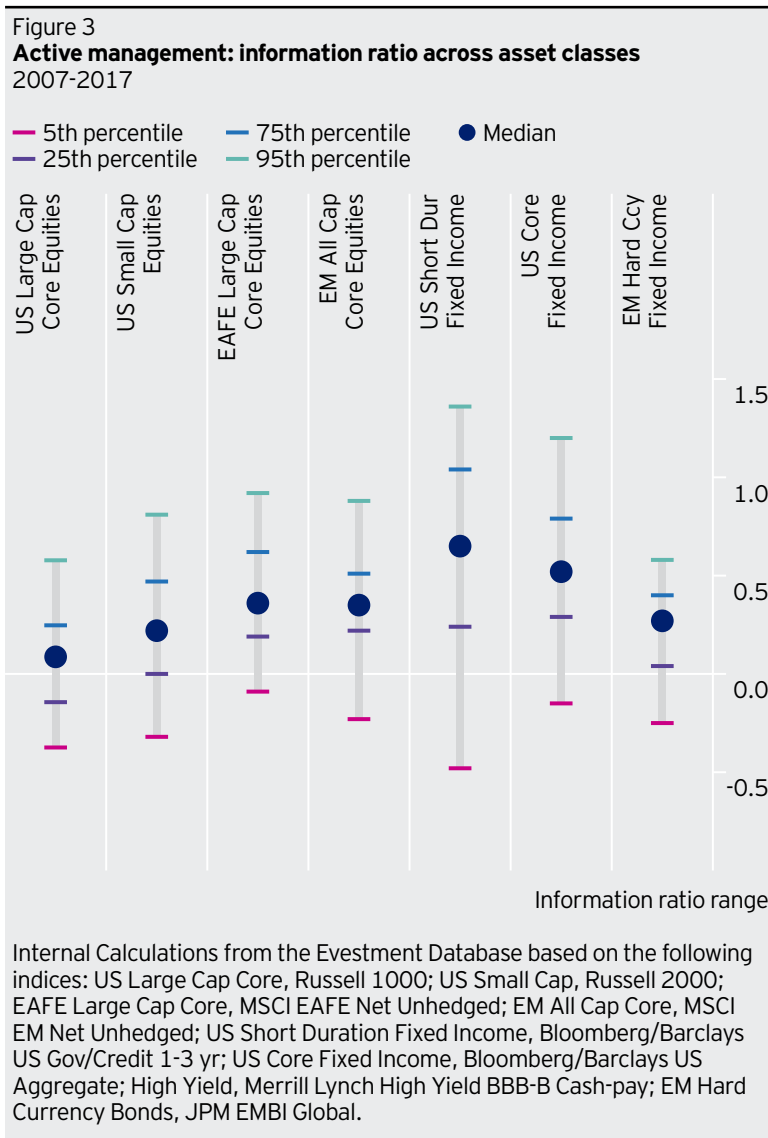
Figure 2  
Excess return from active management across asset classes  
2007-2017



Internal Calculations from the Evestment Database based on the following indices: US Large Cap Core, Russell 1000; US Small Cap, Russell 2000; EAFE Large Cap Core, MSCI EAFE Net Unhedged; EM All Cap Core, MSCI EM Net Unhedged; US Short Duration Fixed Income, Bloomberg/Barclays US Gov/Credit 1-3 yr; US Core Fixed Income, Bloomberg/Barclays US Aggregate; High Yield, Merrill Lynch High Yield BBB-B Cash-pay; EM Hard Currency Bonds, JPM EMBI Global.

Fixed income also offered a more efficient use of risk as illustrated by the information ratios, a measure of how much active risk is consumed. The information ratio indicates the risk-adjusted excess return as the ratio of excess return or alpha to the tracking error, or the volatility of excess returns. Based on the median outcome, actively managed US fixed income uses risk more efficiently than all equity markets. Or, in other words, actively managed US fixed income uses less risk per unit of excess return.

The reasons why fixed income may be more propitious for active management can be explained by both the nature of the fixed income market as well as the standard benchmarks against which performance is measured. First, the fixed income market is highly segmented with pension funds, insurance companies and central banks being “captive” buyers of certain maturity segments to meet their policy objectives. As such, they may be less price sensitive leading to opportunities for arbitrage along the curve. The standard fixed income benchmarks themselves are highly imperfect and inefficient portfolios. First, the composition is based on market capitalization weights, which reflect the relative size of total debt issuance. Replicating a broad fixed income benchmark thus entails investing in those sectors and issuers with the most debt. Finally, the largest component of broad fixed-income benchmarks is US Treasury securities, which are associated with lower yields relative to other investment grade (IG) securities that bear credit risk. Finally, there is an array of active management strategies available to fixed income portfolio managers, which allow them to diversify and tap more sources of return relative to the equity markets.



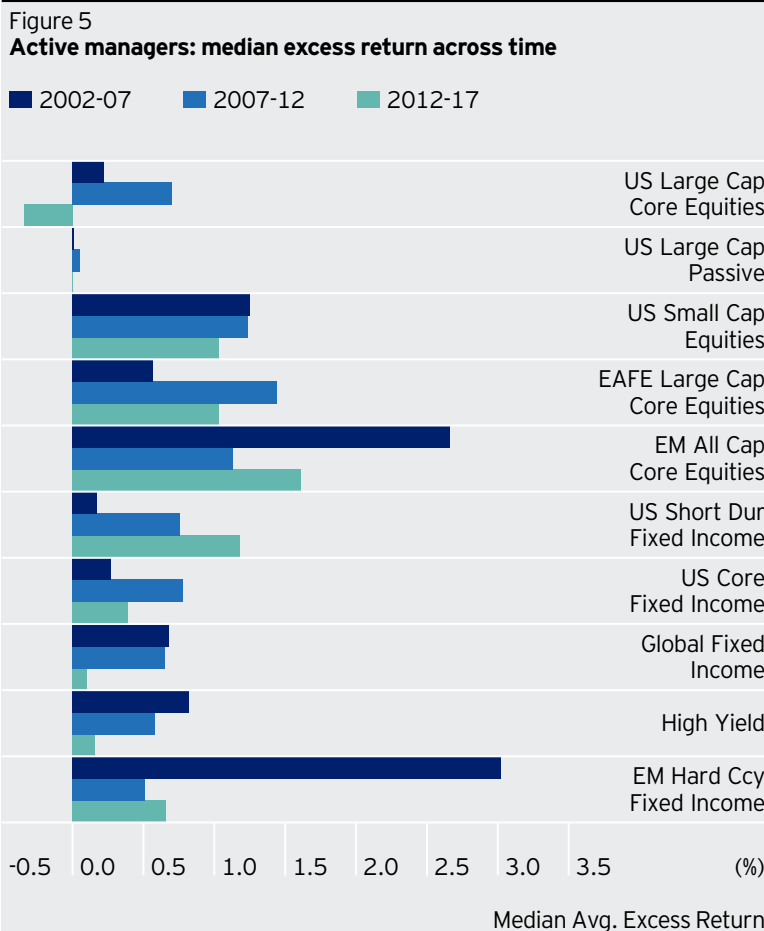
## V. Downside protection and risk management

### Prospect for outperformance versus market indices across time

Historical outperformance of active management has also followed broad trends over time. The past decade has been dominated by numerous instances of financial system risk – the global financial crisis, the euro crisis and Brexit – to which central banks responded by monetary easing. This led to a market characterized by “risk-on/risk-off” whereby risk assets moved in tandem responding to shocks, making it more difficult to outperform indices through differentiation based on the assessment of risks relative to valuations.

The decline in alpha over time is observable in the equity markets in figure 5. In the case of USD Short Duration Fixed Income, however, outperformance by the median manager increased substantially over the three sub-periods analysed. This can be attributed to a systematic tendency of active managers to be overweight higher yielding securities with greater credit risk, discussed in more detail below, and the positive performance of credit securities from 2007-17.

While our empirical studies indicate that there is room for reserves managers to outperform market capitalization benchmarks, active management incurs costs. Internally, active management requires a fairly substantial investment in risk management and reporting systems. And, externally active managers charge higher fees than for passive mandates. Any decision to actively manage needs to be made based on the prospects for outperformance by sector and a full assessment of the costs and reputational risk.



Internal Calculations from the Evestment Database based on the following indices: US Large Cap Core, Russell 1000; US Small Cap, Russell 2000; EAFE Large Cap Core, MSCI EAFE Net Unhedged; EM All Cap Core, MSCI EM Net Unhedged; US Short Duration Fixed Income, Bloomberg/Barclays US Gov/Credit 1-3 yr; US Core Fixed Income, Bloomberg/Barclays US Aggregate; High Yield, Merrill Lynch High Yield BBB-B Cash-pay; EM Hard Currency Bonds, JPM EMBI Global.

As discussed earlier, the cornerstone of risk management is a clear definition by the board or governing body of the minimum threshold level of return. The definition is multi-faceted and includes not only the minimum level but also the tolerance for breaching the minimum on occasion and, relatedly, the expected severity when breached. Importantly, the investment horizon for achieving the minimum threshold needs to be defined. The shorter the investment horizon, the lower will be the risk bearing capacity and, consequently, portfolio returns on average over time. At the highest level, the majority of risk will be embedded within the strategic asset allocation, which will typically define at least 85% of the portfolio risk and return. The remaining risk, expressed either as basis points of return or as a nominal amount, is allocated downstream for the purpose of unavoidable tracking error as well as active management. This amount is at times referred to as a risk allowance or maximum shortfall.

In constraining the downside, risk management needs to encompass both past cumulative excess return as well as the potential for future underperformance. Cumulative excess return captures the results of the risk taken to date and ex ante risk measures capture the potential future underperformance based on assumptions regarding the probability and magnitude of an adverse market move. Both are necessary in constraining the downside and different tools address each risk. Cumulative performance (excess return) tracks what has happened and what cannot be changed. If cumulative underperformance is deemed excessive, positions may be closed or, more severely, risk reduced at the level of the strategic asset allocation (dynamic hedging). Forward-looking measures, include position limits for each significant risk factor as well as probabilistic measures such as ex ante tracking error, value at risk (VAR) and conditional value at risk (CVAR.)

Incentive systems and culture are also critical to preventing unacceptable outcomes. Internally central bank portfolio managers have little incentive to take unacceptable levels of risk and may, in fact, require explicit incentives or at a minimum assurance of a safe haven to take risk. On the other hand, performance fees can incentivise external asset managers to take undue levels of risk for private gain in the classic principal-agent dilemma first outlined by Adam Smith. For this reason, many central banks elect a flat fee compensation for external asset management services and weight highly strong risk management and reporting capacity in selecting and retaining external asset managers.

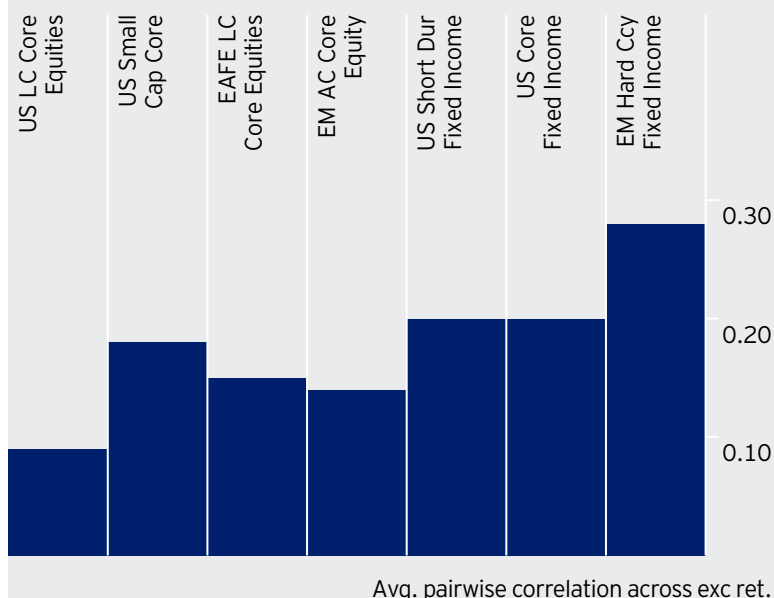
Finally, one of the most important aspects of risk management is clear communication with external stakeholders regarding possible outcomes, including downside risks before they happen. When stakeholders are surprised, portfolio adjustments may be required at the worst possible time resulting in realized losses.

## VI. Impact of diversifying across multiple managers

In theory, allocating risk to multiple, independent managers can improve outcomes as long as their results are less than perfectly correlated. Portfolio managers differ in styles and multiple managers can improve the risk/return profile of the reserves through diversification. Our empirical studies show, however, some correlation of results over the last ten years. This suggests that adding independent portfolio managers-whether internal or external-can be beneficial but only up to a point after which the incremental benefit may not exceed the cost. This appears to be particularly true in US fixed income markets where active manager outcomes were more highly correlated than in equities.

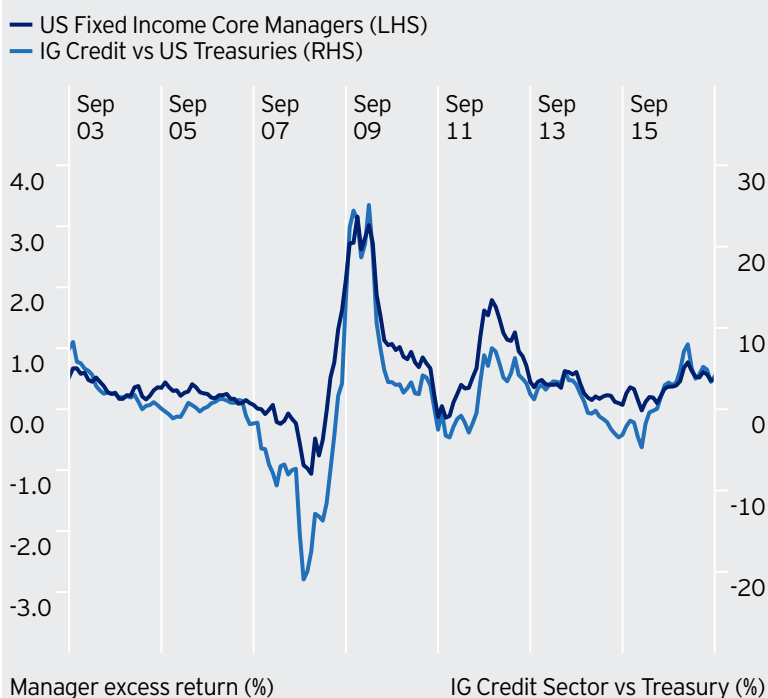
The reason for the higher correlation of outcomes amongst US fixed income core managers may be explained by a fairly similar and consistent credit sector overweight versus the benchmark among most of the fixed income asset managers. The US government and its agencies represent a large portion of any market capitalization weighted index because of their relatively large level of debt relative to the corporate sector. As US Treasuries have the lowest level of credit risk and, yield (within US dollar fixed income markets), switching into any lower grade fixed income security will result in positive carry. Portfolio managers are thus incentivised by the yield pick up to take this risk. Being "long credit" versus the benchmark means that a portfolio manager will tend to do better when credit spreads narrow and do worse when they widen. Figure 6 illustrates the performance of the median fixed income active manager together with the relative return of investment-grade credit over US Treasuries. The two lines follow a very similar pattern, suggesting that a persistent credit sector overweight played a significant role in core fixed income managers' excess performance.

Figure 6  
**Correlation of excess return of active managers across asset classes 2007-2017**



Internal Calculations from the Evestment Database based on the following indices: US Large Cap Core, Russell 1000; US Small Cap, Russell 2000; EAFE Large Cap Core, MSCI EAFE Net Unhedged; EM All Cap Core, MSCI EM Net Unhedged; US Short Duration Fixed Income, Bloomberg/Barclays US Gov/Credit 1-3 yr; US Core Fixed Income, Bloomberg/Barclays US Aggregate; High Yield, Merrill Lynch High Yield BBB-B Cash-pay; EM Hard Currency Bonds, JPM EMBI Global.

Figure 7  
**Investment grade fixed income: excess return of the median active manager and the performance of credit vs treasuries**



Internal Calculations from the Evestment Database: US Core Fixed Income, Bloomberg/Barclays US Aggregate; and Bloomberg/Barclays US Treasury.

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## Concluding remarks

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Central banks are important participants in financial markets and active management is critical not only to achieve excess returns but also for functioning markets. For a central bank, the question of active or passive management is a false dichotomy - both can and should exist at different levels of the investment decision making process, with active risk decisions taken by those portfolio managers closest to the market. Our studies illustrate that there is ample room to actively manage and outperform market capitalization weighted indices, particularly in fixed income markets, while controlling downside risks and central banks do have some advantages in seeking to enhance returns through active management relative to other market participants.

Central bank internal management is important for gaining insights into market dynamics and can be cost effective, particularly for more "generic" market segments such as governments and even investment grade fixed income. Central banks do come up against some obstacles when diversifying into new asset classes that require a fairly hefty investment in infrastructure or may pose reputational risk. For those and more unconstrained mandates, externalisation may be more cost effective and can generate excess returns within acceptable risk parameters when the incentive system is properly aligned.

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## Notes

- <sup>1</sup> Harry Markowitz, "Portfolio Selection", *Journal of Finance*, Vol.7, No 1 (March, 1952)
- <sup>2</sup> Daniel Kahneman and Amos Tversky are credited with the founding of behavioural finance with "Prospect Theory: An Analysis of Decisions Under Risk", *Econometrica*, 1979.
- <sup>3</sup> News.morningstar.com, "Active vs Passive in 11 Charts", January 17, 2018.
- <sup>4</sup> The important question of defining the appropriate investment horizon is discussed in detail in Invesco white paper #2, "Balancing Risk and Return", April 2017
- <sup>5</sup> "Investing for the Long Run", Andrew Ang, Knut Kjaer, November 11, 2011, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1958258](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1958258)
- <sup>6</sup> IMF.org: "Central Bank Reserves Management and International Financial Stability-Some Post-Crisis Reflections", by Bradley Jones, February 16, 2018.

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**Abstract**

This white paper delves into the attributes of a reserve currency from a historical perspective and considers the forces at play in the 21st century as China challenges the US for global economic leadership and major trading countries seek to develop alternatives to the USD in the sphere of global payments. The paper considers these questions within a broader framework of what attributes are required of a country for its currency to be accepted as major reserve currency. And, at a more micro level, what are the policy considerations that drive the optimal currency composition at the level of an individual central bank. Within this context, the paper assesses the role of the USD as a store of value in foreign currency reserves and as a means of exchange for international trade. We suggest reasons why its dominance in both arenas is likely to continue as well as assessing the nature and viability of current challenges to its dominance from major trading countries seeking greater political autonomy.

## I. Currencies and gold as reserve assets

The current system of holding fiat currencies as foreign exchange reserves is relatively new. Over millennia, gold and silver had served both as a means of settlement of international trade and as store of value. In the latter half of the 19th century, foreign currencies began to replace gold for payments and reserves for reasons of convenience as international trade and capital flows blossomed under the British Empire and the actual movement of gold was cumbersome. The British pound dominated foreign currency reserves reflecting its global military, technological and economic leadership but countries held also substantial shares of currencies of other global trading countries including France, Germany and the US. It is worth noting that the GBP retained its dominant share of global reserves until the mid-1950's long after the US had become the world's leader in technology and its largest economy, partly due to the leading international role of UK banks as well as US regulations which constrained the growth of its national banks.<sup>1</sup>

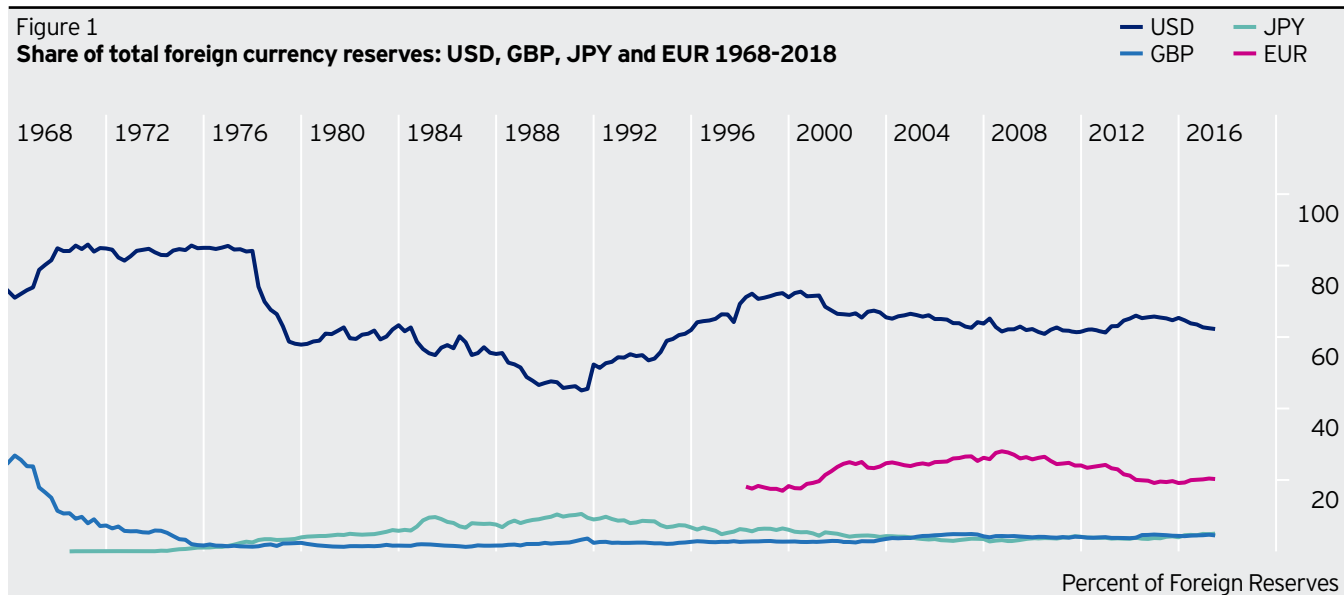
Until 1971, foreign currency reserves represented a claim on the gold of the country of issue at a fixed price. With the depletion of countries' gold holdings during WWII, the US was the only country with sufficient gold to back its currency. Under the Bretton Woods system, the USD was fixed to gold at the price of \$33/oz and other countries fixed their exchange rates to the USD. In 1971, this system collapsed when President Nixon severed the link of the USD to gold. This was only the last in many breakdowns of the use of gold in domestic and international monetary arrangements, which mainly recurred when domestic economic imperatives conflicted with maintaining a fixed exchange rate in line with the commodity reserve backing the base money supply.

In 1971, the system of foreign exchange reserves underwent a fundamental shift, the consequences of which are only fully being realized in the 21st century. Countries found themselves in the position of accepting fiat currencies as a store of value for their national savings, with the value dependent on the strength of the economy and central bank of the issuing country. Over the remainder of the 21st century, central banks accepted USD assets as reserves as the US was at the cutting edge of technological innovation with positive consequences for economic growth, military dominance, political stability and continuity in its support for open trade and capital markets. It is also interesting to note that Germany actively discouraged the use of its currency for reserves through capital controls out of concerns for its monetary policy autonomy.

The system of holding fiat currencies as reserves implies that currency composition is now an investment decision rather than a residual of countries' balance of payments dynamics. This is evident in the adjustments to the holdings of currency following economic crises associated with the country of issue. Figure 1 illustrates the final decline of the GBP as a major reserve currency following the devaluation of the pound in 1967; the rise of the JPY as a reserve currency and subsequent decline following the collapse of the Japanese valuation bubble in 1990; and, the growing share of the EUR after its introduction in 1999 and subsequent decline following the EUR debt crisis of 2012 and questions around the cohesiveness of the Eurocurrency zone.

Before considering the choice of currency to be held as reserves, it is important to reflect on the principal objectives for holding reserves as the relative importance of these objectives will determine the optimal currency composition at an individual country level. Most central banks define their principal policy objective for reserves as: (i) implementing exchange rate policy; (ii) as a store of value for future uncertainties; and, (iii) to give confidence to foreign creditors. These policy objectives broadly translate into the investment objectives of capital preservation, liquidity and return. Until the turn of the 21st century, the first objective took precedence under a global system of mainly fixed rates. Central banks required liquidity to intervene in the markets to defend the currency peg, whether to the USD, the European Rate Mechanism (ERM) or the Special Drawing Right (SDR) basket. The system of fixed exchange rates proved unsustainable, however, when governments sought to maintain pegs inconsistent with the underlying economic fundamentals and over time, floating or managed rate systems have replaced most fixed rate currency regimes. As a consequence, reserve drawdowns have declined in frequency and severity and reserves have become more relevant for financial stability purposes rather than direct exchange rate management. Reflecting this shift in international monetary arrangements, many central bank reserves managers shifted from pure liquidity management to a portfolio management approach with increased emphasis on capital preservation and return. This has been accompanied by greater diversification in currency holdings as well as asset classes, as discussed in earlier white papers.<sup>2</sup>

Figure 1  
Share of total foreign currency reserves: USD, GBP, JPY and EUR 1968-2018



Source: IMF, Bloomberg, reported in USD and unadjusted for exchange rate movements. Data as at 30 June 2018.

## II. Criteria for acceptance of a currency for reserves

The currency of the global leader in terms of international trade, technology, capital markets and military capability dominates international settlements and foreign currency reserves. A country can either promote or discourage the use of its currency for reserves but history shows that it is easier for a government to discourage its use rather than promote it through advocacy. The acceptance of a currency or commodity as a global reserve depends on the country's balance of payments dynamics, capital market liquidity, and political stability and predictability, as discussed in more detail below.

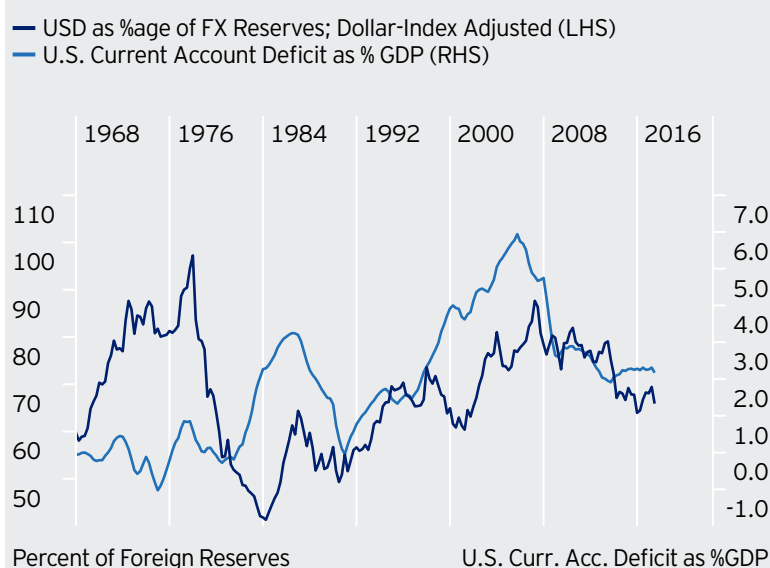
For the currency to be held by central banks, the issuing country needs to provide currency to the rest of the world either through imports of goods and services or export of capital. It sometimes seems - especially nowadays - that an issuing country would need to run a current account deficit, but capital account outflows also work to lubricate growth in world trade and capital flows. As illustrated in Figure 2, the US ran a current account surplus until the early 1980's as the USD share of currency reserves (excluding gold) increased from 60% to nearly 100% in 1978. From 2000, onwards, the burgeoning US large current account deficits fuelled the growth in global reserves, of which the USD maintained its share as net exporters purchased USD to avoid appreciation of their currencies.

While China now leads the world in international trade flows, the USD is still used globally to invoice and settle trade including between third countries where the US is not a party, contributing to continued dollar dominance in reserves. The US represents 14% and 18% of global exports and imports, respectively<sup>3</sup> but about half of all international trade payments over SWIFT are denominated in USD.. The decision of which currency to use for invoicing or payments is ultimately made by micro-economic players for whom there are benefits in using a single currency for pricing both across comparable goods and along the supply chain. These externalities explain the "stickiness" of the use of the USD for payments despite pressure by governments to develop alternatives in the face of the US use of its currency to impose US laws on an extraterritorial basis.

As liquidity is still a paramount objective for reserves managers, the depth and quality of a country's fixed income markets is key to its acceptability as a reserve. Depth is indicated by both market capitalization and daily turnover, a better indicator of actual tradable volumes. Quality refers to the transparency and integrity of issuer information, the integrity of issuer ratings and the market infrastructure required to support liquidity.

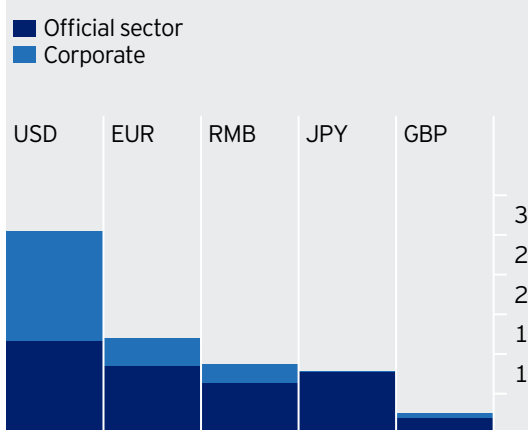
The strength and depth of US capital markets explains to a great extent the persistence of the USD in reserve holdings. Given its depth, the USD is well bid during financial crises, even when the crisis has originated in the US financial sector, as was the case in 2007-08. In addition, the sheer size of global foreign currency reserves excludes smaller countries from any meaningful role as a reserve currency. On aggregate, foreign currency reserves invested in financial assets exceeded \$11 tn in 2018 and the top 25 central banks in terms of reserves each hold over \$100 bn.<sup>4</sup> For central banks with large foreign currency reserves, only the US, EUR, JPY and potentially the on-shore RMB market offer sufficient depth and liquidity as can be seen by the relative size of fixed income markets and their liquidity, as illustrated in Figures 3 and 4.

Figure 2  
**U.S. Dollar's Share in Global Currency Reserves (adjusted for currency effects) and the USD Current Account Balance (%GDP)**



Source: COFER, Bloomberg, Authors' Calculation. Data as at 30 June 2018. Note: The currency shares are adjusted for exchange rate movements using the Dollar Index (DXY) maintained and published by Intercontinental Exchange, Inc. The COFER series, which started in 1994, excludes "unallocated reserves".

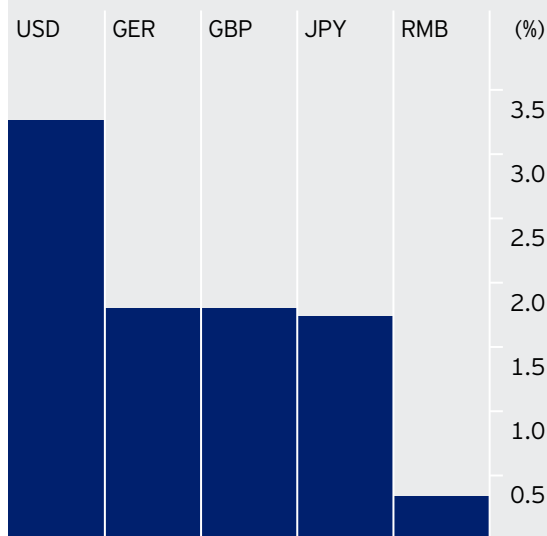
Figure 3  
**Market Capitalization of Reserve Currency Fixed Income Markets (USD tn)**



Sources: Bloomberg, AsDB-Asia Bond Online. Data as at 31 December 2017. Note: "Official sector" includes bonds issued by governments and broadly, government supported institutions or those not purely perceived as private sector. In the US, Treasury, municipalities and the GSEs are included under the official sector. In China, Treasury, Local Government and Policy Banks are included. The corporate sector includes private financial and non-financial sectors.

While the RMB on-shore bond market is the third largest in terms of market capitalization, it is still less liquid as indicated by the substantially lower average daily turnover rates as seen in Figure 4 due primarily to the large relative holdings of onshore bonds by domestic commercial banks in their investment portfolios.

**Figure 4**  
**Government bond liquidity in reserve currencies**  
 Average Daily Turnover (average daily trading volume/bonds outstanding)



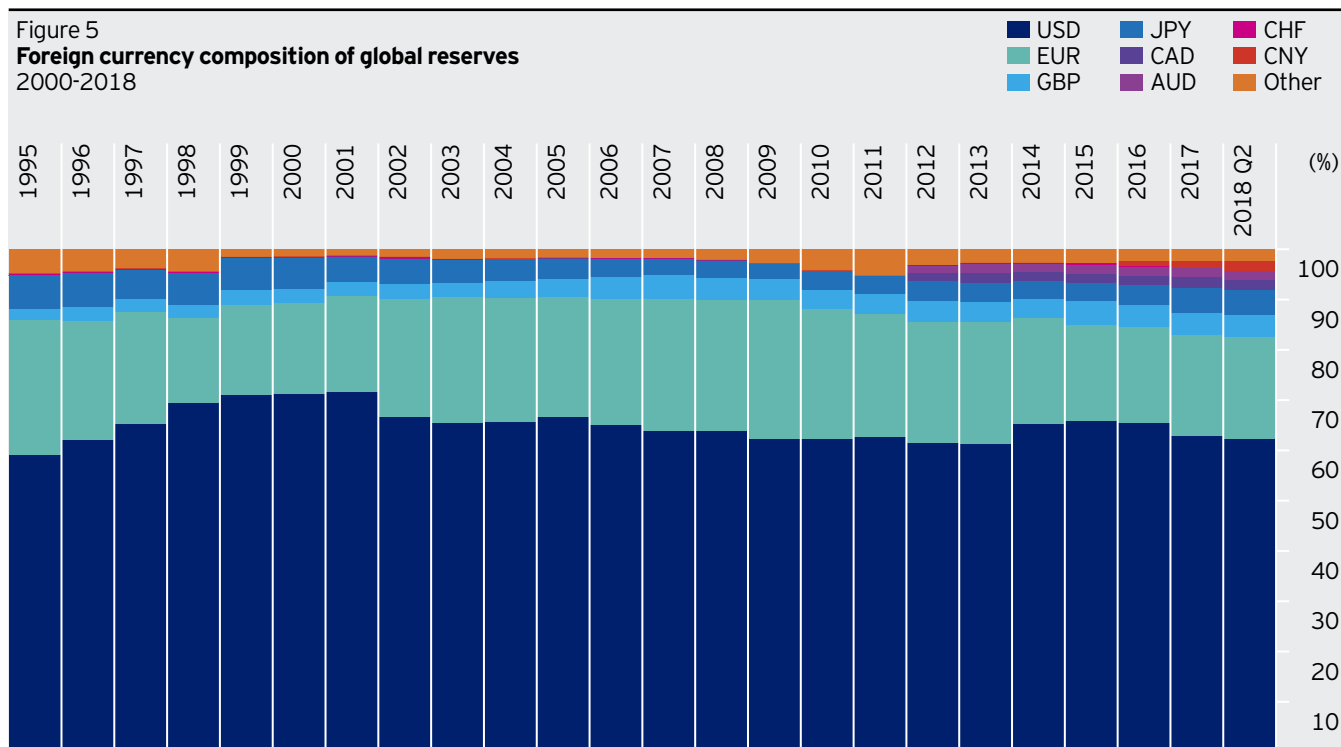
Sources: Sifma, Afme, AsDB Asian Bonds Online. Data as at 31 December 2017.

In addition to market depth, institutional stability and developed market structures support the stability of prices, usability and tradability of reserve currency assets, especially at times of market pressure or outright crisis, when international reserves would have to be sold to maintain domestic financial and economic stability. Stability and predictability are associated with: (i) open markets where participants establish prices based on transparent, comprehensive and credible information regarding the quality of the issuer, the state of the economy and the financial system; (ii) stable government with credible policies and institutions of economic and financial management; and, (iii) the rule of law.

A fiat reserve currency is backed not by gold or other reserves, but by the policy credibility of the central bank or monetary authority that stands behind the currency and the resources and creditworthiness of the state that issues the reserve assets. While moderate inflation or other macro risk premia are not disqualifiers for a reserve currency, credit risk is generally a severe constraint - a core issue that goes to the heart of the purpose of reserves. Macroeconomic factors - such as growth or inflation risk premia, if moderate - are actually part and parcel of the normal evolution of economic cycles, whereas major and sudden shifts in such risk premia are a symptom of boom/bust cycles and make a currency less acceptable for reserves.

The importance of financial stability is evident in the moderate realignments of reserves following The Great Financial Crisis when the share of USD reserves declined from 2008-2013 and central banks also became net buyers of gold. However, in short order, the Eurozone financial crisis of 2012-13 tested the integrity of the Euro itself and the creditworthiness of several Eurozone sovereigns, some of which were held as reserves, resulting in realignment from EUR back to USD assets.

**Figure 5**  
**Foreign currency composition of global reserves**  
 2000-2018



Source: COFERS. Data as at 30 June 2018.

### III. Currency composition as a policy choice

Increasingly, the foreign currency composition of reserves is a policy choice, which becomes evident at a country rather than an aggregate level. Central banks of economies highly integrated with the Euro-zone tend to hold upwards of 80% of reserves in EUR whereas Latin and Central American countries typically tend to invest mainly in USD. Central banks in advanced economies, where the main objective of reserves is to support the financial sector, tend to overweight currencies that are countercyclical during crisis periods, "safe haven assets." And currencies of regional economic hubs such as South Korea, India, Brazil and South Africa may be included in the reserves of neighbouring countries and trade partners.

The policy factors driving the optimal currency mix for a given country include the legal framework, level of economic development, exchange rate regime, level of reserves and, for emerging market countries, reserves adequacy. Figure 6 provides a synopsis of how the mix of these factors will lead to a different solution for the optimal currency mix at the level of the country and central bank.

In Figure 6, the objective for defining the optimal currency composition is risk minimization across different risk frameworks. Alternatively, central banks with ample reserves may seek to maximize risk-adjusted returns, thereby increasing reserves through internal investment return and enhancing government revenues over time. In this instance, central banks would tend to diversify across currencies as well as across asset classes. For all emerging and developing market countries, foreign currency is a major risk to central bank capital in local currency terms but it cannot be hedged as the reserves are held as "backing" of the foreign currency liabilities and potential outflows at a country level rather than the level of the central bank balance sheet. This is not the case for advanced economy central banks, some of which do hedge the foreign currency risk.

Central banks can and do separate currency risk and country credit risk. Central banks in the Eurozone may hold USD assets but sell USD forward to minimize foreign currency risk to central bank capital. In regional trading blocks, neighbouring central banks may elect to hold the currency of the regional economic hub to maintain purchasing power vis a vis its imports.

If the regional hub does not meet minimum credit rating criteria, the central banks may invest in more highly rated multi-lateral bank bond issues in that currency. Currency swaps are another off-balance sheet mechanism for accessing foreign currency during crisis periods without incurring balance sheet exposure to the currency. The Federal Reserve Bank New York offered over \$30bn USD swap lines to six central banks during the global financial crisis.

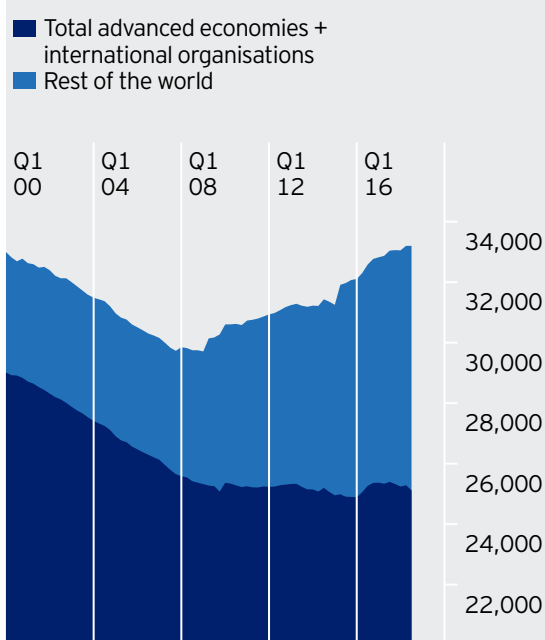
The policy choice of reserve holdings is also influenced by geo-politics. The Central Bank of Russia in 2018 undertook a major realignment of reserves away from the USD in response to US government sanctions imposed upon Russian individuals. Following the withdrawal of the US from the Iran agreement in 2018, both the European Commission and the German government have undertaken deliberations to promote the EUR as a settlement and invoice currency for the imports of oil into Europe. The upturn in central bank purchases of gold may also reflect concerns over US global leadership and its use of the USD to impose its laws on an extraterritorial basis. Since the GFC, emerging and developing economies have doubled their holdings of gold while advanced economies continued to be net sellers, albeit at a much lower rate than prior to the GFC. In 2018, the rate of increase of net purchases of gold spiked to its highest level in three years with China, Russia, Poland, Hungary, Kazakhstan, and Mongolia all reporting substantial increases.

Figure 6  
**Policy frameworks and determinants of currency composition at the country level**

Legal ownership of reserves	Economic Development	Policy Objective	Dominant factors
Government	Advanced	Minimize foreign currency risk at the government level	Currency composition of government foreign currency borrowings
Central bank	Advanced and large financial sectors	Liquidity provision to the financial sector during crisis	Capital market depth; countercyclical assets
Currency union	Advanced-national central banks	Minimize foreign currency risk to central bank capital	Currency composition of central bank liabilities
Central bank	Emerging	Minimize foreign currency risk of reserve adequacy measures	Foreign currency debt of the government, financial sector and private sectors and potential capital outflows
Central bank	Developing	Access to essential imports during crisis periods	Currency of essential imports

For illustrative purposes only.

Figure 7  
**Central bank net purchases of monetary gold (tonnes)**



Source: IMF. Data as at 30 September 2018.

## IV. Incorporating macroeconomic risk factors into currency composition

Broadly speaking, reserves serve as a prudential portfolio to tide countries over during periods of stress. From a policy perspective, it thus makes sense to assess whether there exists a relationship between reserve currencies and domestic risk factors. As an illustration, currencies of countries that are dependent on commodities tend to be procyclical with exchange rates positively correlated with commodity prices and global growth. Other currencies tend to appreciate during crisis periods, just when a central bank may need to deploy reserves. Understanding how currencies behave during the economic cycle and in relation to a country's own macro-economic risk factors can help central banks mitigate risk at a country level or at least avoid doubling up.

Figure 8 provides a visual illustration of currency groups that tend to move in tandem and with other factors such as region, commodities, or "flight to safety" during periods of heightened market volatility.

Since the emerging market crisis of 1997-98, EM currencies have tended to move in tandem across countries with distinctly different macro-economic fundamentals. As evident in Figure 9, this correlation spiked during the EM crisis of 1997-98, which emerged in East Asia and spread across EM countries through what was tagged as "financial contagion." During the decade of central bank quantitative easing, the correlation amongst EM currencies increased further as the Federal Reserve artificially suppressed interest rates and caused the market to trade in a "risk on/risk off" pattern. This is clearly evident in 2013 when the Federal Reserve announced the tapering of its USD bond purchases during the so-called "taper tantrum" and global investors sold "risk assets" including EM debt.

Whilst the correlation of EM currencies increased during quantitative easing, nevertheless the market appears to be better discerning differences amongst countries than was the case in 1997-98. The "financial contagion" evident in Figure 11 during the East Asia crisis of 1997, is less notable in subsequent country crises as, for example, Turkey in 2001 and Argentina in 2001. Figure 10 also illustrates the countercyclical "safe haven" status of JPY, CHF, gold and the Scandinavian currencies during crisis periods.

From an investment and diversification perspective, many central banks now hold EM currencies and EM bonds denominated in reserve currencies in reserve portfolios. Such an approach would be consistent with portfolio theory - to increase overall return with potentially improved risk characteristics based on volatility and correlation to the rest of the reserve portfolio. The overall share of EM currencies is highly constrained, however, by the required liquidity and credit risk factors discussed earlier.

Figure 8

### Currency Clusters and Underlying Risk Factors<sup>5,6</sup>

Based on the correlation across all currencies versus the USD;  
Period: 12/31/2006-9/30/2018

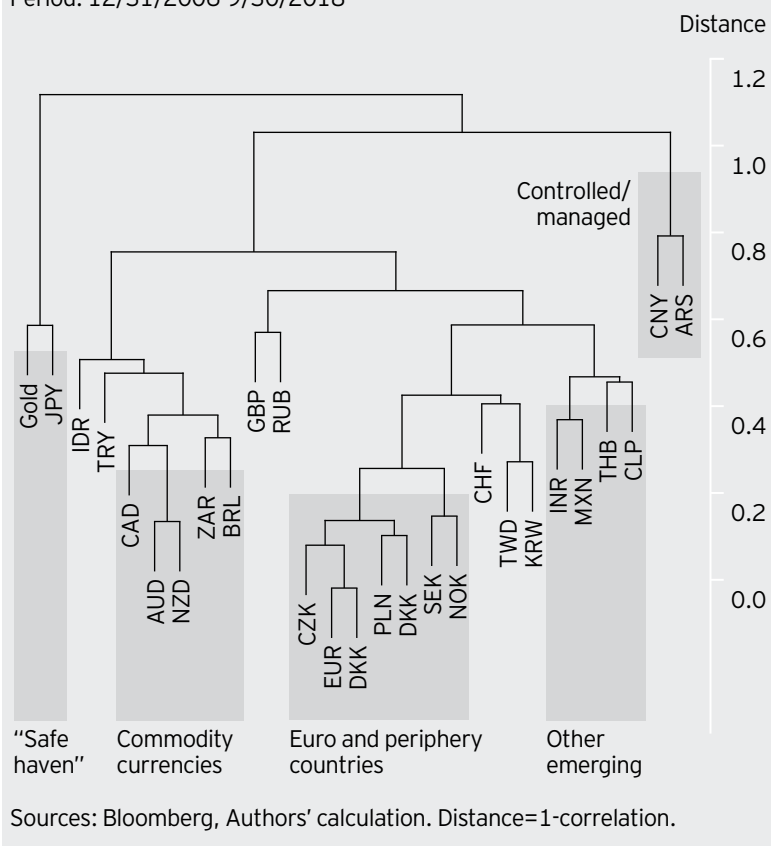
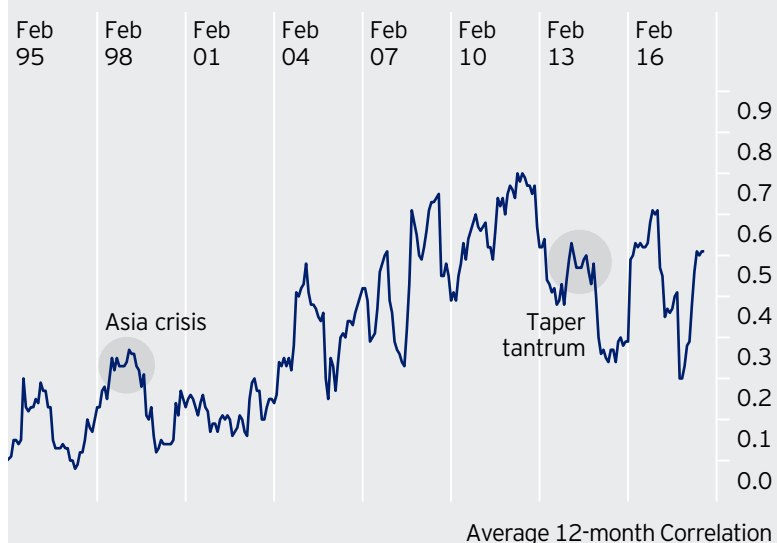


Figure 9

### Emerging market currencies tend to move together with the correlation increasing over crisis periods



Source: Bloomberg, Authors' calculation based on the average 12-month rolling correlation across 14 major EM currencies. Note: The correlation of emerging market currencies ranged from no correlation in 1997 Q1 (value 0) to nearly perfect correlation during the taper tantrum 2012 Q2 (value 0.8) with 1.0 representing the maximum. Values of 0.5 represent a high level of correlation.



## V. The internationalization of the RMB and its prospects as a global reserve currency

The IMF included the RMB in the SDR in November 2017 despite the existence of capital controls, noting the importance of China's share of international trade and the size of the economy. Since then, the number of central banks holding RMB as part of their reserves has increased but the share of aggregate reserves is still quite low at 1.84% despite the elimination of investment quotas under Qualified Foreign Institutional Investor (QFII) in 2016. A number of initiatives are underway, however, to promote the internationalization of the RMB for both trade settlements and reserves.

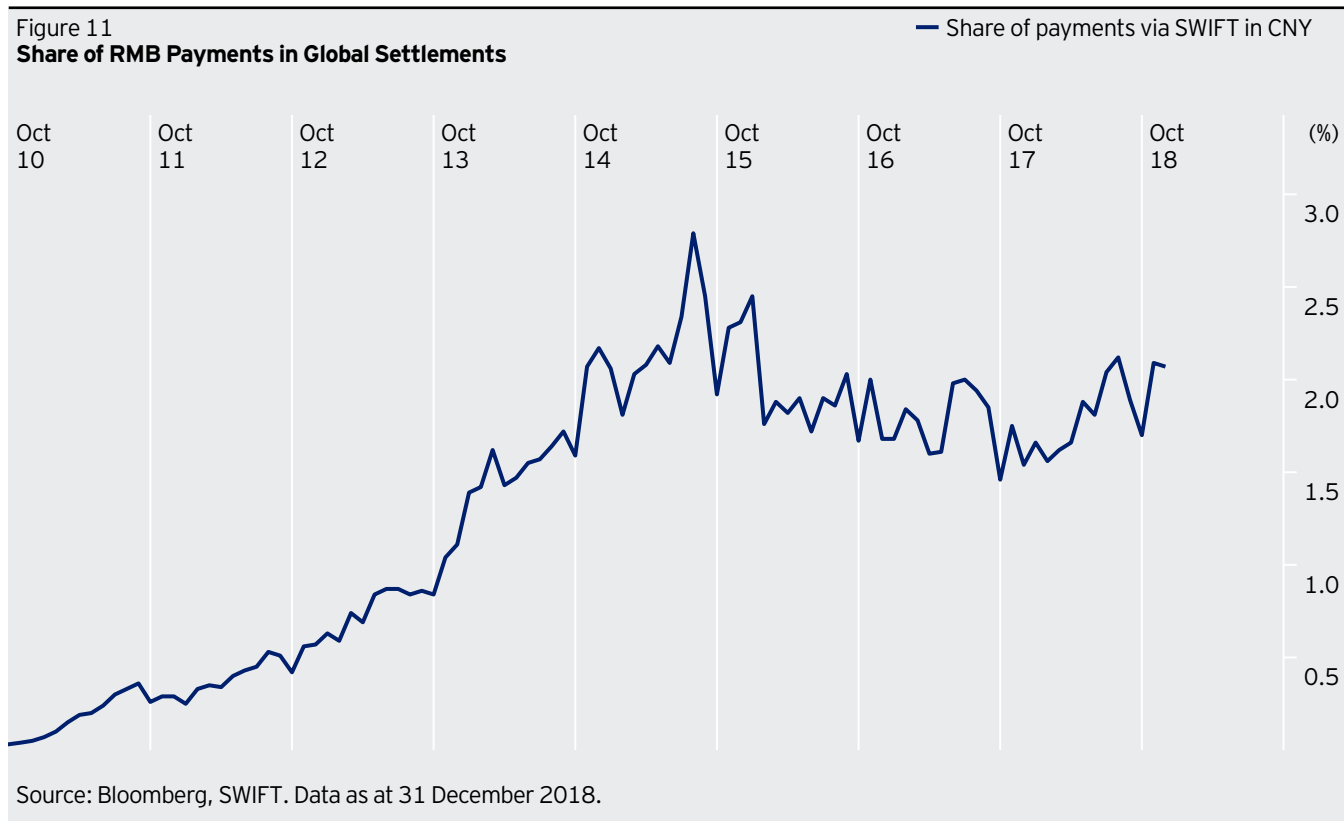
With respect to trade settlement, the government is promoting the use of the RMB as a settlement currency by strengthening the overseas infrastructure including allowing banks to hold offshore RMB accounts, setting up offshore sub-custodians and integrating the RMB into international and regional payments system protocols. These recent initiatives, however, have yet to bear fruit partly due to the positive externalities of pricing in a single currency and thus the "stickiness" of the USD as an invoice currency. In 2018, about 1.52% of total SWIFT payments were settled in RMB with lackluster growth over the past four years.

While the RMB on-shore bond market is the third largest after the combined Eurocurrency bond markets, with a market capitalization of \$9.5 tn, its liquidity as measured by average daily turnover, is quite low relative to other reserve currencies. We would expect liquidity to improve in the near term, albeit at a gradual rate, with recent policy and technology initiatives to provide official and private sector access to the RMB on-shore bond market. Specifically, the PBoC and HKMA launched in 2017 a trading platform, Bond Connect, to provide official and private sector investors direct access to the on-shore bond market and eliminated its earlier program of investment quotas (QFII) for official sector investors. In response to these policy and technical developments, four major international index providers have announced plans to add on-shore RMB bonds to their global fixed income indices. In April 2019, the Bloomberg

Barclays Aggregate (BBA), will add about \$3.3 tn of RMB bonds to its global bond index, representing 6.03% of the \$54tn global bond index. Investment vehicles that track the index will thus need to invest in this sector and rebalance their holdings in line with monthly changes in the index components with a positive impact on market liquidity. Currently, the relatively low level of liquidity can be attributed to the dominance of domestic banks, which holds 64% of total on-shore RMB bonds largely in buy and hold portfolios. We expect improvements in market liquidity to be gradual as foreign ownership of RMB on shore bonds currently represents only 2.1% of total bonds outstanding.

While the Chinese government has assured the right of repatriation to foreign investors in RMB bonds, capital restrictions on residents still exist and the dual exchange rate system may give reserve managers pause. Capital controls, which are often accompanied by multiple exchange rates, can complicate the use of a national currency as a reserve currency for several reasons. Capital controls imply that the external and internal prices of money—the exchange rate and the interest rate—would not represent market-clearing prices. To the extent that a capital-controlled currency is used as a reserve currency, there would in effect be two distinct moneys - one domestic and the other global; and as a corollary, there would be distinct onshore and offshore interest rate markets. This issue would pose a greater challenge in a world where other major exchange rates are floating, because the valuation of one major currency would reflect a segmented market, whereas the others would represented full market clearing prices. International market participants - both private and official - might share the concern that capital controls would permit greater exchange rate or interest rate stability than might be sustainable in the longer run with potential risks to the currency. This concern, however, may be offset by the desire to diversify away from a monopoly provider of currency reserves and towards a multi-polar reserve world.

Figure 11  
Share of RMB Payments in Global Settlements





## VI. Concluding remarks

The status of leading international currency implies a leading role in both official FX reserves and in private financial transactions, spanning both current account and capital flows. In the era of fiat reserve currencies backed by the credibility and resources of the central banks that issue reserve currencies and the States that issue reserve assets, this lead role has generally been played by the largest economy, and leading geopolitical player at the technological frontier, which tends to ensure military leadership as well as high productivity growth, per capita income and hence adequate resources to help facilitate global economic and geopolitical stability for international trade, finance and investment.

We would expect the USD to retain its advantage and disproportionate share of FX reserves for years to come, because of its intrinsic advantages – incumbency, liquidity, depth of capital markets and the policy credibility of the Fed and its repeatedly demonstrated willingness to take into account the spillovers of US policies on the rest of the world. That said, the challenges to the dollar over the longer term are significant, including the large size and role of other major economies in world output, trade and capital flows as well as international concern about erratic or unpredictable behaviour of US policies beyond the remit of the Fed, including the withdrawal from multi-lateralism, imposition of sanctions and loose fiscal and aggressive trade policy, which are largely in the political sphere.

We would therefore also expect the two main contenders for the USD–EUR and RMB–to play an increasing role with continuing purchases of gold as a store of value and diversifier. These offer competition for the dollar, which may constrain the ability of the US to pursue economic or other policies that deviate too far from the needs of the rest of the world. Arguably, this has already been happening in the current economic cycle. The US Federal Reserve delayed plans for tapering quantitative easing in 2013–14 when both US and global financial markets came under pressure; again relented in 2015–16 when global concern about a devaluation in China caused “spill backs” into major economies including the US; and may be doing so again now, as the global economy slows.

We would expect gains by the EUR and RMB at the expense of the USD to be gradual, constrained by the intrinsic challenges of each as a competitor to the dollar, pending quite different institutional reforms in each case. The euro seems very unlikely to develop a full fiscal, banking, capital markets or ultimately, political union which in turn will limit the market size, depth and liquidity of reserve assets relative to the dollar. Specific government bonds may be perceived and treated as reserve assets, such as German Bunds, but others as credit assets, such as Italian BTPs.

In the case of China, the required reforms are proceeding with much greater vigour and speed, including liberalizing and opening up domestic capital markets to cross-border flows both from private and official market participants. However, capital controls on residents are likely to be seen as a source of market segmentation impeding transparent and full price discovery. Such factors might slow the international adoption of the RMB as a store of value in private and central bank portfolios, perhaps more than as a medium of exchange for settlement and invoicing. On balance, it is conceivable that the RMB gains on the USD or takes market share from the EUR, because China's capacity to advance RMB internationalization exceeds the Eurozone's capacity to fully federalize or sufficiently to produce a large, unified government bond market. In addition, the rate of potential growth in both the United States and China exceeds that of the Eurozone, given demographics and trends in innovation and productivity growth, which in turn implies that the Eurozone will tend to lag the other two large economies in their shares of world trade and capital flows, respectively.

Other smaller currencies are likely to play important supporting but not significant roles in the international reserves. Sterling may continue to be an important diversifier, depending on how the Brexit process plays out; if the UK remains a dynamic, open and attractive investment destination as it has been for the last several decades, then the expected EU exit may have limited effect beyond the real depreciation of sterling that has already taken place.

The Japanese yen will likely remain an important reserve currency as a perceived safe haven, along with CHF, given both countries' roles as net international creditors – despite their relatively slow growth and size, respectively. Episodes of risk-off are likely to result in appreciation of both currencies, especially in recessionary or crisis like environments, and so macro factor or correlation based reserve exposure will likely continue to be sought out.

It is also worth noting that some regionally important emerging market economies are likely to continue to play a modest role as regional reserve currencies for smaller neighbouring economies, which have proportionally large trading or investment relationships and in some cases as base currencies for pegs. Examples include South Africa and India.

In closing, it's worth noting that geopolitical trends, shifts and shocks can make a major difference to the composition of reserves – but it is important to distinguish between one-off shocks and sustained trends. For example, one effect of US sanctions on Russia was the re-allocation of Central Bank of Russia reserves from USD to EUR, RMB and gold. Russia may well continue to invest ongoing current account surpluses in non-dollar assets, but the bulk of this is probably idiosyncratic in the sense of applying to a few countries. A more significant challenge to the role of the dollar could arise in opposition to the use of dollar sanctions or extraterritorial application of US laws, if several countries opted together to shift away from the dollar to one other currency for commodities and trade – with the EUR and RMB being the main candidates. Indeed the on-going initiatives by the EC and China to set up alternative arrangements for trade settlement reflect the desire for autonomy in geo-economic trading and geopolitical relationships. In the end, however, central bank policy decisions on currency composition will be driven by individual policy mandates and preferences; and decisions regarding invoice currency determined by the preference of international traders. The decision on the USD will ultimately be in the hand of market participants, based on their assessment of the credibility of US policies and institutions, with limited ability of governments to influence their choice.

## Notes

- <sup>1</sup> For a history and original research on the role of currencies in reserves over the last two centuries, see Barry Eichengreen, Arnaud Meht, Livia Chitu, *How Global Currencies Work: Past, Present and Future*, Princeton University Press, 2018.
- <sup>2</sup> White papers can be found here: [www.igsams.invesco.com](http://www.igsams.invesco.com)
- <sup>3</sup> World Trade Organization, 2017.
- <sup>4</sup> IMF, *International Financial Statistics*.
- <sup>5</sup> This cluster analysis chart, a dendrogram, graphically represent by distance the correlations across all currencies' monthly changes versus the US dollar. Currencies grouped together at the bottom of the chart are more correlated with each other. We thus consider them "similar" and have attributed to these clusters an underlying risk factor based on observed movements over time. Currencies that are connected closer to the top of the chart are less correlated, thus less similar with each other.

<sup>6</sup>

<b>Currency symbol</b>	<b>Currency</b>
JPY	Japanese Yen
IDR	Indonesian Rupiah
TRY	Turkish Lira
CAD	Canadian Dollar
AUD	Australian Dollar
NZD	New Zealand Dollar
ZAR	South African Rand
BRL	Brazilian Real
GBP	Pound Sterling
RUB	Russian Ruble
CZK	Czech Koruna
EUR	Euro
DKK	Danish Krone
PLN	Polish Zloty
HUF	Hungarian Forint
SEK	Swedish Krona
NOK	Norwegian Krone
CHF	Swiss Franc
TWD	New Taiwan Dollar
KRW	South Korean Won
INR	Indian Rupee
MXN	Mexican Peso
THB	Thai Baht
CLP	Chilean Peso
CNY	Chinese Yuan Renminbi
ARS	Argentine Peso



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