

Judit Antal and Áron Gereben: Foreign reserve strategies for emerging Economies – before and after the crisis*,¹

The global financial crisis posed as much of a challenge for the foreign exchange reserve policies of emerging countries as it did for their economic policies and financial systems. This pushed many countries into rethinking their strategies about foreign exchange reserves. This study presents the main objectives behind reserve accumulation by central banks, and summarises the considerations generally taken into account when defining the targeted level of foreign reserves. We also review the motives that led the majority of emerging countries to accumulate large-scale reserves in the period preceding the crisis. Many lessons can be drawn from the crisis about the level and use of reserves, and the possibilities for increasing reserves in times of turmoil. The lessons deemed most important by us, together with the foreign reserve trends of the post-crisis period are presented in the second part of this study. Based on our conclusions, international reserves are likely to increase further. This increase may generate further tensions in the global financial system, despite the fact that higher reserve levels may, on the level of individual countries, be a rational choice. To avoid global imbalances, international coordination and alternative sources of FX liquidity, such as central bank swap lines, new IMF instruments and regional financial solutions – vital in times of crisis – should be reinforced.

INTRODUCTION

Foreign exchange reserve strategies are among the most debated issues of modern central banking. Objectives behind reserve holdings vary from central bank to central bank, typically with little external communication on reserve strategies. Moreover, there are no generally accepted benchmarks for the required, or optimal, level of reserves. The lack of transparency may largely stem from the fact that central banks' primary role is not to achieve a certain reserve level, or a specific financing structure, but rather the achievement of price stability or other monetary policy objectives. Changes in the level of reserves are therefore not fully controlled by the central banks; their dynamics are influenced both by external factors and by influences related to achieving the objectives of monetary policy. The diversity of views about the desirable level of reserves is reflected by the lack of consensus on a generally accepted indicator of foreign reserves to be included in the G20's set of global imbalance indicators, as G20 members could not align their diverse opinions (G20 Summit, February 2011).

A large group of emerging economies, notably in Asia and Latin America, has accumulated substantial foreign reserves over the past two decades. In many cases, the increase in reserves far exceeds the levels warranted by the simple rules-of-thumb of reserve adequacy. This process has sparked a broad debate, also catalysing academic research. According to the literature, reserve growth is partly due to precautionary motives reflecting deeper financial integration, but export-promoting exchange rate policies, together with fears of falling behind peers also played a role. Overall, however, the intention to fulfil the expectations of investors and financial markets increasingly dominates reserve accumulation motives.

The global crisis presented a challenge for foreign reserve policy in a number of countries, prompting many of them to rethink their reserve strategies. For financially integrated economies, the sudden disappearance of FX liquidity from the banking system presented the biggest threat, while capital flight and currency depreciation necessitated FX market intervention in other countries. The lessons drawn from the crisis suggest that emerging countries with higher

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levels of reserves are more resilient to external shocks overall. This phenomenon was also reflected in the behaviour of many emerging countries: following the initial period of the crisis, many central banks decided to increase their reserves further. Apart from the lessons learned from the crisis, reserve accumulation may be driven by numerous other factors: monetary mercantilism, quantitative easing through foreign currency acquisition, or fears of falling behind peers. These factors, coupled with the experience of recent years suggest that reserve accumulation may continue. Growing reserves in emerging countries could contribute to the deepening of global imbalances. At the level of individual countries reserve accumulation may appear sensible; however, at the global level it is not beneficial, and containing it calls for reinforced international coordination.

WHY DO CENTRAL BANKS HOLD FOREIGN EXCHANGE RESERVES?

Central banks across the world provide various and sometimes diverging rationales for their foreign reserve holdings. Although the objectives are different, as a general tendency meeting the expectations of financial markets has increasingly become the focus rather than the classic objectives linked primarily to FX market intervention. In the following section we briefly present the main objectives featured in the communication of various central bank and in the academic literature, from the most frequently to the most rarely cited ones.

Meeting the demands of global financial markets/investors (the "international collateral" function). Holding foreign exchange reserves allows central banks to demonstrate their capacity to withstand financial market turmoil. The volume of reserves is often used by analysts, foreign investors and international financial institutions alike as an indicator of a country's resilience to external shocks. Credit rating agencies also regard the amount of foreign reserves as a vital element of country risk, which thus influences the outcome of rating exercises. The *international collateral* role of reserves is particularly important for emerging economies, which depend on international capital flows.

Providing foreign currency liquidity for government transactions. In many countries the central bank manages the government's accounts and executes foreign currency

transactions for public sector entities. This requires a certain volume of foreign currency reserve, serving as a liquidity buffer for such transactions ("working balance").

Maintaining fixed exchange rate regimes or target zones. For countries with fixed exchange rate regimes or exchange rate fluctuation bands, the use of foreign exchange reserves supports daily operation, as relatively frequent intervention is usually needed to maintain the exchange rate at the target. (An example is Denmark.) With wider fluctuation bands, large-scale intervention is only required in the event of severe FX market turmoil. One of the important objectives of holding reserves in these countries is therefore to defend the exchange rate regime during times of crisis by means of intervention.

Ensuring adequate capacity for FX market intervention. Exceptional shocks affecting the currency can trigger such levels of risk and loss for FX market makers that they may be pushed to withdraw from providing quotes and trading in general. The consequent drying up of FX market liquidity and weakening market infrastructure may trigger further sharp shifts in the exchange rate. Therefore, even the central banks of countries with clean, floating exchange rate regimes uphold the possibility of intervention in the FX market if warranted by extraordinary market circumstances, ensuring the market's liquidity and continuous operation of foreign exchange trading.

What are "foreign exchange reserves"?

A country's foreign exchange reserves include all financial instruments denominated in a foreign currency that embody claims on non-residents and are readily available to the monetary authority. Foreign exchange reserves therefore refer to a portfolio of financial assets, from which the monetary authority's liabilities towards foreign entities are not deducted.^{2,3}

In most cases, foreign exchange reserves are not part of the monetary authority's (country's) net wealth, as they are funded by central bank or government debt. The holding of foreign exchange reserves, therefore, refers to the maintenance of a characteristically liquid gross asset pool financed by debt, which entails economic benefits as well as indirect and direct costs.⁴

² The definition is based on the IMF methodology used in the MNB's statistics. The exact guidelines for the accounting and publication of foreign exchange reserves: "International Reserves and Foreign Currency Liquidity – Guidelines for a Data Template", IMF, 2001 (<http://dsbb.imf.org/Pages/SDDS/SDDSGuide.aspx>).

³ Foreign exchange reserves are, in a strict sense, only the foreign currency deposits and bonds held by central banks. However, the term in popular usage commonly refers to all international reserves, including gold, SDRs and IMF reserve positions, as well as other reserves including repo receivables.

⁴ Misunderstandings related to foreign exchange reserves are usually due to their unilateral use out of context from the central bank balance sheet.

Financing the balance of payments, providing buffer for balance of payments shocks. In countries with no liquid FX market, FX demand and supply stemming from external trade are covered directly through the central bank's foreign exchange reserves, as is the absorption of any inflowing capital. This function is typical of economies in early stages of development and of central banks using a currency board arrangement. The overwhelming majority of emerging economies has sufficiently liquid FX markets that fulfil this role without the need for central bank intervention or participation.

Expanding the set of domestic monetary policy instruments. In certain markets, the amount of securities available as acceptable collateral by the central bank is limited. This is usually due to the low supply of government securities in countries with low public debt. In these countries, monetary policy instruments are sometimes backed by foreign currency rather than securities, i.e. the central bank lends to commercial banks in the form of FX swaps rather than repurchase agreements. Foreign exchange reserves are a by-product of monetary policy implementation in such cases (Australia, Israel, New Zealand).

Increasing national wealth, generating revenue. Foreign exchange reserves generate revenue for central banks, and reserve management should focus on increasing revenue to the greatest possible extent, while ensuring the required liquidity. The revenue-generating role of foreign exchange reserves appears independently in both the international literature and the sets of objectives cited by certain central banks. However, it cannot be considered a primary objective, as the majority of countries do not achieve positive returns on their foreign exchange reserves in a net sense. The direct costs of holding reserves – financing and maintenance costs – generally exceed the yields of the reserve portfolio.⁵

Lender of last resort in foreign currency. A central bank may need, in some cases, foreign exchange resources in the event of bank crises if it decides to bail out a distressed domestic bank based on systemic risk considerations.

Providing ultimate resources for 'extreme' global financial collapses. Some authors suggest that the objective of holding foreign exchange reserves is to ensure that the value of money is preserved in the unlikely event of an extreme global financial meltdown. It is obviously very

difficult to outline such an 'Armageddon' scenario, and to foresee which instruments would maintain their value if such a crisis occurred.

Managing liquidity shortages on the FX swap market. In recent years, several central banks have asserted that a key additional purpose of reserve accumulation is to manage potential FX liquidity shortages on derivatives markets. At the onset of the crisis, deteriorating confidence triggered the dry-up of FX swap markets, first in developed, then in emerging countries. This led to both monetary policy dilemmas and financial stability risks in many countries with deep financial mutual integration. A number of central banks provided FX swap instruments to their banking systems to ease the shortage of foreign currency liquidity.

Similarly to other central banks, it is the statutory task of the Magyar Nemzeti Bank – as stipulated in the Act on the Magyar Nemzeti Bank – to manage the country's foreign exchange reserves. The foreign exchange reserves held by the MNB serve various purposes, the most important of which include:

- to ensure the level of reserves expected by market participants (role of "international collateral");
- to ensure adequate capacity for interventions;
- to alleviate foreign currency liquidity problems in the event of systemic liquidity crises;
- to meet transactions-related demand for foreign currency (provide the FX liquidity required for the foreign currency payment obligations of the government).

HOW MUCH RESERVES SHOULD ONE HOLD?

There is no single best way to determine the optimal level of foreign exchange reserves. The benefits and costs of holding reserves are very difficult to weigh by way of formal economic models, primarily because reserves are generally used in bulk only in times of severe crisis. The probability of such situations, the unfolding of crises and the benefits of using reserves can only be quantified by making uncertain, *ad hoc* assumptions.

International practice thus tends to define simple rules-of-thumb for determining the necessary levels of foreign

⁵ The situation is different if a country manages its own sovereign wealth as a foreign currency asset fund (e.g. Norway). This generally occurs in oil-producing countries, where state revenues from oil production are so high that their use in annual budgets is restricted based on economic policy considerations, and the accumulating capital is collected and managed in sovereign wealth funds instead.

exchange reserves to be held by countries. These rules-of-thumb are incorporated into the recommendations of international organisations, the internal practice of central banks, and are also used by rating agencies, banks and economic analysts to assess the foreign exchange reserve levels of countries, and hence their external vulnerability.

The most common reserve indicators are the following.

The ratio of foreign exchange reserves to short-term external debt (the 'Guidotti-Greenspan rule'). Following the experience of the 1997–98 Asian crisis, short-term external debt (debt with remaining maturity of one year or less) saw its role increase in determining a benchmark for foreign exchange reserves. The significance of short-term external debt as an indicator of reserve needs arises from financial globalisation. In a financially integrated world economy, contrary to past experience, the major external risk is not linked to the financing of the current account balance deficit, but rather to sudden capital outflows. Moreover, empirical research on the Asian crisis suggested that the ratio of foreign exchange reserves to short-term debt is closely related to the probability and severity of a crisis (Edison, 2003).

According to this method, which is commonly referred to as the Guidotti-Greenspan rule, foreign exchange reserves should equal short-term debt, thereby ensuring sufficient liquid assets in the event that a country cannot renew its short-term external debt.

The rule has numerous alternative versions. According to some, the optimal level of reserves should also cover the current account balance deficit for the current year in addition to short-term debt. This corresponds to the assumption that no adjustments occur in external balance developments despite the funding crisis. Others include interest obligations related to external debt when defining the benchmark reserve rate, over and above the value of short-term external debt. Yet others only include debt elements denominated in foreign currency, based on the fact that repayment of debt denominated in domestic currency does not require foreign currency.

Guidotti-type rules can be criticised on several grounds. For one, the reserve requirement is difficult to gauge, as most countries do not publish data on the maturity structure of their external debt. Moreover, recent experience suggests that short-term debt may accumulate rapidly, while central banks often have little room for manoeuvre to increase their reserves. Thirdly, the indicator does not adequately measure the drying up of external funding or the foreign currency needs arising from the

flight of foreign investors, as the maturity of the assets does not necessarily correspond to their liquidity. While the indicator does not take certain easy-to-sell debt elements into account, it may overestimate the volume of capital outflow for other items. For example, in the case of loans granted by non-resident owners such as parent banks or parent companies, it is hardly plausible that subsidiaries with good long-term growth prospects would be cut off from intercompany financing, even if it is provided in a short-term form. Finally, the indicator ignores the risk of capital flight by domestic entities in the event of a banking crisis, which could trigger a financing crisis similar to that of the drying up of capital inflows.

Reserve indicators based on gross external debt. Some of the above criticisms could be resolved if central banks took total external debt into consideration, rather than only short-term debt. Such an approach could better mitigate the risk of reserves proving insufficient in the event of a sudden shortening of maturities. Wyplosz (2007) proposed a similar method, arguing that instead of using short-term debt, the reserve benchmark should be defined as a percentage of total external debt. Wyplosz lists several arguments that support the use of total external debt: (1) better availability of data; (2) the one-year limit is arbitrary and lacks grounding, as (3) long-term debt elements are not necessarily more stable compared to short-term ones (during times of crisis, holders of long-term instruments can hedge or sell, which can also contribute to the depreciation of the exchange rate).

M2-based indicators. According to the M2 rule, reserves must cover a given percentage of bank savings with maturities of less than two years. The rationale is that M2 is a good measure of liquid funding within the banking system, and therefore of funding risk that may arise if the confidence of domestic deposit-holders deteriorates, as in a banking crisis. For this indicator, no generally accepted value exist as for the Guidotti rule. Numerous analyses, however, place the optimal reserve level within the 5–25 per cent range. Green and Torgerson (2007) link the benchmark value to the exchange rate regime: countries with floating exchange rates should target the lower edge of the range. At the same time, market analyses often use peer-group comparisons of countries with similar fundamentals, rather than setting a specific threshold value.

Much criticism targets this indicator as well. The M2 rule only takes risk arising from banking crises into consideration, while gauging such risk – the reserve needs stemming from the banking crisis and from the outflow of domestic savings – imperfectly. The two-year limit is, as in the previous case, arbitrary, and unable to capture the amount of potentially volatile savings.

Table 1
Rules-of-thumb of foreign reserve adequacy monitored by credit rating agencies and investment banks

	Import rule	M2 rule	Guidotti-type rule	Gross external debt	Gross external financing need
Fitch			X		
Moody's		X	X	X	
Standard & Poor's					X
Deutsche Bank	X	X	X		
Goldman Sachs		X			
Citibank		X	X		
Barclays			X		X

Note: Data compiled by the MNB from credit rating agency and investment bank analyses.

Import rule. The rule states that foreign exchange reserves must cover three months of import accounts. The indicator primarily attempts to capture risks related to financing the current account balance in countries with fixed exchange rate regimes. The literature agrees that with the liberalisation of capital markets the import coverage indicator has essentially lost all relevance. Many analysts and investors nevertheless still monitor developments using this indicator.

The above simple indicators are difficult to justify from a theoretical perspective. However, in practice analysts of countries' external vulnerability (international institutions, credit rating agencies, market analysts, investment banks) place great emphasis on them. Table 1 presents the set of indicators used by several investment banks and credit rating agencies. It reveals that the M2 and Guidotti rules are the most commonly used indicators of foreign exchange reserve adequacy. Thus to satisfy the expectations of the international investor environment, it is important to monitor these indicators, even if the underlying economic considerations are not always well-founded.

The literature on reserves has been increasingly focusing on models that, contrary to the above rules-of-thumb, consider both the benefits and costs of reserve holdings when defining the desirable level of reserves. This phenomenon is related in part to the foreign exchange reserve build-up after the Asian crisis, and in part to the current crisis. In addition, recent years have seen numerous studies published examining the motives behind reserve accumulation in an international comparison, and setting foreign exchange reserve benchmarks by summarising past experience of groups of countries using econometric tools (panel regression models).

Although far more sophisticated in terms of methodology, both the cost-benefit models and the panel regression analyses still strongly rely in spirit on the simple rules-of-

thumb analysed to this day by credit rating agencies and investment banks.

Optimising models. Based on the logic of these models, foreign exchange reserves can be viewed as a means of preventing and hedging against crises, defined as the sudden reversal of capital flows. The benefit of holding reserves during such crises can be measured using the likelihood of the crisis and the output loss suffered in crisis years in the absence of reserves, while its cost can be captured using a yield difference. Comparison of the marginal cost and the benefit determines the optimal level of reserves for a given set of circumstances. The methodology used is generally based on variants of the Jeanne and Rancière (2008) model.

In the past, such models of optimal reserve holdings have not seen much practical use, and served mainly to explain past developments in reserves in specific countries or regions. Recently published studies, however, often use such models to suggest a reserve target for individual countries. Optimising models of reserve adequacy are thus no longer confined to academic literature. Such approaches are applied, for instance, to Chile (Garcia and Soto, 2004), New Zealand (Gereben and Woolford, 2005; Gordon, 2005), Uruguay (Gonçalves, 2007) and Croatia (Čeh and Krznar, 2008, 2009).

The main advantage of models assuming optimising behaviour is that they explicitly take into account the costs and benefits of holding reserves. However, the richer framework also presents drawbacks: many of the parameters used in the models – such as the likelihood and cost of crises, or the degree of risk appetite – cannot be backed by robust empirical grounding. The expert judgments used in the calibration of the models thus bring a subjective element into the outcome.

Panel data regression models. Another stream in the literature attempts to explain observed reserve levels for

specific country groups using variables assigned to the supposedly important motives of reserve accumulation. These analyses usually look at the explanatory power of the following factors:

- (1) size of the economy (GDP per capita, population);
- (2) current account vulnerability (import/GDP, [export+import]/GDP, export volatility);
- (3) capital account vulnerability (financial openness, M2/GDP, short debt/GDP, proportion of external debt in a foreign currency);
- (4) exchange rate flexibility (exchange rate volatility, type of exchange rate regime);
- (5) opportunity cost of holding reserves (yield difference).

According to the theory, the first three groups of indicators exert a positive, while the last two groups exert a negative effect on reserve levels.

Previous studies (for example Edison, 2003) typically base their explanations of reserve levels on the size of the economy and the vulnerability of the current account balance: besides the size of the economy, the size of and fluctuations in foreign trade, and the fluctuations in the exchange rate are factors that influence the foreign exchange reserve levels of most countries. According to the analyses, the costs of holding reserves are only marginally taken into account by countries when establishing their reserve levels.

Recent studies (for example Obstfeld et al., 2008) emphasise that financial variables, in particular the size of the banking system, must also be given a high priority when setting the optimal reserve level. They argue that foreign exchange reserves must be sufficient for handling a simultaneous currency crisis and banking crisis. Moreover, they deem that in the event of a crisis, outflow may take place at a faster rate from banks' domestic deposits than from external debt elements. As short-term external debt matures progressively, the effect of not renewing these funds only exerts pressure several months later, while in the event of a banking crisis, domestic liquid funds may be withdrawn from the country in a matter of weeks. The authors therefore consider that the M2/GDP indicator (measuring the liquid funding of the banking system) plays a fundamental role in the optimal reserve level. Their empirical analysis underscores the importance of the liquid funding in the banking system in

explaining past developments in foreign exchange reserves. They also demonstrate that the type of exchange rate regime, whether fixed or floating, does not influence reserve holdings in the countries under review. Central banks, however, tend to allocate higher reserves to debt denominated in foreign currency as compared to debt denominated in domestic currency.

Panel data regression models suggest suitable reserve levels on the basis of past reserve levels observed in peer groups, and on motivating factors. The question these models answer is how much reserves countries normally hold in given circumstances, but do not define any economically optimal value. In their analysis, Cheung and Qian (2009) attempt to determine the role of examples set by other countries in reserve accumulation, the fear of falling behind neighbours. The authors use the average reserve levels of the countries included in the sample as an explanatory variable. According to their findings, fear of falling behind competitors – the so-called 'Keeping up with the Joneses' effect – is significant, and has been an increasingly important factor in determining reserve levels since 1997.

The advantage of this approach is that required reserve levels are determined by taking a range of indicators into consideration simultaneously. The drawback, however, is that it fails to account for the cost of holding reserves, and that it defines the "expected", rather than the economically optimal reserve levels.

In Hungary the Magyar Nemzeti Bank formulates its view on the necessary level of reserves using a variety of indicators, and considers both the benefits and the costs of holding reserves. The Monetary Council determines a target value for foreign exchange reserves within a band set based on three main indicators (the Guidotti rule, a cost-benefit optimising model and the indicator incorporating the level of gross debt), taking various auxiliary indicators into account.

It is nevertheless important to note that the central bank has only limited control over the actual level of foreign exchange reserves. The constraints set by the liquidity of the currency market leave only a limited room for manoeuvre for foreign exchange purchases and sales. Foreign currency bond issuances aimed at increasing reserves can only be carried out in line with public debt management policy. Moreover, the crisis has revealed that in times of global financial market turbulences the opportunities of reserve accumulation become even more limited in each possible market.

FOREIGN EXCHANGE RESERVE TRENDS BEFORE THE CRISIS: WHY DID EMERGING COUNTRIES INCREASE THEIR RESERVES?

The past two decades have seen large-scale, rapid increases in the foreign exchange reserves of every country. Chart 1 illustrates that the accumulation of reserves accelerated after the Asian crisis and was most prominent in the emerging countries most severely hit by the crisis. In addition to South-East Asia, the Latin American region began to pile up substantial foreign exchange reserves as well. In contrast, developed countries show a different development: their foreign exchange reserves have only increased slightly over the past decades. Foreign exchange reserves in emerging economies have in many cases reached levels that – as illustrated in Chart 2 – are highly excessive, even based on traditional reserve adequacy indicators such as the Guidotti rule.⁶

In recent years the economic literature on foreign exchange reserves has sought to address the issue of the underlying reasons and motives behind the surge in reserves. Three main reasons have been identified in the literature.

Precautionary motives. This argument claims that the aim of increased reserves is to hedge against the vulnerability arising from international financial integration and to

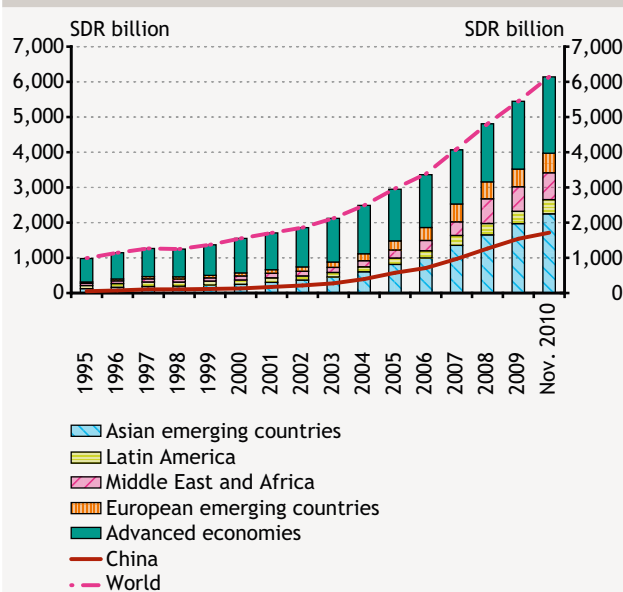
maintain a buffer against the sudden flight of capital (Aizenman and Lee, 2007).

Monetary mercantilism. Increases in reserves are the by-product of exchange rate devaluations and of restraining exchange rate appreciation through the sale of domestic currency by the central bank. It aims at maintaining and improving export competitiveness (Aizenman and Lee, 2007).

Fears of falling behind neighbours ('keeping up with the Joneses'). This argument holds that the objective of holding reserves is to ensure that reserve indicators do not fall behind those of a country's competitors. This behaviour may be motivated by numerous different considerations. It can be demonstrated, for instance, that the Asian crisis incurred substantially higher costs for countries with lower reserves. Higher reserve levels relative to peers can also increase capital inflows (Cheung and Qian, 2009).

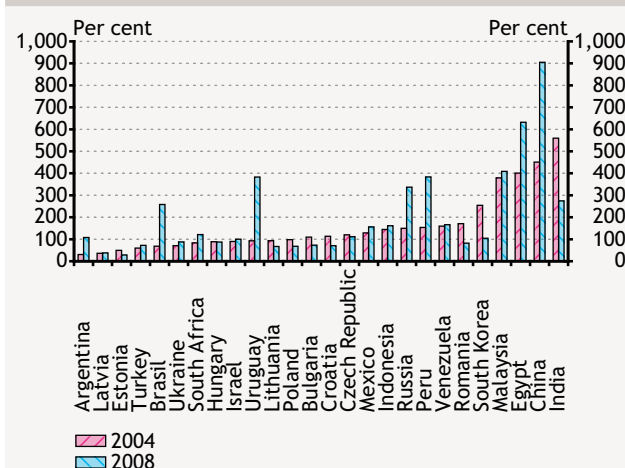
Part of the empirical literature explains the dynamics of reserve accumulation with variables capturing various motives. The prudential motives are generally captured using financial openness figures and exchange rate risk indicators; mercantilist considerations using exchange rate deviations from an equilibrium value (usually purchasing power parity) and export growth; and fears of falling behind neighbours using the reserve allocation of the region or country group under review. Another part of the studies

Chart 1
Foreign exchange reserves by region



Sources: IFS, Bank of China.

Chart 2
Developments in the Guidotti indicator (reserves to short-term external debt) in various countries



Source: IMF calculations. There may be methodological differences in the calculation of the various country indicators.

⁶ According to the Guidotti rule, foreign exchange reserves must cover the country's short-term external debt (foreign exchange reserve adequacy rules are discussed later in this article).

defines the reserve level justified by the prudential motive on the basis of theoretical models, and compares actual reserve holdings to the theoretically optimal value.

The majority of authors conclude that the increases in reserve holdings in emerging economies are partially (Aizenman and Lee, 2007; Durdu et al., 2007; Jeanne and Rancière, 2008; Obstfeld et al., 2008) or entirely (Garcia and Soto, 2004; Rodrik, 2006; Ruiz-Arranz and Zavadjil, 2008) spurred by prudential considerations. At the same time, certain authors argue in favour of the importance of mercantilist considerations (Edison, 2003; Genberg et al., 2005; Green and Torgerson, 2007; Delatte and Fouquau 2009). Increases in competitors' holdings also exert a significant effect on reserve accumulation (Cheung and Qian, 2009).

The main conclusions of the above research are the following.

Although it is not clear whether the upward dynamics of reserves observed since the turn of the millennium are partially or entirely the result of prudential considerations, it can be ascertained that *the prudential motive often justifies far higher reserve levels than the rules-of-thumb (e.g. the Guidotti rule)*. Even in the studies arguing that export-boosting measures play an important role in increasing reserves, the growth spurred solely by prudential considerations is higher in most cases than the level warranted by traditional indicators.

Efforts to avoid falling behind neighbours and competitors had a significant effect on the reserve accumulation of Asian countries. This motive only gained ground after the Asian crisis. From the perspective of global economy welfare, increasing reserves on the grounds of such considerations is far from optimal, even if the decision may appear sensible at the level of individual countries.

The literature therefore considers hedging against the increase in international capital flows, the deepening of financial integration and the resulting risks – the possible sudden reversal of capital flows – as the main motor of reserve accumulation. At the same time, it remains unclear as to the mechanisms through which foreign exchange reserves decrease the costs of rapid capital flight.

The classical argument holds that in the event of sudden stops, reserves can be used to replenish withdrawn capital.

Another possible mechanism is that high reserve levels decrease the likelihood of capital flight and the ensuing crises in the first place, or, if they do occur, decrease the amount of capital outflow. The pertaining empirical findings show a mixed picture: certain studies (Bussière and Mulder, 1999; Garcia and Soto, 2004; Levi-Yeyati, 2008) assert that reserves significantly decrease the likelihood of crises, while others (Berg et al., 2004; Jeanne and Rancière, 2008) argue that the effect is questionable.

A third potential benefit is that reserve accumulation and reserve holdings generally mitigate the entire economy's cost of external financing. According to Levy-Yeyati (2008), a one per cent increase in reserves may cut sovereign premia by 0.5 per cent. According to Ruiz-Arranz and Zavadjil (2008), the effect of reserves on sovereign premia is non-linear; their findings reveal that reserves amounting to 120-130 per cent of short-term external debt can substantially curb sovereign premia.

LESSONS OF THE CRISIS: ARE HIGH RESERVES REALLY BENEFICIAL?

In the post-Lehman period, foreign exchange reserve policies, one of the key elements of crisis management under real stress, had to prove themselves worldwide. The crisis, overarching both geographical and instrument market boundaries, and changes in investor expectations spurred many countries to rethink their earlier strategies. The main lessons drawn from the crisis can be summed up as follows:

Short-term debt forming the basis of the Guidotti rule may surge rapidly. One of the main lessons of the crisis has been the unexpected and sudden increase in short-term debt. In times of turmoil, the terms of financial markets shorten significantly, and spreads on long-term funding skyrocket. Long-term funding is therefore renewed for far shorter maturities, and the new funding is also characterised by shorter terms.⁷ From a central bank perspective, the rapid increase in short-term debt can create difficulties for reserve adequacy. Statistics are anyhow published with a lag of several months. It is particularly difficult for central banks to quickly replenish their foreign exchange reserves during times of crisis.

Investors and credit rating agencies expected emerging market central banks to comply with the Guidotti rule, even at the deepest point of the crisis. Following the onset of the crisis, the reserve adequacy of emerging countries became

⁷ In Hungary, besides the abovementioned reasons, changes in statistical methodology also contributed largely to the increase in the posted short-term debt in 2008.

the focus of investor and credit rating agency attention. When assessing reserve levels, commentators did not take into consideration that decreases in foreign exchange reserves are a necessity in such situations. Decreasing reserves often go hand in hand with substantial increases in risk premia. As a result, many countries chose to see their currencies depreciate sharply, rather than tapping into their reserves.

Parent bank funding was rolled over even in the most critical period of the crisis. The rationale behind the Guidotti rule is for reserves to ensure coverage for maturing external funding over the span of a year, even if capital inflows grind to a halt. At the same time, experience from the crisis reinforced one of the criticisms made against the Guidotti rule, namely that the rule overstates the extent of capital outflow. This is because parent banks and parent companies are likely to continue funding their otherwise profitable subsidiaries even during the crisis (Banai et al., 2010). Funds are generally withdrawn only once the firm or bank has ample coverage to offset it. The above may highlight the fact that the outflow of foreign funds may be substantially lower than the volume estimated on the basis of maturing external debt.

In the event of a liquidity crisis, it may be necessary for central banks to provide liquidity on the derivative (swap) markets, besides spot FX market intervention, which may in turn increase the reserve requirement. Prior to the onset of the crisis, central banks generally did not foresee that FX swaps could also dry up on the spot FX market given liquidity-boosting intervention, thus calling for central bank intervention. In the period following the subprime crisis and especially the collapse of Lehman Brothers, most developed and emerging FX swap markets were affected by USD shortages. The FX liquidity shortage emerging in developed countries, in conjunction with deteriorating confidence, led to the drying up of most FX swap markets worldwide. The crisis highlighted the fact that coverage for liquidity provision by the central bank to counter the drying up of swap markets must be taken into account when sizing foreign exchange reserves.

Besides the classic forms of foreign reserves, alternative sources of foreign currency liquidity (swap and repo transactions, IMF FCL, etc.) played an important role. The central banks of many developed and emerging countries received FX liquidity in various forms from the Federal Reserve, the ECB or the Swiss National Bank. Mexico,

Poland and Columbia were granted access to the IMF's new instrument, the Flexible Credit Line. These liquidity-providing instruments allowed central banks to address the foreign currency liquidity shortages on derivative markets without using their reserves. When access to such instruments was announced, markets reacted very positively in most cases, even in countries such as South Korea, Brazil or Singapore, where the size of these instruments was minor relative to the reserves holdings.⁸

In the event of a global crisis, it is often impossible to replenish reserves through sovereign bond issuance. One option for increasing reserves is to issue foreign currency debt. The crisis highlighted the fact that this is often not a viable means of replenishing reserves during times of actual crisis. Decreasing global risk appetite went hand in hand with a drastic slump in demand for the sovereign debt of emerging economies; there were no issuances, or if there were, they were paired with extremely high premia. In the Central and East European region only Poland and Slovakia managed to issue sovereign bonds between July 2008 and March 2009, albeit only in relatively small volumes (Kiss M. and Mák, 2009). At the same time the majority of countries in the region saw other channels of external funding dry up as well, forcing many of them to borrow from international organisations.

In Hungary, short-term external debt had already begun to rise right before the onset of the crisis,⁹ while deteriorating external financing conditions increasingly narrowed the options for replenishing reserves. Following the onset of the crisis, the FX liquidity shortage that emerged in the banking system called for rapid central bank intervention.

Analyses of Hungary continued to reflect investor expectations of increasing foreign exchange reserves even at the deepest point of the crisis. The repo and swap agreement with the ECB and the international loan agreement injected the liquidity needed for operating central bank instruments, and improved confidence vis-à-vis Hungary.

A major positive experience was that the parent bank funding forming the lion's share of short-term debt was rolled over even in the most critical period, with even more funds flowing in. Past developments do not, however, allow general conclusions to be drawn for the future.

⁸ Aizenman and Pasricha (2009) examined the effect of the announcement of the Fed's swap line extended to Brazil, Mexico, South Korea and Singapore on 29 October 2008 on their respective exchange rates. While the exchange rates of emerging countries depreciated by 0.15 per cent on average following the announcement, exchange rates in the four beneficiary countries appreciated by an average of 4 per cent.

⁹ Changes in statistical methodology also played a role in the rapid rise of short-term external debt. Some of the changes in methodology and revisions increased the debt dynamics of short-term external debt during the critical period, while others retroactively caused significant increases in data levels.

THE EFFECTS OF THE CRISIS ON NATIONAL RESERVE STRATEGIES

The lessons drawn from the crisis have led many countries to rethink their strategies about foreign exchange reserves. Central banks in several developed countries substantially altered their picture of optimal reserve levels (e.g. Australia, Sweden, Denmark, New Zealand), and the level of liquid reserves that can be tapped into in times of crisis also increased thanks to the FX swap lines and other credit line agreements offered by the major central banks issuing reserve currencies. At the same time, many emerging countries (e.g. Israel, South Korea and Mexico) expressed their intention to increase reserves.

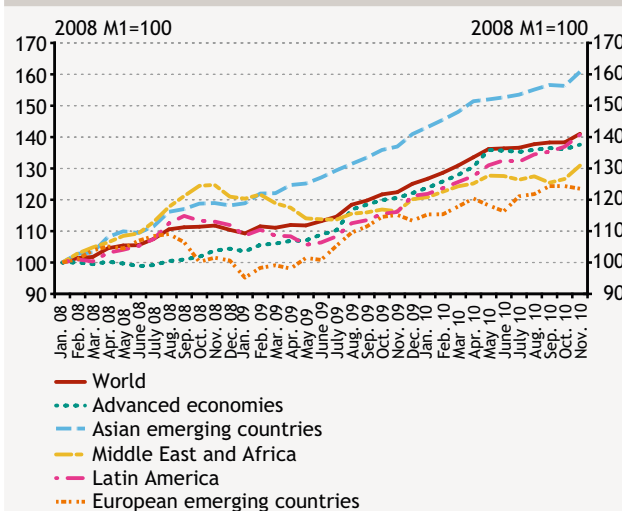
Denmark already had high reserves in comparison to developed European countries even before the onset of the crisis. This may primarily stem from the country's commitment to low exchange rate volatility, which warranted the reinforcement of its intervention capacity. External resources play a key role in the financing of the Danish banking system. The drying up of external funding during the crisis led to the unavoidable increase of the role of FX liquidity provision and FX funding by the central bank. The Danish central bank started building up substantial reserves, seeing the previous level double by mid-2009.

In Sweden, reserve levels were dipped into by the FX liquidity instruments directly extended to the banking system on the one hand, and by those indirectly extended to the countries where Swedish subsidiary banks operated (Estonia, Latvia and Iceland). The Swedish debt management agency issued FX bonds amounting to USD 13 billion in order to replenish reserves and the central bank contracted a further EUR 3 billion loan from the ECB. Moreover, Sweden concluded FX swap agreements with the ECB and the Federal Reserve.

Israel, choosing to abstain from the reserve accumulation competition in the past, decided to ramp up its reserve levels early on in the crisis. Prior to the crisis, Israel had low reserve levels, both in an absolute sense and in comparison with other emerging economies. Israel experienced significant capital inflows during the crisis thanks to its relatively favourable macroeconomic prospects, leading to an appreciation of its currency. Reserves were primarily increased through daily interventions of equal amounts.

Due to the reserve accumulation over the past decades, the majority of Asian and Latin American emerging economies had greater leeway for managing the crisis than in previous sudden steps. While in the past, the lack of sufficient intervention capacity left few short-term adaptation options

Chart 3
Changes in the reserve levels during the crisis
(in SDR)



Source: IFS.

besides currency depreciation, one of the main current crisis management measures has been the utilisation of reserves in certain countries. Russia used up nearly 30 per cent of its foreign reserves, while South Korea used up over 20 per cent to buffer the short-term impacts of the crisis (Chart 3).

The events have also made their mark on the debate about the optimal or excessive size of reserves. In its analysis Standard and Poor's (2008) states that while one year prior to the crisis many thought that the accumulation of reserves in Asia was excessive and contributed to global imbalances, the experience of the crisis proved otherwise. In their study published prior to the crisis, Park and Estrada argue against the holding of substantial reserves, while the revised version of the study published in 2009 (Park and Estrada, 2009) concludes that South Korea's experiences in 2008 question the previously established findings.

Aizenman and Sun (2009) provide a thorough study of emerging market reserves during the crisis. Their findings reveal that half of the emerging countries used reserves to accommodate the effects of the crisis. A sharp decrease of reserves mainly manifested itself in primary goods exporting countries, while countries presumably holding high foreign reserves due to financial openness and integration used up their reserves in a much smaller scale, if at all. The majority of countries only used up one quarter of their reserves during the crisis, while the average exchange rate depreciation in the sample was around 30 per cent between August 2008 and February 2009. The authors conclude that using reserves may be more costly for financially integrated emerging countries than exchange rate depreciation.

Fear of losing reserves may be motivated by several factors. Firstly, decreasing reserves may trigger speculative attacks, and secondly, it may increase the costs of external financing, thereby pushing up the overall costs of the crisis. These impacts may be exacerbated by any lagging behind the peer group countries.

Following the early stages of the crisis, reserve accumulation regained momentum in a broad group of emerging countries. Mexico and South Korea both announced plans to increase their reserves. Mexico first concluded an FX swap agreement with the Federal Reserve, and the USD 47 billion credit line it received from the IMF increased its potential level of foreign exchange reserves. As of 2010, the central bank aims to ensure funds for long-term reserve accumulation by issuing FX options. South Korea's reserves were presumably once again built up to historical levels by FX swap lines and FX purchases made by the central bank.

Besides the fear of falling behind neighbours and compliance with the expectations of investors, an additional motive may have spurred reserve accumulation during the crisis: besides "classic" mercantilist considerations, intervention by selling one's own currency is a convenient method of quantitative monetary easing in small, open economies. In countries where interest rate policy approaches the lower bound, intervention prompting depreciation may be a good method for boosting the economy with monetary measures; this may lead to further increases in reserve levels.

The level of foreign exchange reserves in Hungary at the end of 2010 approached EUR 34 billion, which is nearly double the pre-crisis volume. Increases in foreign reserves overall exceeded the growth in debt indicators reflecting various vulnerabilities stemming from the crisis, thereby contributing to making the country more resilient to external shocks.

CONCLUSIONS – THE NEED FOR INTERNATIONAL COORDINATION AND MACROPRUDENTIAL REGULATION

The lessons of the crisis and foreign exchange reserves that continue to swell even during times of crisis suggest further accumulation in global reserves. This increase in reserves is motivated by many factors. Countries with higher reserves proved more resilient in the crisis. Besides monetary mercantilism, quantitative easing through foreign exchange

intervention may gain an increasing role in the long run. Increases in reserve holdings may exacerbate fears of falling behind neighbours, similarly to the events seen after the Asian crisis.

Further growth in reserves may see the race to pile up reserves among emerging countries lead to an imbalance; the scurry may seem rational on the level of individual countries, but is detrimental on a general scale. Maintaining high reserve levels usually comes with significant explicit and implicit costs. Central banks generally invest foreign exchange reserves in safe and liquid, that is low-yielding instruments. Because financing is generally more costly than the return realised on the reserves, increasing reserves dampens central bank profit and incurs fiscal costs. Besides these direct costs, there are also certain indirect costs: reserve accumulation channels domestic savings and capital inflow into foreign instruments, thereby withdrawing them from private investments (crowding-out effect). The experience of certain countries also reveals that increasing reserve levels also attracts short-term, destabilizing capital flows through moral hazard. Increases in the reserves held by emerging countries also generate continuous capital flows towards developed countries, further deepening the global imbalances. A continuation of the increase of the savings gap between developed and emerging countries could pose a threat to global financial stability and may easily trigger future financial turbulence.

International coordination would be necessary in order to arrive at a solution that is optimal for both individual countries and the world. A good solution would be the creation of an alternative system of FX liquidity and financing instruments that could be used to increase reserves; these played a vital role in managing the crisis. Such solutions include the swap facilities between emerging and developed countries introduced during the crisis or the IMF's new Flexible Credit Line instrument, which enable emerging countries to access FX liquidity in the event of a sudden stop, without depleting their reserves. *Reserve pools* represent a similar concept; the Chiang Mai initiative created amongst Asian countries is an example thereof.¹⁰

At the same time, it is clear that regional and bilateral agreements only present a partial solution. Swap lines provided by developed countries were primarily motivated by the risks stemming from the indirect exposure of the

¹⁰ The Chiang Mai Initiative (CMI) is an arrangement concluded in 2000 between South-East Asian countries (ASEAN) and Japan, China and South Korea, in the context of which participants concluded bilateral swap agreements. Participating countries can also use each other's reserves within certain limits in order to manage FX liquidity problems. The agreement was prompted by the lessons learned from the 1997 crisis and the negative experiences with IMF programmes. In the course of 2008–2009, there was no such usage in the framework of the CMI.

banking systems of parent countries. Such agreements would not have been established if the banking systems of the countries providing the swap instruments had themselves not been facing difficulties, and had an interest in mitigating the problems of the foreign exposures of their banking systems. It is uncertain whether such assistance would be offered in the event of regional or localised crises. The issue of *moral hazard* also arose in relation to long-term swap agreements.¹¹

Regional swap agreements (*reserve pools*) could come under pressure if an entire region were affected by a crisis, and every member of the reserve pool would need foreign exchange reserves. For these reasons, bilaterally and regionally provided instruments can only substitute reserve holdings to a small extent.

The FX swap instruments and credit lines provided by international financial institutions could, at the same time, become a permanent feature of the international financial system. The instruments created by the IMF – such as the FCL, open to countries with better fundamentals and sounder economic policy pasts, or the PCL, open to those with weaker performances – could manage systemic risks. For these instruments to curb excessive reserve accumulation, however, the stigma, whether real or imaginary, felt by countries must be eradicated.

Besides the development of an “international financial safety net”, the other main concept for limiting reserve build-up could be the establishment of macroprudential regulation aiding the reduction of reserve requirements. The broad experience of CEE countries has been that the maturity of banks’ external, generally FX-denominated funds shortened sharply during the crisis. This decrease in duration represents a risk for financial stability, as maturity mismatch deteriorated significantly on banks’ balance sheets. In particular, the maturity mismatch of assets and liabilities per currency increased, which could engender problems for ensuring FX liquidity and closing open balance sheet FX positions in the event of the drying up of derivative markets. The above risks could be managed by creating a regulation limiting the shortening of the maturity of bank’s external funds, also restraining increases in short-term external debt and the foreign exchange reserve requirement.

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¹¹ Obstfeld et al. (2009) present that the Fed provided assistance in the form of swaps to countries that already had high reserve levels to begin with, paired with a good track record.

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