RISK MANAGEMENT MEASURES OF CENTRAL BANKS FOR THE FOREIGN EXCHANGE RESERVE

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ABSTRACT

The management of foreign exchange reserves is an important task undertaken by central banks. Based on the design of exchange rate arrangements and the requirements of monetary policy, foreign reserve assets may serve a variety of purposes, ranging from exchange rate management to external debt management. Hence central banks efficient and effective management of foreign reserves is vital if they are to fulfil their mandates comprehensively.

The prudent allocation and management of foreign reserves helps in maintaining the liquidity needed to fulfil policy mandates and also in minimising the costs of holding reserves. Central bank foreign reserves risk management can contribute to these objectives by managing and controlling the exposure to financial and operational risks

This paper makes an attempt to review the research work done on studying the risk management strategies of central banks for managing and neutralizing foreign exchange reserve.

Key words: foreign exchange reserve, risk management, central banks

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Introduction

It has been worldwide estimated that in 2007 more than 15% of world GDP, ie, more than US$ 12 trillion constitute the domestic and foreign financial assets of central banks and public wealth, and also about more than 10 per cent of the global market capitalization of equity and fixed-income securities markets comprises of their assets. This reflects unprecedented growth of their financial assets and the revolution of risk management techniques since last 15 years. The investment and risk management policies and procedures of central banks and other public investors have undergone a profound transformation. The purpose of this paper is to provide a comprehensive and structured overview of issues and techniques in the area of central bank risk management.

In one of the survey done by JP Morgan in 2007 to find out the total foreign reserve with the central banks in the world, it was obtained that they together hold USD billion 6459 . The survey also identified top five reserve holders which are listed in the table 1.1.

Table1.1: Foreign reserves of G3 Central Banks in December 2007

Top Five reserve holders	USD billion
China	1,528
Japan	954
Russia	446
Taiwan	270
India	268

Source: IMF, JP Morgan, New trends in reserve management – Central bank survey, February 2008,for domestic financial assets, Central banks website

Due consideration is given to the policy tasks of central bank, in particular to foreign reserves which is directly considered as policy assets and need to stand ready for intervention purposes. Also it has certain particular duties in terms of transparency and accountability. All this will have an impact on their investment policies and risk management techniques. The operational risk faced by RBI has been defined by the Basel Committee on Banking Supervision as the risk of

loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputational risk. This definition is based on the underlying causes of operational risk. It seeks to identify why a loss happened and at the broadest level includes the breakdown by four causes: people, processes, systems and external factors. In order to mitigate such risk central banks have explained different motives of holding foreign reserve and through a survey JPMorgan have identified the most important motives. Table 1.2 overviews how central banks perceive the relevance of different motives to hold reserves as obtained by JPMorgan in a survey conducted in 2007

Table 1.2 Different reasons for holding foreign exchange reserves – importance attributed by reserve managers according to a JPMorgan survey in April 2007

	Very important	Important	Somewhat important	Total
Conduct FX policies (interventions)	44%	23%	23%	91%
Crisis insurance	37%	28%	7%	72%
Serve external debt obligations	23%	12%	19%	53%
Ensure import coverage	21%	9%	19%	49%
Support country's credit standing	12%	14%	23%	49%
Build national wealth (future generations)	12%	19%	28%	59%
Other	5%	0%	2%	7%

Source: JPMorgan 'New trends in reserve management – Central bank survey', February 2008.

The table 1.2 shows that the most dominating risk of central bank is exchange rate risk for which no premium is earned. . It derives from one of the main policy tasks of a central bank, namely to hold foreign reserves for intervention purposes. This reflects that central bank holds huge non-remunerated risks, and is highly risk averse on remunerated risks. In contrast, the commercial banks and others main risk are always remunerative and holders earn a risk premium for it. Also for commercial and private banks credit risk outweighs market risk, but for central its vice-versa

This shows the necessity to study the central bank's risk management method and understand that whether it is able to mitigate risk and does it uses the different hedging tools to reduce it?

This paper makes an attempt to study the literature review on central banks risk management methods and find out the gap in the research work which requires further detail study

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Literature Review

John Nugee, 1996, Chief Manager for Reserve Management, Bank of England, presented a paper in International Monetary Fund conference on Sovereign Asset and Liability Management, wherein he discussed the evolution of Central bank reserve management and argued that the Balance Sheet approach has many advantages in helping the authorities in some major policy decision related to reserve management.

Robert N McCauley and Ben S C Fung, 2003, Choosing instruments in managing dollar foreign exchange reserves, analyse the instruments in which central bank have invested their dollar reserves in recent years and poses three questions: How is the official dollar portfolio invested? How has the choice of instrument evolved over time? And how did the recent events, including the return of recession and US fiscal deficits, lower Treasury yields and corporate defaults altered its evolution? In the 1990s, official reserve managers continued to extend the maturity of their dollar portfolio as they had in the 1980s. Among their long-term holdings, however, they doubled the weight on instruments other than Treasury notes. Overall, by early 2000, reserve managers appeared to have only about half of their official dollar reserve portfolio invested in US Treasury securities. More recently, their preference for agency and US corporate debt has further diversified the official portfolio away from US Treasury securities.

In Schobert's analysis, by **Woodford (2003)** 74 per cent of observed annual central bank losses were due to FX issues. An idea of integrated risk management has been developed for central banks. An integrated risk management obviously needs to look at the entire balance sheet of a central bank, and at all major risk factors, including the non-alienable risk factor (i.e. the risk factors relating to policy tasks). In a recent comprehensive study, Schobert analyses 108 central

banks'financial statements over a total of 1880 years. Out of those, 43 central banks recorded at least once an annual loss, and 146 years of losses were observed in total. She attributes 41 per cent of loss years to the need to sterilize excess liquidity (which is typically due to large foreign exchange flows into the central bank balance sheet), and 33 per cent to FX valuation changes (i.e. devaluation of foreign reserves). Only 3 per cent would be attributed to credit losses, and there is no separate category regarding losses due to market price changes other than foreign exchange rate changes. In other words, interest rate risks were not considered a relevant category, probably because never was an end of year loss driven by changes of interest rates. These findings confirm that policies, and in particular foreign exchange rate policies, are the real threat to central bank profitability and capital, and not interest rate and credit risks; although those are the types of risks to which central bank risk managers devote most of their time, as these are the risks that are controlled through financial risk management decisions, while the others are largely implied by policy considerations, which may be seen to be outside the reach of financial risk management. However, even if a total priority of policy considerations would be accepted, still the lesson from the findings of Schobert and others is that when optimizing the financial assets of a central bank from the financial risk management perspective, one should never ignore the policy risk factors and how they correlate with the classical financial risk factors

Wooldridge, 2006, have suggested that monetary authorities since 1970s gradually diversified into higher-yielding, higher-risk instruments, but nevertheless reserves are still invested mostly in very liquid assets, with limited credit risk. The table 1.3 provides a survey of the degree of diversification across instrument classes that have been achieved by central banks in foreign reserves

Table 1.3: Asset classes used by central banks in their foreign reserve management

Asset class	Estimated share of asset class in total reserves
Central Government Bonds	79%
US Agencies debt	18%
Corporate bonds	3%
ABS/MBS	5%

Deposits	20%
Gold	10%

Source: Wooldridge, 2006

JP Morgan reserve managers' survey on asset classes showed that almost all central banks invest their foreign reserves into sovereign bonds in the relevant currency. Also, a large majority invests in (AAA rated) US Agency debt and supranational bonds, whereby the weight of the latter in the market portfolio is very small. All other major types of bonds (corporate, MBS/ABS, bank bonds) are eligible for around 50 per cent of central banks. Outside fixed-income securities, deposits are of course used by most central banks, while equity has been made eligible only by around 10 per cent of central banks.

According to **Wooldridge (2006),** the share of deposits is distributed rather heterogeneously across central banks. For instance India would have held 76% of its reserves in the form of deposits in 2006, and Russia 69%.Gold reserves still constituted 60% of foreign reserves in 1980. Currency composition of international foreign reserves would have been in 2006: around 65% in USD, 25% in EUR, JPY, GBP, and all the rest around 3% each.

Jaewoo Lee, Gian Maria Milesi-Ferretti, and Luca Ricci, 2006, Methodology for CGER Exchange Rate Assessments,IMF,approved by Raghuram G. Rajan, has explained three different methodologies, a "macroeconomic balance" approach, a reduced form "equilibrium real exchange rate" approach, and an "external sustainability" approach, to understand the consistency of current account balance and real effective exchange rates. He discussed that the approaches are complementary to one another in the process of arriving at "exchange rate assessments." He also explicitly recognized the much greater weight of key emerging market countries in the problem of global imbalances and currency misalignments.

Fernando Gonza´ lez and Phillipe Molitor (2007) work on Risk mitigation measures and credit risk assessment in central bank policy operations, highlights on the varieties of financial instruments used by Central bank to implement monetary policy. These instruments include repurchase transactions, outright transactions, central bank debt certificates, foreign exchange

swaps and the collection of fixed-term deposits. Out of these instruments, repurchase transactions are the most important tool used by central banks in the conduct of monetary policy. Repurchase transactions, also called 'reverse transactions' or 'repos', consist of the provision of funds against the guarantee of collateral for a limited and pre-specified period of time. The transaction can be divided into two legs, the cash and the collateral leg.

The cash leg is akin to a classical lending operation. The lender transfers an amount of cash to a borrower at the initiation of a transaction. The borrower commits to pay the cash amount lent plus compensation (i.e. interest) back to the lender at maturity. Second, counterparty risk can also be reduced by implementing a system of limits linking the exposure to each counterparty to its credit quality, so that the potential loss is kept at low levels. For central banks, however, such a system is generally incompatible with an efficient and transparent tender procedure for allotting liquidity. Finally, counterparty risk can be mitigated by requiring the borrower to provide adequate collateral. This approach mitigates financial risks without limiting the number of counterparties or interfering with the allotment procedure. It is a common approach chosen by major central banks when conducting repurchases operations. When combined with the appropriate risk management tools, collateralization can reduce the overall risk to negligible levels. The collateral leg of a repurchase transaction consists, hence, of providing collateral amounting at least in value to the cash borrowed to the lender, which is returned by the borrower upon receiving back the cash lent and the compensation at maturity of the transaction.

Despite the central role of collateral in current financial markets and in particular central bank monetary policy operations, little academic work exists on risk mitigation measures and risk control determination

Ulrich Bindseil and Francesco Papadia, 2007, in their work, Risk management and market impact of central bank credit operations has presented an analytical approach to the establishment of a central bank collateral framework to protect against credit losses. A collateral framework should ensure that the residual risks from credit exposures (e.g. lending) are in line with the central bank credit risk tolerance. At the same time, such a framework should remain reasonably simple. If a central bank accepts different types of collateral, it should apply

differentiated risk mitigation measures, to ensure that the risk remaining after the application of these measures complies with its risk tolerance. . Once the necessary risk mitigation measures have been defined for each type of asset, the central bank can rank each asset type according to its costs and benefits and then set a cut-off point which takes into account collateral demand.

Ulrich Bindseil, 2007, in his paper discussed that foreign exchange rate policy is one of the traditional elements of central bank policy. This typically implies the holding of foreign exchange reserves creates the risks of mark-to-market losses. In the paper, the author has discussed that holding foreign exchange reserves is costly for central banks, in particular for countries which have (i) a need to mop up excess liquidity in their domestic money market; (ii) have higher domestic interest rates than the interest rate of the reserve currency; (iii) of which the currency is subject to revaluation gains.

Ulrich has further substantiate his work by discussing the survey of Dalton and Dziobek (2005) which revealed that all of the substantial central bank losses they detected during the 1990s, concerning Brazil, Chile, the Czech Republic, Hungary, Korea and Thailand, reflected some foreign reserves issue. In fact all of these reflected a mismatch between returns on foreign reserves assets and higher costs of absorbing domestic liquidity (reflecting both interest rate differentials and revaluation effects

Jean-Charles Sevet ,2008 in his work, Operational risk management(ORM) in central banks, discussed that the critical challenge appears to central banks is to develop and nurture new ORM techniques He believes that role models are required to develop and nurture a new organizational culture and respond to three key demands:

1. Serving the needs and aspirations of highly educated and experienced service professionals, ORM cannot impose intrusive transparency, but must credibly encourage individuals and teams to openly disclose own mistakes and near misses.

2. Faced with an increasingly complex and uncertain business environment, ORM cannot just 'build awareness' on operational risks but must foster proactive attitudes of risk detection, prevention and mitigation.

3. Spurred by new constraints of effectiveness and efficiency, ORM must fundamentally re-orientate the traditional zero-risk culture of central bankers towards a culture of explicit risk tolerance and of cost–benefit assessments of controls.

He concludes that ORM is presently at a very nascent stage

Ulrich Bindseil, Fernando Gonza´ lez and Evangelos Tabakis, 2009, in the edited book, Risk Management for Central Banks and Other Public Investors surveys the fundamental issues and techniques associated with risk management and shows how central banks and other public investors can create better risk management frameworks. It looks at a specific area of risk management, first presenting general problems and then showing how these materialize in the special case of public institutions.

JP Morgan 2008 survey on derivatives conducted amongst 38 reserve managers of Central bank showed that the highest approved derivatives were FX forwards, swaps and Interest rate futures. However central bank planned derivatives is minimal. This reflects that despite of the approval for the use of derivatives to manage foreign exchange reserve risk, the actual use of derivatives is very small. Table 1.4 provides results on derivative use by central banks from the 2007 JPMorgan survey.

Table 1.4: Derivative currently allowed or planned to be allowed according to JP Morgan survey conducted amongst 38 reserve managers in April 2007

Derivatives	Approved	Planned
Gold Swap	32%	3%
Gold Options	24%	3%
FX forwards	76%	3%
FX swaps	63%	5%

FX futures	18%	3%
FX options	26%	16%
Interest rate futures	61%	13%
Interest rate swaps	53%	16%
Interest rate options	18%	18%
Credit derivatives	8%	11%
Equity derivatives	8%	0%
Non gold commodity derivatives	5%	0%

Source: JP Morgan "New trends in reserve management. Central bank survey, February, 2008

Evangelos Tabakis and Benedict Weller, 2009, in his work, Collateral and risk mitigation frameworks of central bank policyoperations – a comparison across central banks, makes a comparison of collateral policies and related risk management practices of three major central banks (the Federal Reserve Board, Bank of Japan and the European Central Bank) supplemented by less detailed information on a larger group of central banks. This comparison could serve also as an informal test of the model of collateral management policy. Two general facts distilled from the comparison seem to suggest that the model does capture the 'way of thinking' of central banks when developing their collateral policy.

First, central banks that implement monetary policy mainly or partly by lending to the banking system collateralize their exposure. This implies that protection against financial loss in such operations, even if these have policy objective, ranks high in the priorities of central banks' policies.

Second, the first assets to be accepted as eligible collateral are invariably government securities. This seems to confirm the prediction of the model that assets are included in the list of eligible collateral in the order of increasing risk mitigation costs. Government securities, arguably the least risky assets to be accepted as collateral, carry a minimum such cost. At the same time, it becomes clear that the model is too simple to capture and explain the variability of collateral policies among central banks even if these implement monetary policy in broadly similar ways.

Both differences in the fundamental principles chosen as the basis for the collateral policy of the central bank as well as the differences in the financial markets in which central banks operate are important determinants of the ultimate form that the collateral framework will take.

Finally, the fact that collateral management is a cost-intensive function in a central bank suggests that decisions to change it could be difficult and slow explaining also why practices may remain different despite converging tendencies.

Evangelos Tabakis and Benedict Weller,2009 in their work, Organizational issues in the risk management function of central banks, identifies risk management as a separate function in a central bank, with resources specifically dedicated to it, is a rather new development in the world of central banking. This may be considered surprising since central banks are, effectively, risk managers for the financial system as a whole. In their core functions of designing and implementing monetary policy and safeguarding financial stability, they manage the risk of inflation1 and the systemic risks inherent in financial crises. Strangely however, until recently, they had not paid as much attention to the management of their own balance sheet risks that emanate from their market operations. At the same time central banks as investors are facing increased challenges. Some have accumulated considerable sizes of foreign reserves and need to invest them in a diversified manner. This in turn makes them exposed to more complicated markets and more sophisticated instruments. Finally, risk management expertise is increasingly in demand in order to understand the complexity of risk transfer mechanisms in financial markets and detect potential risks of systemic nature.

In view of these developments, issues relating to the organization of the risk management function in the central bank are actively discussed in the central bank community. However,a number of questions such as the position of the risk management function in the organization of the central bank, the amount of resources dedicated to it, the types and frequency of reporting, the form of cooperation with other business areas and in particular those that take risks, the synergies between financial and operational risk management, the challenges of recruiting and training staff have yet to find their optimal answers. However, it does attempt to provide a way of thinking about these questions which is consistent with financial theory, regulatory directives

and best practices in financial institutions while, at the same time, considering the idiosyncrasies of the central bank.

Here the debate on the similarities and differences between central banks and other financial institutions was used to discuss the impact of the idiosyncrasies of the central bank on Governance principles in relation to the risk management function, but also to draw practical conclusions on how to organize such a function. Despite the various specificities of central banks that stem out of their policy orientation and their privilege to issue legal tender, the core governance principles relating to the function of risk management are not substantially different from the private sector. On the contrary, the paper also argued that it is particularly in those operations which are specific to central banks, i.e. those that have a policy goal, where a strong risk management framework is necessary. In fact the conclusion could be that the central bank should follow best practices in risk management for financial institutions as the default rule and deviate for them only if important and well documented policy reasons exist for such a deviation.

Finally, it has been argued that what remains an important element of the risk management function of the central bank is the existence and further fostering of an adequate risk management culture in the institution. Such a culture that steers away from both extreme risk averseness, traditionally associated with central banks, and a lack of the necessary risk awareness is imperative for the appropriate functioning of the central bank both under normal circumstances and during a financial crisis.

Jukka Pihlman and Han van der Hoorn, 2010, in their paper Procyclicality in Central Bank Reserve Management: Evidence from the Crisis, IMF working paper, analyzes reserve managers' actions during the crisis and draws some lessons for strategic asset allocation of reserves. The paper identifies the linkages between reserve management and financial stability during the global financial crises which started in 2007.It have important implications for the strategic asset allocation and reserve management activities of central banks. The paper ends by raising some important new questions for reserve management that are worth studying.

Tamim Bayoumi and Christian Saborowski, 2012, in their paper, Accounting for Reserves, IMF working paper, examined the impact of reserve intervention on the current account, with a particular emphasis on the role of capital controls. The results confirm their hypothesis that the level of capital controls is crucial to the impact of intervention on the current account. For a country with a closed capital account, the results suggest that every dollar of intervention moves the current account by 50 cents. The more positive message coming out of this paper is that the impact of reserve accumulation has been falling over time as countries have reduced their current account restrictions. Hence, even though intervention is rising, the size of the impact on the current account is dwindling (as a ratio to global GDP). Their calculations suggest that the impact of a given amount of reserve accumulation on imbalances has been falling over time.

Conclusion

There is extensive research done in the area of foreign exchange reserve of central banks but however the researcher feels that risk management of foreign exchange reserve needs further in-depth studies, particularly foe emerging economies.

Literature review has shown that different methodologies have been developed to study the consistency of current account and exchange rate such as balanced sheet approach a macroeconomic balance approach, equilibrium real exchange rate approach, and an external sustainability approach. John Nugee has also discussed the importance of balance sheet approach in taking some policy decision related to foreign reserve management. To take this study one step ahead, balance sheet approach can be used to study the risk management of central banks

Philman has shown a distinct link between foreign reserve and financial stability. This was supported by another study which confirms the hypothesis that the level of capital controls is crucial to the impact of intervention on the current account. For a country with a closed capital account, the results suggest that every dollar of intervention moves the current account by 50 cents. However further studies by Tamim Bayoumi showed that the impact of foreign reserve on the imbalances of current and capital account is fading over the period due to the removal of restrictions on current account.

One of the paper identifies the linkages between reserve management and financial stability during the global financial crises which started in 2007.It have important implications for the strategic asset allocation and reserve management activities of central banks. The paper ends by raising some important new questions for reserve management that are worth studying The more positive message coming out of this paper is that the impact of reserve accumulation has been falling over time as countries have reduced their current account restrictions This calls for another research to understand its importance in the present changing scenario

A study was done on analysing the instruments used to maintain dollar foreign reserve by Robert N McCauley. However this was just the beginning and more detailed research has come forward in this area. For instance, Wooldridge, have shown through a survey that most of the central banks uses government bonds as an instrument for managing foreign reserve. This may be risk free investment but in the present scenario due of the vastness of globalisation, the researcher feels some studies are required to understand the other instrument like derivatives for better return.

Explicit recognition is given by one of the IMF research paper approved by Raghuram G. Rajan on the identification of the problems of global imbalances and currency misalignments for the key emerging market countries. However there are limited studies on the way such problems can be tackled by the emerging economies

Despite the recognition of the central role of collateral in current financial markets and in particular central bank monetary policy operations by some authors, little academic work exists on risk mitigation measures and risk control determination.

Some of the findings confirmed that foreign exchange rate policies, are the real threat to central bank profitability and capital, and not interest rate and credit risks; although those are the types of risks to which central bank risk managers devote most of their time, as these are the risks that are controlled through financial risk management decisions, while the others are largely implied by policy considerations, which may be seen to be outside the reach of financial risk management. However, even if a total priority of policy considerations would be accepted, still the lesson from the findings of Schobert and others is that when optimizing the financial assets of

a central bank from the financial risk management perspective, one should never ignore the policy risk factors and how they correlate with the classical financial risk factors

Ulrich detected that during the 1990s, central bank of countries like, Brazil, Chile, the Czech Republic, Hungary, Korea and Thailand, faced substantial losses due to some foreign reserves issue. In fact all of these reflected a mismatch between returns on foreign reserves assets and higher costs of absorbing domestic liquidity (reflecting both interest rate differentials and revaluation effects)

The importance of operational risk management was identified by Jean-Charles Sevet, 2008. However he accepted that good research work is needed in this area. The JPMorgan survey of 2008 showed that despite of the approval for the use of derivatives to manage foreign exchange reserve risk, the actual use of derivatives is very small.

It is rightly pointed out by Evangelos Tabakis and Benedict Weller in 2009 that central banks had not paid much attention to the management of their own balance sheet risks that emanate from their market operations. At the same time central banks as investors are facing increased challenges. Some have accumulated considerable sizes of foreign reserves and need to invest them in a diversified manner. This in turn makes them exposed to more complicated markets and more sophisticated instruments. Finally, risk management expertise is increasingly in demand in order to understand the complexity of risk transfer mechanisms in financial markets and detect potential risks of systemic nature.

To conclude, the researcher has identified some of the research gaps in the area of foreign exchange reserve risk management in terms of choice of better risk managing instrument and their usage with respect to the amount of the foreign asset that different central bank holds. Further, in today's changing scenario, research work has to be done to identify some of the better market instrument that can mitigate the foreign exchange reserve risk management by central banks. It can also be noted that there is not much work done in comparing the central bank risk management strategies across the globe.

Bibliography

- Accompanying document and case studies. Washington (DC): International Monetary Fund Working Paper
- Anna Lingel and Elizabeth Sheedy, 2012, the Influence of Risk Governance on Risk Outcomes – International Evidence, Macquarie Applied Finance Centre Research Paper No. 37
- Anupam Mitra, 2013, Comparative Analysis of Foreign Exchange Risk Management Practices among nonbanking Companies in India, ADRRI Journal, Vol. 3, No.3, pp 38-51, December, www.adrri.org, http://www.adrri.org/journal
- Bakker, Age F.P. and Ingmar R.Y. van Herpt, 2007, Central Bank Reserve Management:
- Borio, Claudio, Jannecke Ebbesen, Gabriele Galati, and Alexandra Heath, 2008, "FX Reserve Management: Elements of a Framework," BIS Papers, No 38.
- Committee on the Global Financial System. 2001. Collateral in wholesale financial markets:
- European Central Bank. 2004a. 'Risk mitigation measures in Eurosystem credit operations',
- European Central Bank. 2004b. 'The euro bond market study',
- European Central Bank. 2006a. 'Portfolio management at the ECB', Monthly Bulletin 4/2006: 75–86.
- European Central Bank. 2006b. 'The implementation of monetary policy in the euro area
- European Central Bank. 2007a. 'Euro Money Market Study 2007', www.ecb.europa.eu/pub/
- European Central Bank. 2007b. 'The collateral frameworks of the Federal Reserve System, the Bank of Japan and the Eurosystem', Monthly Bulletin 10/2007: 85–100.
- Financial Crisis," Speech at Risk Europe, Frankfurt am Main, Foreign Exchange Reserves," BIS Quarterly Review, March, pp. 39–46
- General documentation of Eurosystem monetary policy instruments and procedures', General Documentation, www.ecb.int/pub/pdf/other/gendoc2006en.pdf
- González-Páramo, José Manuel, 2009, "Managing Risk: The Role of the Central Bank, http://www.ecb.int/press/key/date/2009/html/sp090604.en.html.

- International Monetary Fund. 2004. Guidelines for foreign exchange reserve management.
- International Monetary Fund. 2005. Guidelines for foreign exchange reserve management.
- Interest and Prices: Foundations of a Theory of Monetary Policy, Series 8674. 2003 Princeton: Princeton University Press.
- Jorge A. Chan-Lau, 2005, Hedging Foreign Exchange Risk in Chile: Markets and Instruments,IMF Working Paper
- Jukka Pihlman and Han van der Hoorn, 2010, Procyclicality in Central Bank Reserve Management: Evidence from the Crisis, IMF Working Paper
- Manisha goel, Gupta S.L, Lalit goel, 2011, An Analysis of Foreign Exchange Exposure Management, by MNCs in India, 2011, Zenith Research, September issue 5, www.zenithresearch.org.in.
- Manzanares, Andres and Henrik Schwartzlose, 2009, "Risk Control, Compliance Monitoring and Reporting," in Risk Management for Central Banks and Other Public Investors, ed. by Ulrich Bindseil, Fernando González, and Evangelos Tabakis (Cambridge: Cambridge University Press).
- McCauley, Robert N. and Ben S.C. Fung, 2003, "Choosing Instruments in Managing Dollar, Monthly Bulletin New Trends, from Liquidity to Return (Cheltenham: Edward Elgar). 05/2004: 71–9.
- Nuge´e, J. 2000. Foreign exchange reserves management. Handbooks in Central Banking vol. 19. London: Bank of England Centre for Central Banking Studies.
- Nuge´e, J. 2000. Foreign exchange reserves management. Handbooks in Central Banking, pdf/other/euromoneymarketstudy200702en.pdf.
- Recent trends, risk management and market dynamics. Basel: Bank for International Report by the secretariat of the United Nations Conference on Trade and Development, Geneva, 2008, United Nations conference on trade and development Geneva
- Reserve Bank of India: Functions and Working, www.rbi.org.in ,review 09/2006: 25–38.
- Settlements, www.bis.org/publ/cgfs17.pdf.

- Shashidhar M. Lokare, 2014, Re-emerging Stress in the Asset Quality of Indian Banks: Macro-Financial Linkages, RBI working paper series
- Steven Phillips, Luis Catão, Luca Ricci, Rudolfs Bems, Mitali Das, Julian Di Giovanni, D. Filiz Unsal, Marola Castillo, Jungjin Lee, Jair Rodriguez and Mauricio Vargas, 2013, The External Balance Assessment (EBA) Methodology, IMF Working Paper
- Tamim Bayoumi and Christian Saborowski, 2012, Accounting for Reserves, IMF Working Paper Approved by Raghuram G. Rajan, Methodology for CGER Exchange Rate Assessments, IMF Washington (DC): International Monetary Fund.
- Woodford, M. 2001. 'Monetary policy in the information economy', NBER Working Paper,
- Wooldridge, P. D. 2006. 'The changing composition of official reserves', BIS Quarterly www.ecb.int/pub/pdf/other/eurobondmarketstudy2004en.pdf.