



---

# Central bank whitepaper

## Managing liquidity risk

---

### Arnab Das

Head of Emerging Markets Macro,  
Invesco Fixed Income

---

### Jennifer Johnson-Calari

JJC Advisory, Founder and Former Head  
of Reserves Advisory and Management  
Program (RAMP) World Bank

---

### Adam Kobor

Director of Investments,  
New York University Endowment Fund

---

## 1. Executive summary

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.

---

## Contents

- 
- 2. Understanding liquidity risk**
    - 2.1. Objectives and challenges
    - 2.2. Drawdowns, responses and the cost of liquidity
    - 2.3. Tranching and other tools

---

  - 3. Understanding market structure and liquidity dynamics**
    - 3.1. Size matters
    - 3.2. A market of multiple agents
    - 3.3. A brief note about volatility

---

  - 4. Concluding remarks**

## 2. Understanding liquidity risk

### 2.1. 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.

### 2.2. 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.

### 2.3. 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

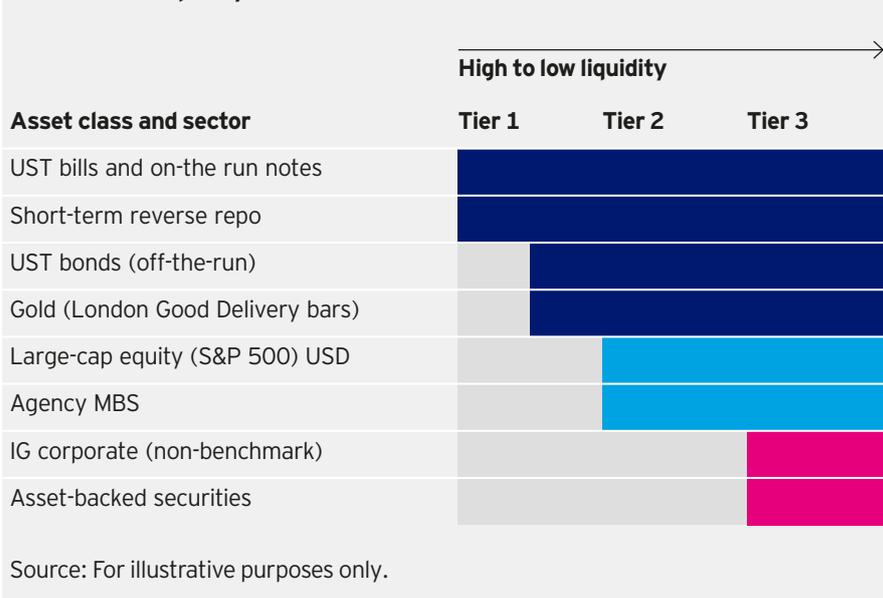
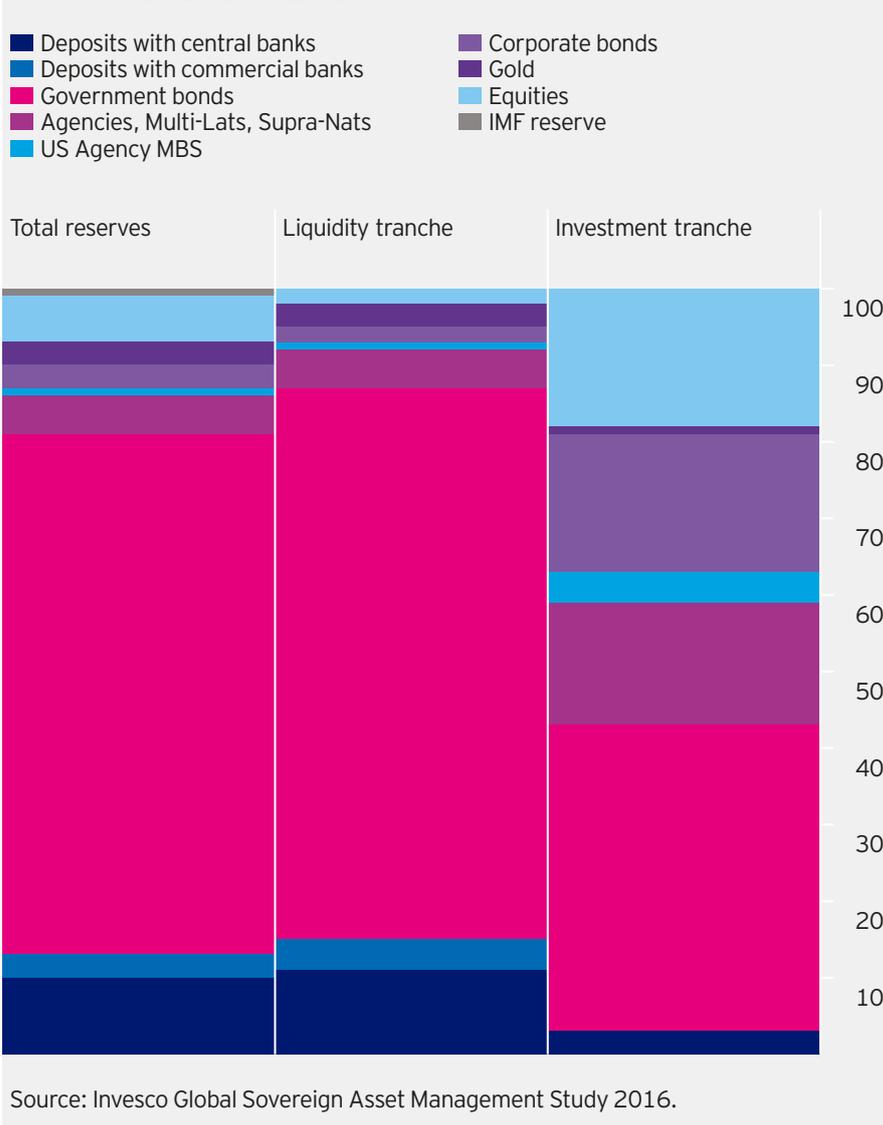


Figure 3  
Select central bank asset allocation



### 3. Understanding market structure and liquidity dynamics

#### 3.1. Size matters

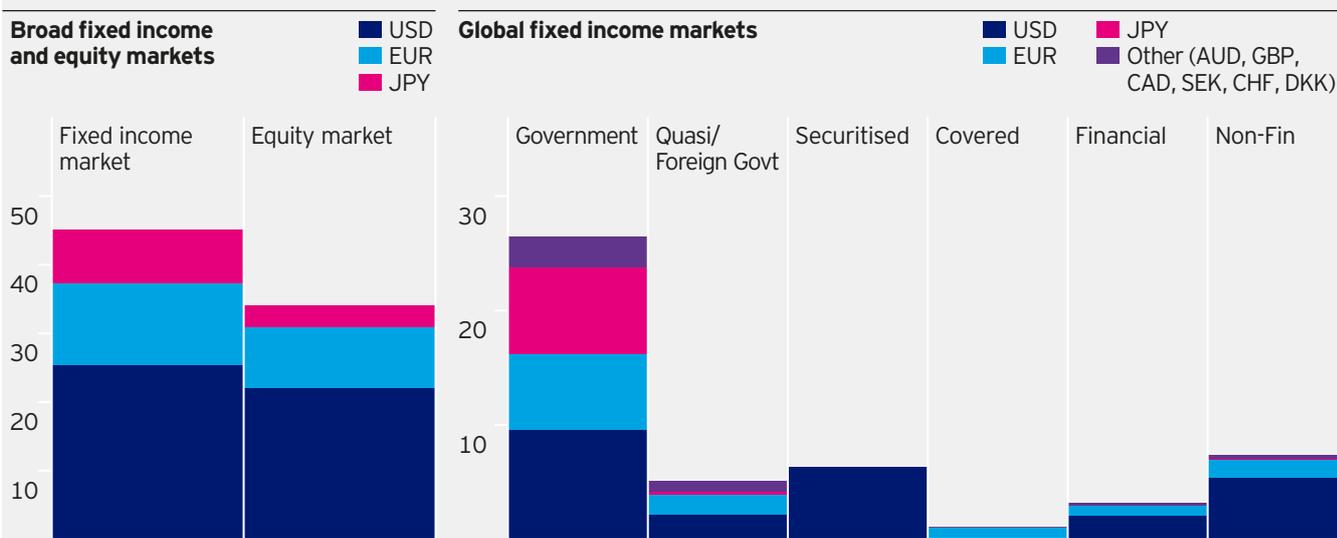
In this chapter we analyse numerous traditional indicators of liquidity. This will allow us to develop a richer picture of the myriad considerations that reserves managers must take into account when managing liquidity risk. An obvious starting point for such an analysis, at least for our purposes here,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

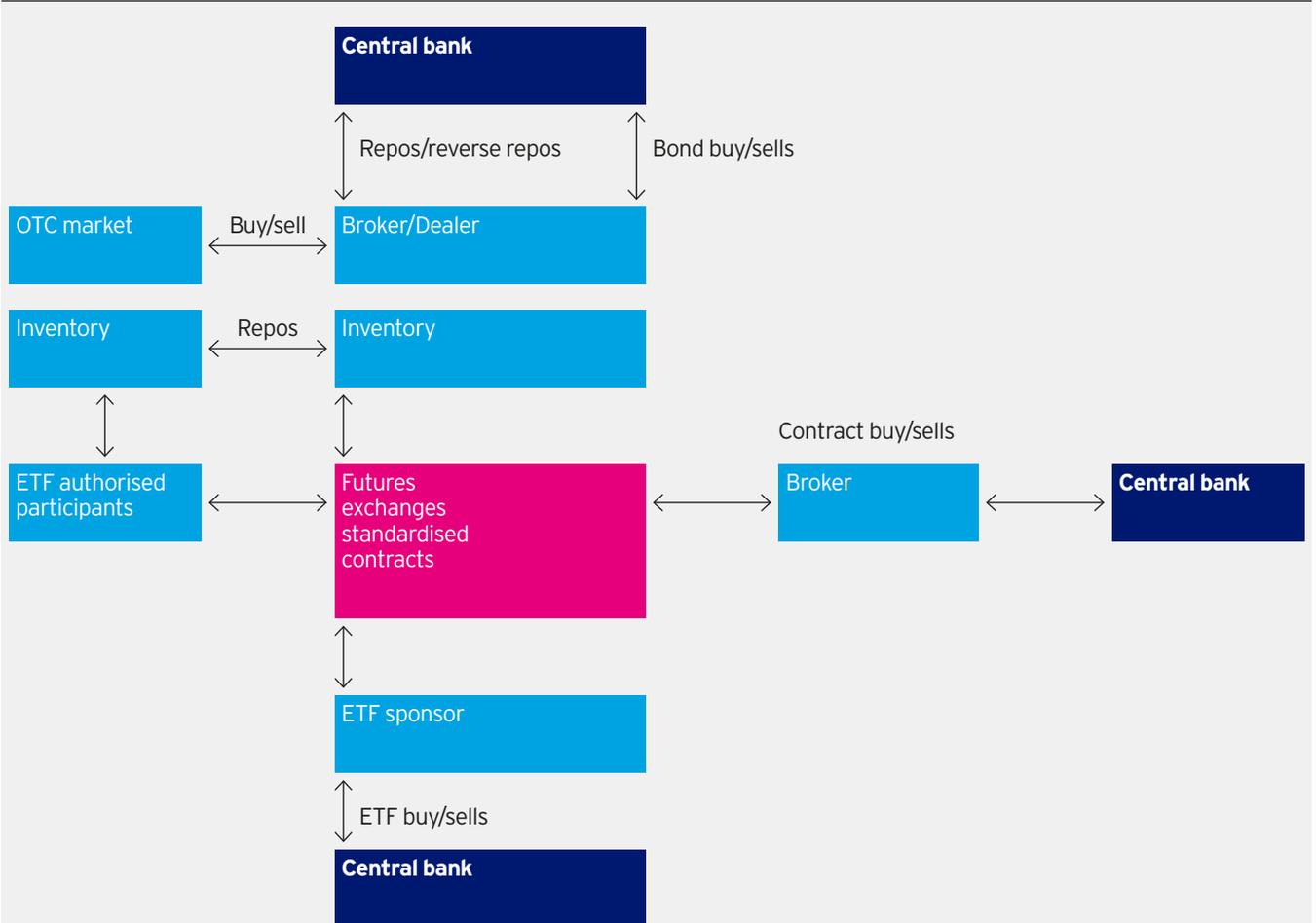
Source: SIFMA, as at end of 2016.

### 3.2. 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.

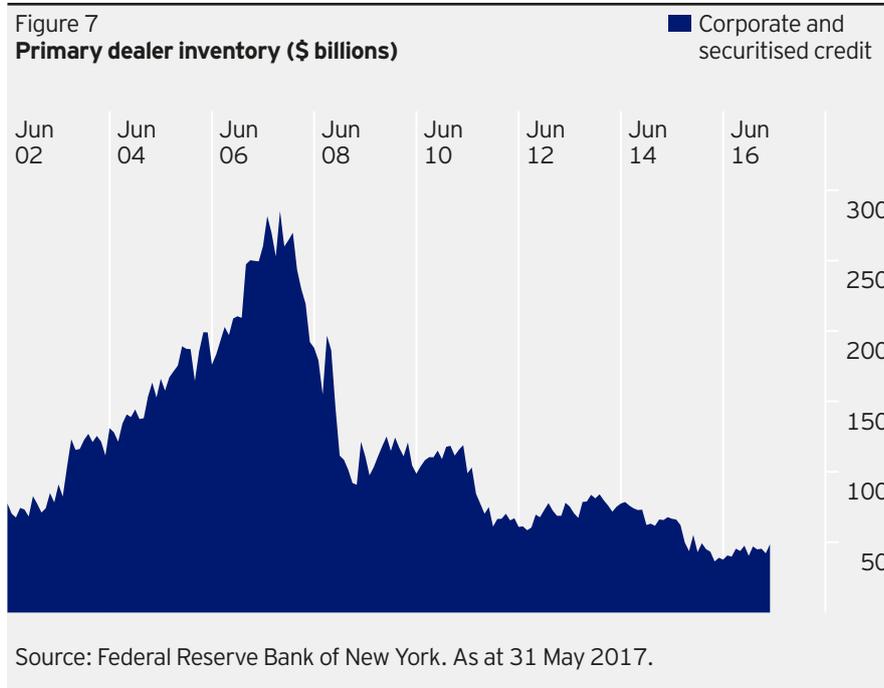
Figure 6  
Market structure



Source: For illustrative purposes only.

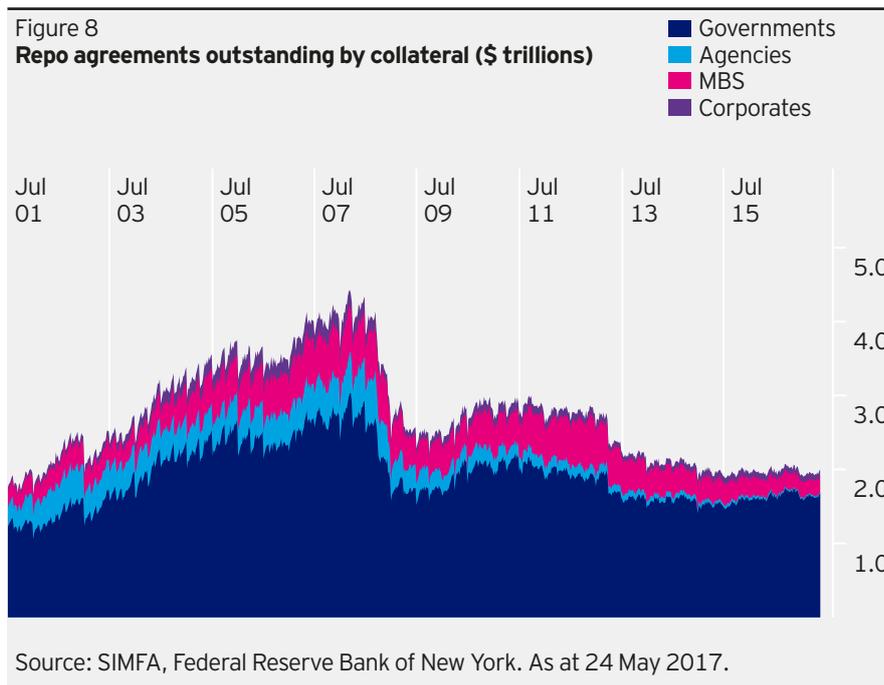
### 3. Understanding market structure and liquidity dynamics

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.



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.



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.

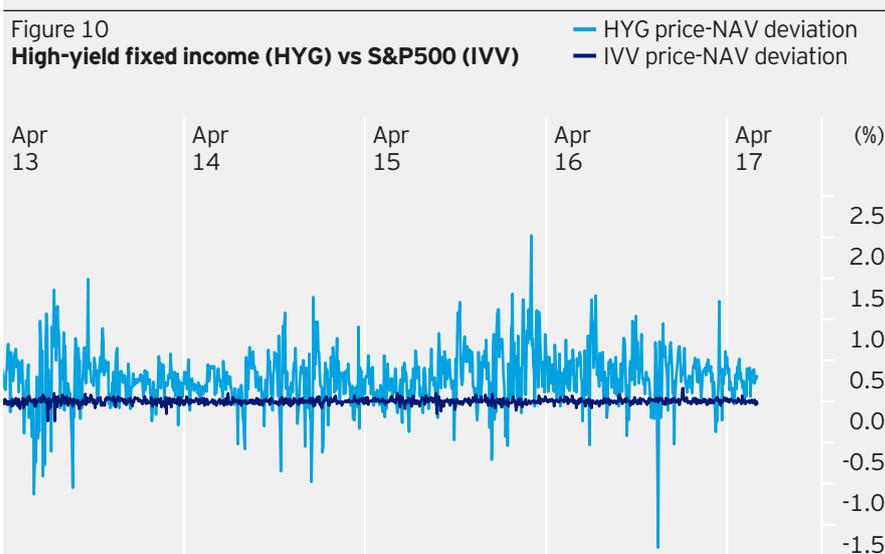
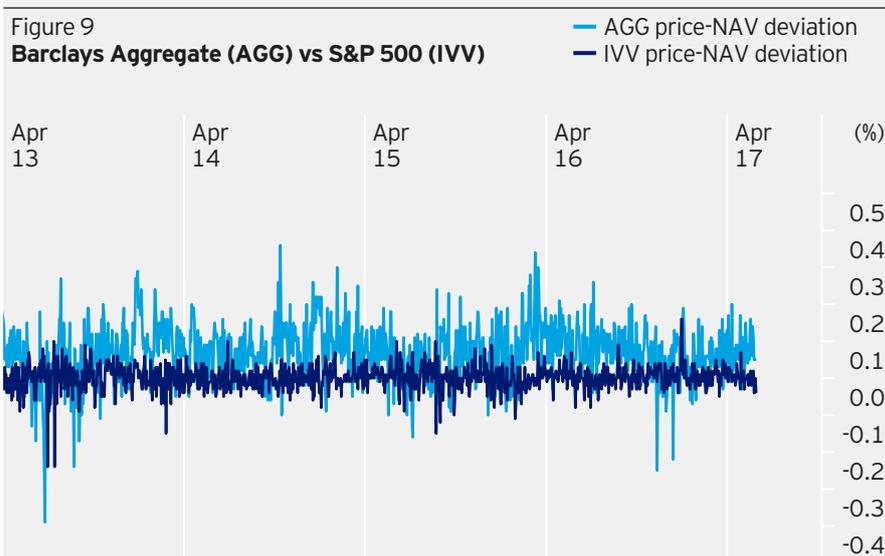
### 3.3. A brief note about volatility

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.

---

## 4. Concluding remarks

---

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.

---

<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.

---

## Important information

---

This document is for information purposes only and is not an offering. It is not intended for and should not be distributed to, or relied upon by, members of the public. Circulation, disclosure, or dissemination of all or any part of this material to any unauthorised persons is prohibited. All data provided by Invesco as at 30 April 2017, unless otherwise stated.

The opinions expressed are current as of the date of this publication and are subject to change without notice. The document contains general information only and does not take into account individual objectives, taxation position or financial needs. Nor does this constitute a recommendation of the suitability of any investment strategy for a particular Investor.

This is not an invitation to subscribe for shares in a fund nor is it to be construed as an offer to buy or sell any financial instruments. While great care has been taken to ensure that the information contained herein is accurate, no responsibility can be accepted for any errors, mistakes or omissions or for any action taken in reliance thereon. You may only reproduce, circulate and use this document (or any part of it) with the consent of Invesco.

This document has been prepared only for those persons to whom Invesco has provided it for informational purposes only. This document is not an offering of a financial product and is not intended for and should not be distributed to retail clients who are resident in jurisdiction where its distribution is not authorized or is unlawful. Circulation, disclosure, or dissemination of all or any part of this document to any person without the consent of Invesco is prohibited.

This document may contain statements that are not purely historical in nature but are "forward-looking statements," which are based on certain assumptions of future events. Forward-looking statements are based on information available on the date hereof, and Invesco does not assume any duty to update any forward-looking statement. Actual events may differ from those assumed. There can be no assurance that forward-looking statements, including any projected returns, will materialize or that actual market conditions and/or performance results will not be materially different or worse than those presented.

The information in this document has been prepared without taking into account any investor's investment objectives, financial situation or particular needs. Before acting on the information the investor should consider its appropriateness having regard to their investment objectives, financial situation and needs.

You should note that this information:

- may contain references to amounts which are not in local currencies;
- may contain financial information which is not prepared in accordance with the laws or practices of your country of residence;
- may not address risks associated with investment in foreign currency denominated investments; and
- does not address local tax issues.

All material presented is compiled from sources believed to be reliable and current, but accuracy cannot be guaranteed. Investment involves risk. Please review all financial material carefully before investing. The opinions expressed are based on current market conditions and are subject to change without notice. These opinions may differ from those of other Invesco investment professionals.

The distribution and offering of this document in certain jurisdictions may be restricted by law. Persons into whose possession this marketing material may come are required to inform themselves about and to comply with any relevant restrictions. This does not constitute an offer or solicitation by anyone in any jurisdiction in which such an offer is not authorised or to any person to whom it is unlawful to make such an offer or solicitation.