C GLOBAL LIQUIDITY: MEASUREMENT AND FINANCIAL STABILITY IMPLICATIONS

Global liquidity, both in times of abundance and shortage, has a range of implications for financial stability. Surges in global liquidity may be associated with strong asset price increases, rapidly rising credit growth and – in extreme cases – excessive risk-taking among investors. Shortages of global liquidity may lead to disruptions in the functioning of financial markets and – in extreme cases – depressed investor risk appetite, leading to malfunctioning markets.

This special feature takes a broad perspective and starts by defining and identifying the key drivers behind the multifaceted concept of global liquidity, all of which are related to more accommodative global financing conditions.[1] Thereafter, a conceptual framework is proposed for how policy-makers can monitor global liquidity. This involves looking in depth at a broad set of indicators such as: (i) short-term interest rates in advanced and emerging economies; (ii) asset price valuation indicators; (iii) uncertainty, risk appetite and financial liquidity indicators; and (iv) capital flows, international reserves and cross-border credit growth. Building on this framework, the special feature also discusses policy responses to global liquidity developments from a financial stability viewpoint.

INTRODUCTION

In spite of increased attention to global liquidity in recent years, a clear-cut definition is still missing. Liquidity is a multifaceted concept and, if anything, the common element in all of the definitions appears to be "ease of financing". From a global perspective, an essential distinction is made between central bank liquidity and liquidity created outside the public sector. Central bank liquidity can be considered as the amount of funds unconditionally available to settle claims through monetary authorities. Liquidity generated outside the public sector refers to liquidity provided by the financial and non-financial sectors, and is considered a key determinant of funding conditions globally.[2]

Chart C.1 Real broad money growth in advanced and emerging economies

(Q1 1998 – Q3 2010; percentage change per annum)

advanced economies
emerging markets
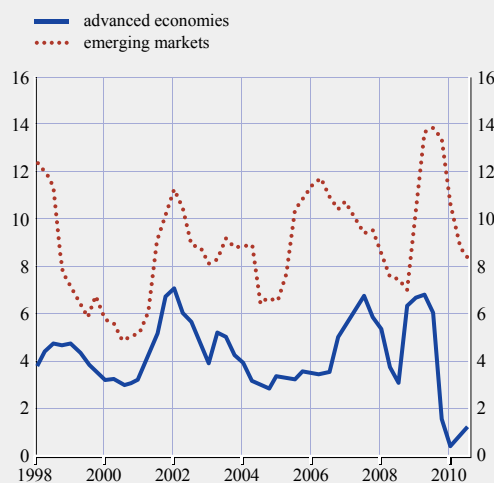
Sources: ECB, Eurostat, BIS and IMF.
Note: The data are converted into euro using the purchasing power parity exchange rate. The advanced economies include France, Germany, Japan, the United Kingdom and the United States. The emerging market economies comprise Brazil, Chile, China, India, Malaysia, Mexico, Russia, South Africa, South Korea and Saudi Arabia.

Traditionally, global liquidity has been defined as the sum of narrow money created by central banks and international reserves within advanced economies. Such a monetary liquidity measure is, however, less suitable today owing to global financial integration, new financial innovations that have led to alternative channels of access to credit and the growing importance of emerging markets. On the former point, a broader definition of money – including "close substitutes" for money – helps to capture global liquidity. On the latter point, real broad money growth has been higher in emerging economies compared with advanced economies over the past decade (see Chart C.1). This suggests that traditional measures that only include advanced economies do not fully measure overall global

1 This special feature partly reflects the ECB contribution to a wider study of global liquidity by the Committee on the Global Financial System in a paper entitled "Global liquidity – concept, measurement and policy implications", *CGFS Papers,* No 45, November 2011.
2 This type of liquidity is endogenous in nature, which is related to the fact that the provision of liquidity by banks is closely linked to liquidity provision by other financial institutions (given that this determines the circumstances through which balance sheets can be funded).

liquidity. These measures also fail to take into account the increasing role of liquidity generated by the financial and non-financial sectors.

INDICATORS OF EXCESS GLOBAL LIQUIDITY

Not only is it difficult to arrive at a unanimous definition of the concept of global liquidity, but it is equally difficult to derive a quantitative threshold to identify an excess or a shortage of global liquidity.

Nevertheless, a number of specific indicators of global liquidity are presented which help to address the shortcomings of the traditional measures and provide a picture of when liquidity may be abundant or scarce. Depending on the policy question at hand, these indicators can be divided into four broad categories. Each is assessed below. Given the difficulties in determining to what extent global liquidity is excessive or scarce, it is important to stress that any conclusion should be based on a broad set of indicators.

Short-term interest rates and global liquidity conditions

A first set of indicators which can provide a measure of global liquidity conditions relates to short-term interest rates in advanced and emerging market economies. Short-term interest rates, mostly determined by central banks, are a crucial determinant of households', banks' and non-financial firms' financing costs and thus is an essential element in understanding global liquidity conditions as a precondition to gauging financial stability risks from extreme liquidity conditions. Domestic short-term interest rates, through expectations about the future path of policy rates, also influence risk-free (nominal) yield curves. Interbank market rates and those for other financial assets, in turn, are set on the basis of these risk-free rates, adding risk premia for liquidity and counterparty risks that reflect market-specific characteristics (such as depth of markets or risk management practices) as well as risk appetite. The level of interest rates, in turn, affects the growth rate of credit and overall liquidity conditions throughout the economy.

Chart C.2 Real ex post interest rates in advanced and emerging economies

(Q1 2002 – Q2 2011, percentage change per annum)

advanced economies
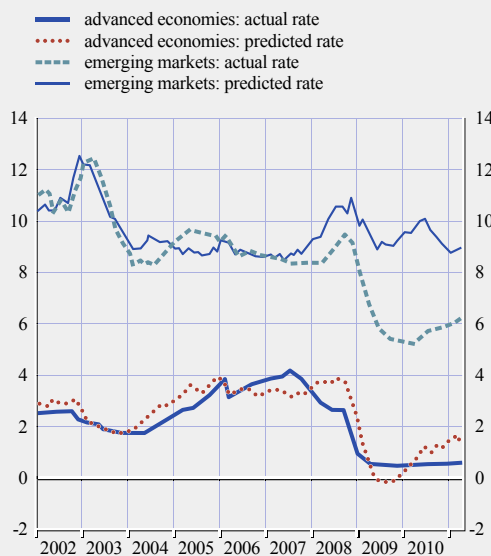emerging markets
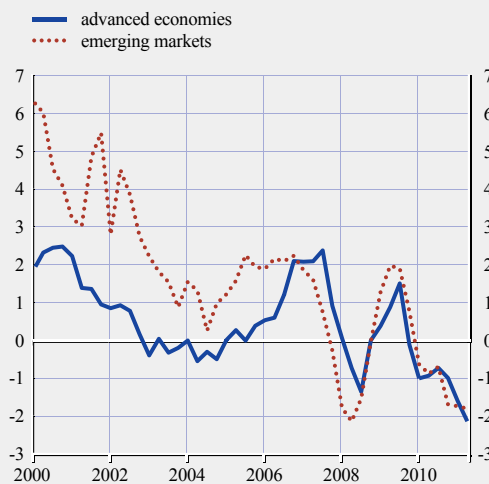
Sources: Haver Analytics and ECB calculations.
Notes: The advanced economies include the euro area, Japan, Sweden, Switzerland, the United Kingdom and the United States. The emerging market economies include Argentina, Brazil, China, Hong Kong, Indonesia, India, Mexico, Russia, Singapore, South Korea, Taiwan, Thailand and Turkey.

Chart C.2 presents real interest rates in advanced and emerging economies. The real interest rates are calculated by subtracting the annual rate of inflation from the individual economies' policy rates. These rates are then aggregated together using GDP weights. This type of indicator is one tool for gauging global liquidity conditions. For instance, prolonged periods of very low real rates may induce excessive risk-taking and elevated credit growth, which may have adverse consequences for financial stability.

Two important features can be noted from the chart. First, there has been a marked convergence in short-term real rates in advanced and emerging market economies over the past decade. This probably reflects closer real economic and financial ties between the two economic blocs. Second, real ex post interest rates have hovered in negative territory since early 2010, resulting from low policy rates coupled with relatively high inflation rates in some economies. The low short-term real rates observed over the past two years should mainly be seen as a reflection of

Chart C.3 Aggregate GDP-weighted Taylor rule estimates for advanced and emerging economies

(Jan. 2002 – Apr. 2011, percentages)

— advanced economies: actual rate
···· advanced economies: predicted rate
---- emerging markets: actual rate
— emerging markets: predicted rate

Sources: Haver Analytics, Consensus Economics and ECB calculations.
Notes: The advanced economies include Australia, Canada, the euro area, Iceland, Israel, Norway, New Zealand, Sweden, Switzerland, the United Kingdom and the United States. The emerging market economies include Brazil, Chile, Colombia, the Czech Republic, Hungary, Indonesia, India, Mexico, Peru, the Philippines, Poland, Romania, Russia, South Africa, South Korea, Thailand, Turkey and the Ukraine.

policy measures taken around the world to face the global economic challenges.

An alternative means by which to demonstrate the role of central bank interest rates in determining global liquidity conditions would be to make use of Taylor rules. Taylor rules can show how central banks have historically adjusted their policy rates to changes in the macroeconomic environment (i.e. inflation and output).[3] It should be noted that results will differ, depending on the way the Taylor rules are estimated (backward looking, forward looking, the inclusion of an interest smoothing component, how the output gap measure is calculated, etc.). Moreover, estimates are based on average central bank behaviour over the sample under consideration. Structural changes in the macro series, changes in central banks' objectives and market participants' behaviour are not fully taken into account. Keeping these

caveats in mind, by aggregating the estimates for a large set of economies, Taylor rules can still help policy-makers to form a rough view about global liquidity conditions.

A simple rule of thumb says that liquidity is neither too high nor too low if policy rates are broadly in line with the policy rates implied by the Taylor rule. While subject to numerous caveats, not least that unconventional monetary policy measures are not taken into account, aggregated Taylor rules can nonetheless provide an illustrative cross-country quantitative benchmark for evaluating global liquidity.

Comparing aggregated actual and implied policy rates suggests that throughout the current crisis, interest rates in emerging markets have been below those implied by standard Taylor rules, whereas central banks in advanced economies, on an aggregate basis, have set their policy rates broadly in line with Taylor rule predictions (see Chart C.3).[4]

Asset price valuation

Alternatively, global liquidity conditions can indirectly be measured by asset price valuation indicators. Misaligned asset prices may partly reflect excessive liquidity conditions with negative consequences for financial stability. For instance, excess liquidity and loose financing conditions may induce investors to take on too much risk, thereby compressing the risk premium on financial and real estate assets. As a result, asset prices may rise to levels elevated from their fundamentals, which in turn may lead to costly asset price booms and

3   See J.B. Taylor, "Discretion versus policy rules in practice", Carnegie-Rochester conference series on public policy, No 39, 1993; A. Orphanides, "Taylor Rules", *Finance and Economics Discussion Series*, Federal Reserve Board, No 18, 2007; and IMF, "What is global liquidity?", *World Economic Outlook,* October 2007.

4   A. Amzallag, S. Bashir and M. Fratzscher, "Inflation targeting in advanced and emerging economies - before and after the financial crisis", *ECB Working Paper Series*, forthcoming. The Taylor rule rates are estimated up to March 2008 using real-time, forward-looking expectations of inflation and the output gap. More recent data is used to project the rates forward and thus assess whether pre-financial crisis monetary policy objectives appear to have shifted in each country. Chart C.3 displays the real GDP-weighted averages of individual country policy and Taylor rule-predicted rates.

Chart C.4 Aggregated price/earnings (P/E) ratio for advanced and emerging economies

(1980 – 2011; ratio)

———— advanced economies
·········· emerging markets

Sources: Thomson Reuters Datastream and Haver.
Notes: The aggregated P/E ratio for advanced economies consists of GDP-weighted estimates for the United States, the euro area, Japan, the United Kingdom, Sweden and Switzerland. The P/E ratio for emerging markets is aggregated by Thomson Reuters Datastream.

busts. Empirical research on global liquidity and asset prices has mostly focused on the impact on equity, commodity and house prices. For instance, Baks and Kramer[5] find that global liquidity (as measured by G7 excess money growth) is negatively correlated with interest rates and positively related to equity returns. The IMF has recently examined the linkages between global liquidity expansion, asset prices and capital inflows in emerging economies.[6] This study found that rising global liquidity is associated with rising equity returns and declining real interest rates in 34 "liquidity-receiving" economies. In addition, Alessi and Detken[7] examine the extent to which financial and real indicators can help to predict costly asset price boom and bust cycles, using data from between 1970 and 2007 for 18 OECD countries. They find that global financial variables (M1 gap and credit gap, in particular) are more informative than real variables in detecting these boom and bust cycles.

A standard valuation metric for stock markets is the price/earnings (P/E) ratio. In general, the P/E

ratio tends to display mean-reverting behaviour over time (see Chart C.4). The reversion back to its mean usually emanates from its price component and, to a lesser extent, reflects a correction of the earnings component. Thus, if the P/E ratio is hovering at levels much above its mean, this could indicate it has risen above the levels suggested by its "fundamentals". During 2011 P/E ratios in emerging markets have remained rather stable, broadly in line with their long-term averages, whereas P/E ratios in advanced economies have dropped to levels slightly below their long-term averages.

Uncertainty, risk appetite and financial market liquidity indicators

A third set of indicators to measure global liquidity relates to estimates of uncertainty, risk appetite and financial market liquidity indicators. For instance, the search for yield (or lack thereof) can have important implications for global financial stability through misallocations of financial and economic resources and the associated financial stability risks. Policy-makers should also view global liquidity in relation to market uncertainty and risk aversion. There is empirical evidence that during periods of ample liquidity, asset price volatility tends to be low. Abnormally low asset price volatility can have the effect that market participants take on too much risk in their portfolio decisions, which in turn can have adverse consequences for financial stability in the form of misallocations and costly asset price booms and busts.

The implied volatility derived from option prices on the US S&P 500 index (i.e. the VIX index) is an indicator of risk monitored by most policy-makers and financial market commentators. This measure is theoretically appealing as it measures the expected volatility

5 K. Baks and C. Kramer, "Global Liquidity and Asset Prices: Measurement, Implications and Spillovers," *IMF Working Paper*, No 99/168, 1999.
6 IMF, "Global Liquidity Expansion: Effects on 'Receiving' Economies and Policy Response Options", *Global Financial Stability Report*, April 2010.
7 L. Alessi and C. Detken, "Quasi real time early warning indicators for costly asset price boom/bust cycles: A role for global liquidity", *European Journal of Political Economy,* No 27(3), 2011.

**Chart C.5 Decomposition of the VIX into uncertainty and risk aversion**

(Jan. 1990 – Aug. 2011)

— uncertainty
···· risk aversion
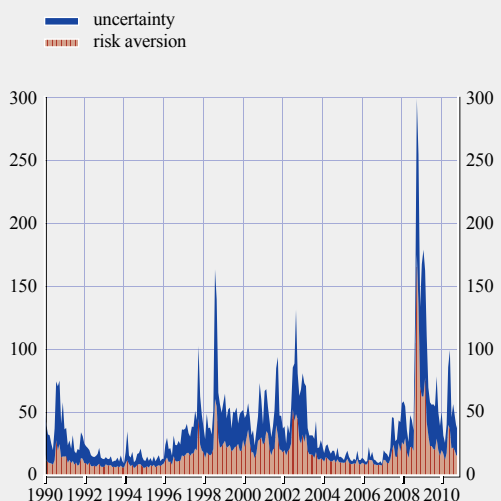
Sources: Thomson Reuters Datastream and ECB calculations.
Note: Risk aversion is the difference between the squared VIX (rescaled to reflect expected variance over a period of one month) and the conditional variance (uncertainty).

Chart C.6 Spreads between three-month deposit and overnight index swap rates in selected money markets

(Aug. 2007 – Nov. 2009; basis points)

— EUR
···· GBP
--- USD
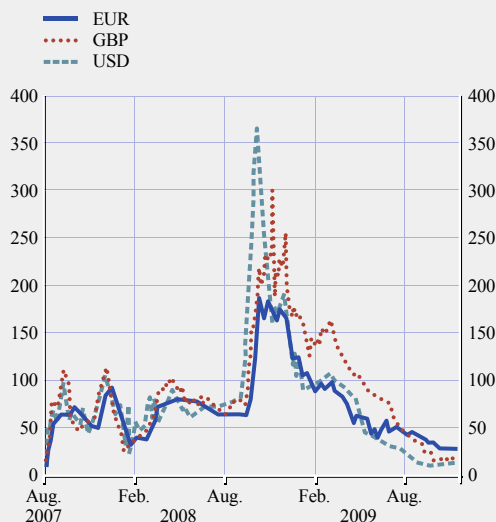
Source: Bloomberg.

in the eyes of investors. If expected volatility measures across major markets remain well below their average for a prolonged period, this can indicate that global liquidity is too ample.

It is important to note that implied stock market volatility captures both the perceived price and level of uncertainty of future stock price movements. Bekaert et al.[8] thus attempt to decompose the VIX into its risk aversion (price) and uncertainty (level) components (see Chart C.5). This decomposition can help policy-makers to gauge the interactions between global liquidity and market uncertainty/risk aversion.

Bekaert et al. examine the link between market uncertainty/risk aversion and monetary policy in the United States. This is important more broadly in the context of the assessment of global liquidity given that "risk aversion" and "economic uncertainty" may have different effects on asset prices. For example, to the extent that excessively low global asset returns lead to a search for yield among investors, the

related rise in risk appetite may be symptomatic of a rise in global liquidity.

Financial market liquidity can also be used to assess global liquidity conditions. For instance, substantial concerns over liquidity risk in September 2008 triggered looser global financing conditions, and a subsequent rise in global liquidity (see Chart C.6). Arbitrage would imply a zero spread in interbank term spreads at a three-month maturity, while a non-zero spread is indicative of tension in the interbank market. This indicator can provide policy-makers with insights into the degree of liquidity risk faced by the banking sector as a whole across major markets.

Developments in carry trades are also of interest in the context of global liquidity as carry trades are more likely to occur in an environment of favourable financing conditions and low financial market volatility, while they tend to

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8 G. Bekaert, M. Hoerova and M. Lo Duca, "Risk, Uncertainty, and Monetary Policy", *NBER Working Papers*, No 16397, 2010.

Chart C.7 Global carry trade attractiveness indicator

(Jan. 1997 – Oct. 2011)

Sources: Thomson Reuters Datastream and ECB calculations.
Notes: The Japanese yen and the Swiss franc are defined as funding (low-yielding) currencies and the Australian dollar, the Canadian dollar, the US dollar and the New Zealand dollar as investing (high-yielding) currencies. The attractiveness indicator is computed as the interest rate differential between a high-yielding currency and a low-yielding currency, divided by the exponentially weighted moving average (EWMA) volatility of the foreign exchange rate between the two countries. The global carry trade attractiveness indicator is computed as an equally-weighted average of the eight bilateral series.

retract in use during global liquidity shortages. Carry-trade opportunities mainly arise owing to differences in the monetary policy stance across regions. A carry trade consists of an unhedged bet where an investor borrows in low-yielding currencies and invests in high-yielding currencies. If the bilateral exchange rate between the two countries remains unchanged over the investment horizon, the investor makes a profit equal to the interest rate differentials.

No direct data on carry trades exist so policy-makers have to rely on indicators such as ex post returns from carry trade strategies, currency flows in the international banking system or net open positions of non-commercial traders in different currency futures. In addition, one ex ante approach is to compute a "carry trade attractiveness indicator".[9] This is computed as the interest rate differential between a high-yielding currency and a low-yielding currency, divided by the exchange rate volatility between the two currencies. A "high" ratio between two currencies would imply, everything else held equal, a

favourable carry trade environment. By averaging carry trade attractiveness indicators for a number of well-known bilateral funding and investment currency strategies, it is possible to gauge carry trade attractiveness on a global scale.

This global carry trade attractiveness indicator suggests less favourable conditions for carry trades since 2007/08 mainly owing to higher foreign exchange volatility (see Chart C.7). From a global liquidity perspective, the low attractiveness of carry trades possibly reflects less favourable funding conditions and global liquidity shortages.

All in all, financial market liquidity indicators have the common theme of being volatile and should thus be treated with utmost caution. Notwithstanding the obvious caveats, a close monitoring and analysis of a broad range of financial market indicators can be helpful if a policy-maker wishes to better understand the interaction between global liquidity conditions and the functioning of financial markets.

Capital flows, international reserves and cross-border credit growth

A fourth and last set of indicators to measure global liquidity relates to capital flows, international reserves and cross-border credit growth. The potential for sudden stops and reversals in such flows represents an important financial stability risk. Given that the quality of the data used to calculate these indicators can sometimes be questionable, a broad set of indicators should be monitored before any policy actions can be taken.

Over recent decades, emerging markets have become increasingly important for the world economy. Strong economic growth coupled with rising asset prices and relatively high credit growth means that these economies should also be closely monitored from a global liquidity perspective.

9 See G. Galati, A. Heath and P. McGuire, "Evidence of carry trade activity", *BIS Quarterly Review*, September 2007.

The combination of the increased importance of emerging markets and improved opportunities to seek finance abroad suggests that measures of cross-border credit should be closely monitored by policy-makers. In fact, the growth in international bank credit exhibits boom-and-bust cycles that correspond closely to episodes of financial distress. Moreover, periods of particularly strong growth in cross-border credit often coincide with episodes of elevated risk appetite and compressed risk premia.

Furthermore, developments in various measures of capital flows (net, gross and the composition of flows), stock prices, credit growth and foreign reserves in emerging markets are particularly important.

An environment of excessive global liquidity may be characterised by abnormally high capital inflows to emerging markets, stock prices surging to levels much above firms' earnings growth, credit growth rising much faster than nominal GDP growth and foreign reserves increasing to levels beyond what would satisfy the traditional motives for holding reserves

Global liquidity and capital flows are closely connected. Push factors, such as accommodative monetary policy and quantitative easing strategies in advanced economies, may drive capital into emerging market assets. Apart from potentially being a reflection of excess liquidity, elevated capital inflows may have a number of adverse consequences for financial stability. First, strong inflows can place further upward pressure on assets in countries where valuations are already high, therefore leading to substantial deviations of prices from fundamental values. Second, strong net inflows can produce undesired real exchange rate appreciation, leading to overshooting and an undermining of the competitiveness of the economy. Third, an environment of high appetite for emerging market securities in combination with low interest rates in advanced economies increases the incentive for emerging markets to issue debt in foreign currency, especially in countries with exchange rate regimes that are not fully flexible.

This could lead to excessive exposure to foreign exchange risk.

Foreign reserve accumulation in emerging markets warrants further discussion, given the substantial increase in reserve holdings in these economies, particularly since 2007. Foreign reserves are partially accumulated by these economies for precautionary purposes, as a liquidity buffer to self-insure against future crises. The build-up of reserves has been used in some cases as a tool for maintaining export competitiveness by controlling the pace of appreciation of the domestic currency.

The accumulation of reserves can contribute to global liquidity through its impact on global bond yield configurations, as flows of capital to emerging markets are channelled back to advanced economies, mainly via purchases of US Treasury bonds. As global liquidity in a broad sense can be seen as (and measured by) the "ease of financing", strong foreign demand for US Treasuries exerts a downward pressure on yields and thus has a marked impact on global liquidity. It is difficult to estimate the exact price sensitivity of bond yields owing to

Chart C.8 Foreign reserve holdings in emerging markets

(Q1 2000 – Q2 2011; USD billions)

reserves
100% of short-term debt
20% of M2
three months of imports
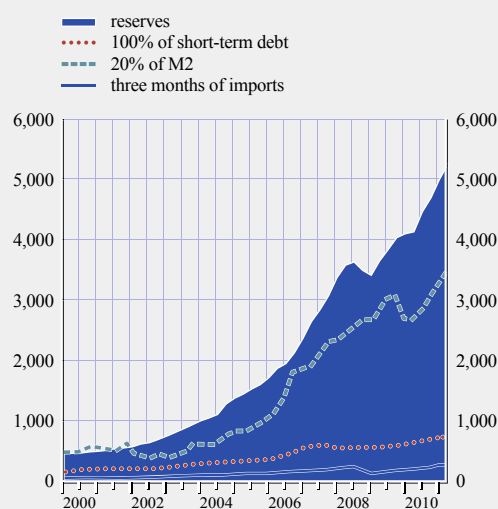
Sources: IMF, WEO and World Bank.

elevated demand, but one often-quoted study by Warnock and Warnock[10] finds that foreign purchases significantly lowered US Treasury yields, by some 90 basis points in 2005.

Rule-of-thumb measures to assess a benchmark level of reserves include three months of import coverage, 20% of broad money, or 100% of short-term debt. Levels of reserves beyond these benchmarks provide an indication of excess reserves. Accumulation of reserves for non-precautionary purposes can affect global liquidity conditions by contributing to an artificially low yield environment. The level of reserve holdings in emerging markets has been in excess of all three rule-of-thumb benchmark levels since 2003 (see Chart C.8).

POLICY RESPONSES

Armed with signals from these methods for measuring global liquidity, a key question is how public sector authorities respond when the measures signal important aberrations. In this vein, the ongoing discussions regarding policy responses to global liquidity developments can be summarised in terms of two broad needs. First, there is a need to agree on measures that can deal with liquidity surges and the associated build-up of risks. Second, policy-makers need to improve the ability to handle situations of liquidity shortages and the ensuing potential disruptions.

Global capital and liquidity regulations discussed within the Basel Committee on Banking Supervision are at the core when it comes to dealing with liquidity surges. Regarding capital regulations, there is a need for banks to hold more capital as well as counter-cyclical capital buffers and additional capital to further enhance their loss-absorption capacity. This is particularly crucial for institutions that are deemed systemically important. Furthermore, strengthened liquidity regulation should help to constrain the ability of the banking system to provide maturity transformation services, which should then reduce the amplitude of boom-bust cycles in global liquidity provision.

These reforms are, however, not enough by themselves to avoid costly asset price booms and busts; they need to be complemented with further macroprudential policy initiatives.

When it comes to addressing liquidity shortages, they can be divided into domestic and foreign currency liquidity shortages. Domestic shortages are usually handled by the central banks in the form of changes in liquidity operations and, in some cases, via purchases of assets. It is important to note that the central bank is the only institution which can supply domestic liquidity in an unlimited quantity.

To address foreign currency shortages, the main sources of public sector liquidity at the international level include: foreign exchange reserves, various IMF lending facilities (including new IMF instruments which increase the scale and flexibility for responding to global liquidity shortages), regional arrangements, special drawing rights and currency swaps and related arrangements between central banks. While foreign reserves helped to insulate some emerging market economies from funding difficulties in the course of 2008, the level of these reserves remain, as indicated above, beyond a level which could be considered to be precautionary.

Central bank currency swap arrangements have been an effective tool for addressing foreign currency liquidity shortages. While it is important that there are no technical obstacles to establishing these swap lines in times of need, it is of even more importance that the provision of liquidity under such arrangements is subject to "constructive ambiguity". Central banks should hence not commit ex ante to the provision of international liquidity in a crisis. This is necessary in order to: (i) preserve monetary policy autonomy; (ii) respect the mandate, resources, expertise and, ultimately, nature of these institutions; and (iii) minimise

10 F. Warnock and V. Warnock, "International capital flows and US interest rates", *Journal of International Money and Finance*, Vol. 28, October 2009.

the risk of moral hazard behaviour at the global level on the part of the recipients of the liquidity. The unique ability of the central bank to provide unlimited liquidity in the currencies that are demanded globally means that its role in addressing global liquidity shocks is key. That said, the financial risks for the liquidity-providing central banks need to be kept to a minimum. To enable central banks to continue to fulfil their mandate, it will be necessary for liquidity-providing mechanisms to protect the soundness of central banks' balance sheets. This implies an appropriate design which includes the use of risk-mitigating mechanisms. While central bank policies are the key avenue for influencing public sector liquidity, the regulatory and macroprudential policy framework has a central role in influencing liquidity provision by the financial and non-financial sectors.

CONCLUDING REMARKS

This special feature defined and empirically illustrated the notion of "global liquidity". Since the concept of global liquidity is very broad, the focus has been on a core sub-set of definitions and measures. It has been argued that policy-makers should aim to monitor a broad set of indicators and that the indicators may differ depending on the policy question at hand.

The financial stability implications of global liquidity may differ according to the indicator used to measure it. In broad terms, however, global liquidity affects financial stability through its impact on asset prices and overall financing and credit conditions. Global liquidity generated by the financial and non-financial sectors is strongly cyclical, and closely related to investor risk appetite and (de)leveraging by financial institutions. In times of easy funding conditions, there may be global liquidity surges associated with strong asset price rises, rapidly rising credit growth and higher risk-taking among investors. Such liquidity-surging cycles may reverse in times of financial distress through deleveraging. As a result, addressing global liquidity cycles and surges in global liquidity require an appropriate macro-prudential policy framework

to mitigate the risks to financial stability. In times of global liquidity shortages, the central bank plays a crucial role in the provision of public sector liquidity. It is important to stress, however, that this should be seen as part of a multi-layered approach whereby no single player has overall responsibility for handling a global liquidity crisis.