ISSN 2238-1201

BANCO CENTRAL DO BRASIL

June 2012
Volume 4

International Reserves Management Report

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ISSN 2238-1201
CNPJ 00.038.166/0001-05

International Reserves Management Report	Brasília	v. 4	Jun.	2012	p. 1-29

International Reserves Management Report

Yearly Banco Central do Brasil/Executive Office for Corporate Risk and Benchmarks publication.

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Executive summary

Over the last few years Central Bank of Brazil (BCB) has been extending transparency of the international reserves administration process. This publication is the fourth volume of the International Reserves Management Report describing historical data and performance during 2011.

On 12.30.2011, Brazil's international reserves amounted to US$352.01 billion, 21.9% higher than on 12.31.2010. In 2011, due to BCB's risk preference, the international reserves diversification process and the foreign exchange hedging policy of the registered external liabilities were continued. This policy of foreign exchange hedge follows the security principle in the international reserves investment. The investments' market risk, which aggregates the components of interests and currencies, for the year of 2011, increased 16.7% when compared to 2010 average values, due mainly to an increase in the average maturity of investment.

The profitability of the international reserves registered in 2011 was 3.6%. Despite being higher than the result observed in 2010, which was 1.82%, the value is below the annual average of 4.7% for the period from 2003 to 2011. The low yields environment observed in the international financial market is the reason for the lower profitability of the international reserves, when compared to historical average values.

The international reserves management is based on a sound governance system, which comprises the hierarchy defined among the decision levels, as well as a system with daily performance control and evaluation, and investments monitoring. For this end, a framework based on three pillars was conceived: i) benchmark portfolio; ii) operational limits; and iii) performance evaluation. In addition, the market risk, credit risk, liquidity risk and operational risk are also monitored on a daily basis.

The International Reserves Management Report is divided into six chapters. The first presents the foundations in which the international reserves management is based. The second describes the investment policy. The third presents the several risks involved. The fourth shows the results of the reserves investment, which enables to verify the strategies adequacy vis-à-vis the strategic objectives defined by BCB. The fifth presents tables with data from which the report's graphs were built. Lastly, a glossary of the main terms used is presented.

1

International reserves management

This chapter presents the foundations on which the international reserves management is based.

1.1 Introduction

The year of 2011 was marked by the worsening of the sovereign debt crisis in several countries in the Euro Zone. The economical effects of the global recession, which started in the 2008 crisis, associated to the loss of the investors' confidence caused great instability in the international markets. In August, 2011, the credit-rating agency Standard & Poor´s downgraded United States of America (USA) from AAA to AA. It was the first time USA was downgraded since it was classified as the highest notch in 1917. The main reason for this situation was the Congress impasse to solve the American debt issue that estimated high expenditures and at the same time legal obstacles that forbid the debt rollover. On the other hand, emerging markets showed up economic growth during 2011. In a context of high international liquidity, the difference between the emerging markets and developed countries interest rates encouraged high international capital inflows which contributed a lot to the increase of the reserves (behavior intensified after 2008). Particularly in Brazil the foreign currency inflows were really high in 2011 and the Central Bank of Brazil kept its policy of accumulating international reserves.

1.2 Governance

According to Law 4.595, from December 31st 1964, BCB's has the exclusive responsibility to be depositary of the gold, foreign currency and special drawing rights (SDR) reserves. In the BCB, it is responsibility of the Board of Directors to establish the strategic objectives and the profile of risk and return of the country's international reserves.

The reserves governance structure is supported by an integrated risk management policy of the Central Bank of Brazil (BCB). The investments are made according to guidelines established by BCB's Board of Directors, who defines the risk and return profile through an appropriate benchmark portfolio, the operational limits for the authorized deviations from this benchmark portfolio and the performance evaluation criteria. The organizational structure reinforces the controls and information flow mechanisms, enabling the institution to have an investment process focused on an appropriate risk management.

BCB's Board of Directors defined, in June 2000, a risk management and strategic asset allocation framework based on the best international practices. This

modeling was subject to the International Monetary Fund (IMF) audit in 2002, which highlighted the excellence of the work performed.

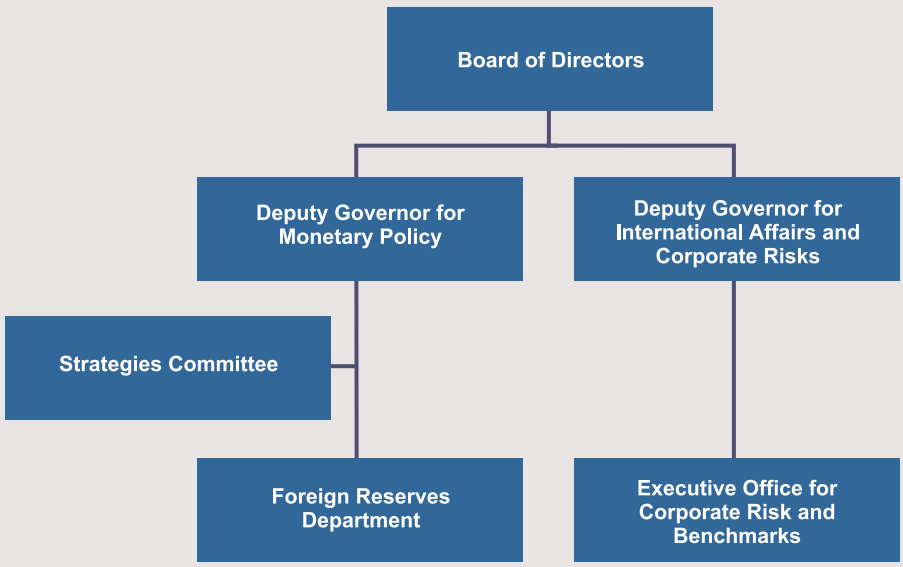
In 2006, with the setting up of the Executive Office for Monetary Policy Integrated Risk Management (Gepom), an additional important step was taken to extend the transparency and improve the governance in the international reserves management process.

In May 2011, BCB's Board of Directors extended Gepom's role, which took the responsibility of integrating the risks for the whole institution and after that was called Executive Office for Corporate Risks and Benchmarks (Geris). The area is subordinated to the International Affairs and Corporate Risks Deputy Governor (Direx), with more independence of the operational areas.

The Enterprise Risk Management (ERM) contributes significantly to the continuous improvement of BCB's tasks, optimizing allocation of institutional, human and financial assets. Besides that, it makes things clear on respect to the institution's risk profile and helps to adequate it according to BCB's strategic goals. In this process, the operational references proposed by Geris and established by the Deputy Governor are essential to achieve those goals.

In the governance's structure, the reserves management is organized according to figure 1.1.

Figure 1.1 – Governance Structure of the International Reserves



At the highest level of the structure, there is the BCB's Board of Directors, which is responsible for defining the long term strategies through a benchmark portfolio, for evaluating the results obtained in the reserves investment and for defining the operational limits to which the investment policy operators are subject to.

The effective management of the resources is divided in two levels. The first level is the long term management, which, ultimately, is responsible for major part of the reserves total return. Geris is responsible for developing the models of strategic asset allocation, as well as for proposing to the Deputy Governor for Monetary Policy (Dipom) and the Deputy Governor of International Affairs and Corporate Risks (Direx) the benchmark portfolio, the operational guidelines and the performance evaluation criteria which are subject to the Board of Directors appreciation. The Department of International Reserves (Depin) collaborates with the process providing operational and market information.

In the second level there is the short term management. The Strategies Committee, chaired by the Deputy Governor for Monetary Policy, holds quarterly meetings and establishes benchmark deviation strategies, observing the defined limits. This way of management is called active management and its main objective is the improvement of total return, taking advantage of eventual market opportunities. The Depin is responsible for proposing the short term strategies that are validated by the strategies committee. Moreover, as a result of Depin daily monitoring of the market, the Department may propose, at any time, changes in the active strategies adopted.

Depin is also responsible for the strategies implementation and daily monitoring of the international market.

Geris is responsible for defining and developing the risk models and the performance evaluation methodologies. This area also prepares quarterly risk and performance reports to the Board of Directors.

There is a management system, internally developed, to monitor the investment guidelines and criteria. The controls are performed daily and eventual breaches of the established limits are automatically informed by the system to all the members of the Board of Directors.

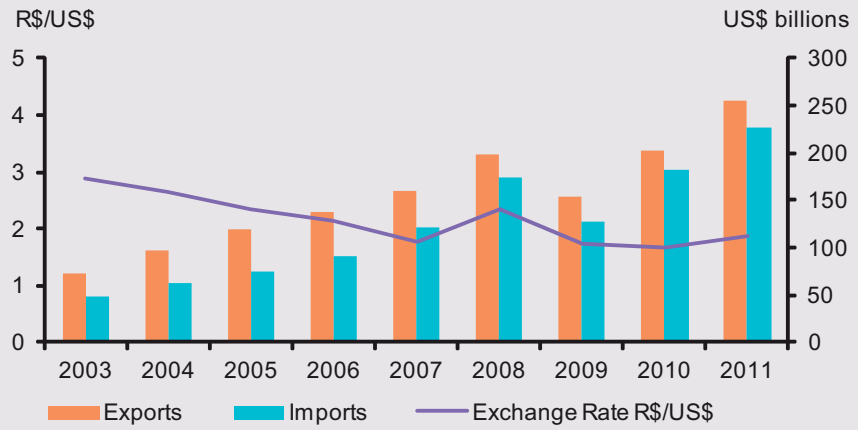
Regarding the operational issues, the international reserves investment process includes the investment, compliance and settlement tasks. Compliance and settlement are critical procedures for the reserves management for affecting security, liquidity and profitability issues, in a settlement environment of multiple currencies, areas and time zones.

Finally, the international reserves administration process is subject to five different types of control: i) internal control by the Depin's Monitoring Division (Dimon). ii) internal control of the BCB's Audit; iii) external control to the BCB, however internal to the Government performed by the Office of the General Comptroller (CGU); iv) external control by The Brazilian Court of Audit (TCU) ; and v) external control performed by independent auditor.

1.3 Economic indicators

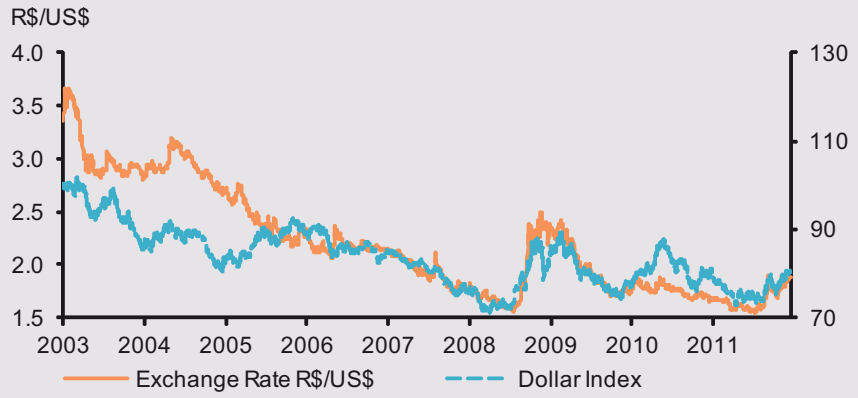
In 2011, the balance of trade maintained the surplus pattern, and the Brazilian Real, that had been appreciating against the United States Dollar, depreciated 11.18% compared to the end of 2010 (graph 1.1). It should be noticed that the depreciation of the Brazilian Real presents high correlation with the dollar index valuation, which is a basket of developed countries currencies, shown on graph 1.2. On the other hand, the CRB commodities index has a high negative correlation with the Brazilian Real depreciation, as shown in the graph 1.3.

Graph 1.1 – Trade balance and exchange rate (R$/US$)



Source: Central Bank of Brazil

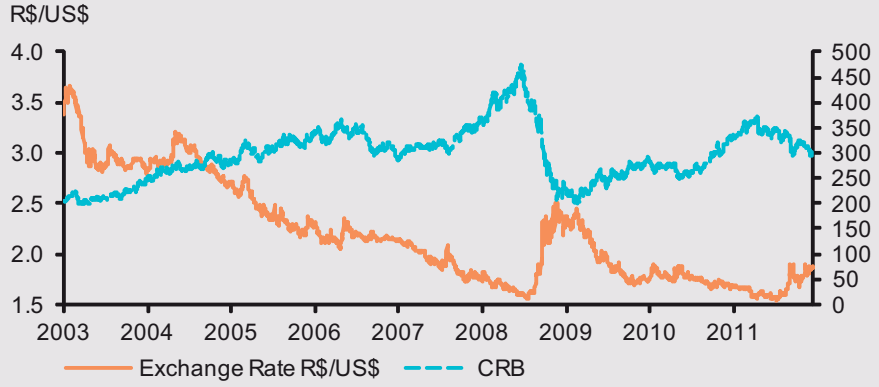
Graph 1.2 – Exchange rate (R$/US$) and Dollar Index



Source: Reuters

The Brazilian Gross Domestic Product (GDP) grew 2.73% in 2011, keeping the growth trend, but at a lower pace if compared to 2010. The descending trajectory of the public sector net debt (PSND) as a proportion of the GDP persisted and it could be noticed a slight increase of the international reserves as proportion of the GDP, due to the Central Bank performance. Graph 1.4 presents the PSND's and the international reserves' evolution as a ratio of the GDP.

Graph 1.3 – Exchange rate (R$/US$) and CRB



Source: Bloomberg

Graph 1.4 – Public sector net debt and international reserves (% GDP)

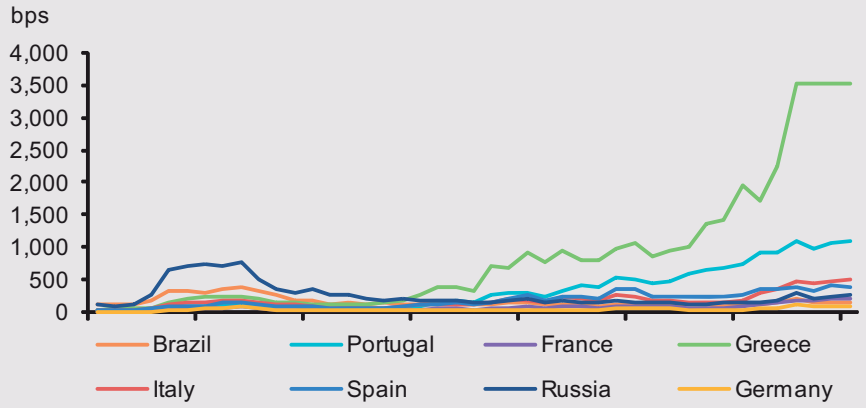
Source: Central Bank of Brazil

Graph 1.5 shows the evolution of the credit default swaps (CDS) spreads for Brazil and several European economies. The objective is to emphasize the worsening of the credit quality of the Euro area, due to the solvency problems of several countries of the region, notably Portugal, Italy, Ireland, Greece and Spain. It may be noticed that Brazil's credit quality, measured by CDS' spread was, at the end of 2011, better than all those countries, being close to France's. When compared to Russia, China and South Africa, Brazil presents CDS' spreads higher than China, only, as shown in graph 1.6.

2011 was a year marked by the low yields which prevailed for fixed-income bonds in advanced economies. As the 2007-2009 financial crisis unfolded into a sovereign debt crisis, total assets of four important central banks (Federal Reserve, European Central Bank, Bank of England and Bank of Japan) increased 25% on average in 2011, due to non-conventional monetary policy initiatives aimed to stimulate the economic activity (this is the case for US, United Kingdom and Japan), and supporting the local financial system (this is the case for the Euro Zone), as shown in Graph 1.7. Moreover, the US debt ceiling clog led to mounting pressure on financial markets in July and August 2011. The S&P500 index, for example, decreased by 11% from the beginning-of-the-year to August 5, 2011, when Standard & Poor's

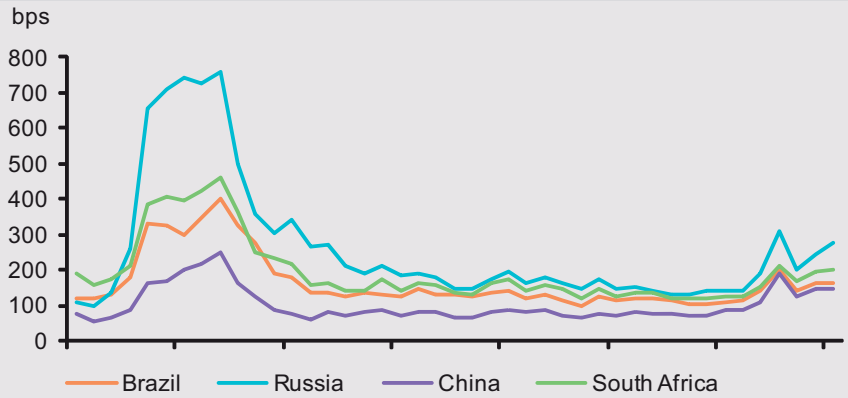
downgraded the rating of the US debt. The VIX index increased by 170% during the same period. Anyhow, both indices ended up signaling a lower stress level by the end-2011, as the S&P500 index decreased by 1% from the beginning-of-the-year, while the VIX index increased by 33% during the same period, according to Graph 1.8. Finally, international interest rates ended the year 2011 at a lower level than 2010, and they are expected to remain at these low levels in 2012. The 2-year government bond rates for advanced economies are shown in Graph 1.9.

Graph 1.5 – Sovereign CDS spreads (5 years)



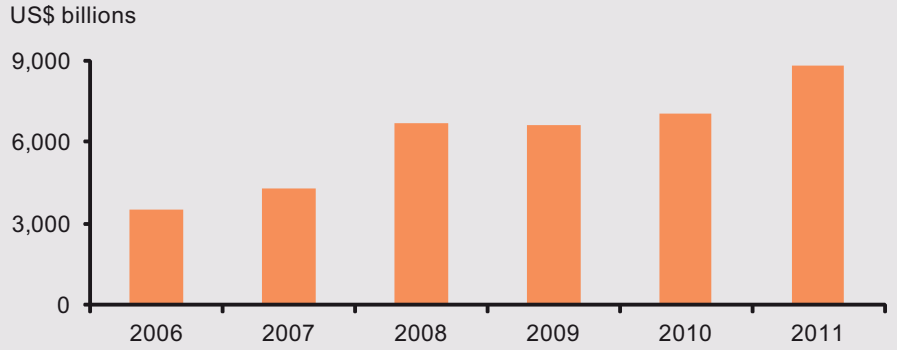
Source: Bloomberg

Graph 1.6 – Sovereign CDS spreads (5 years) – emerging markets



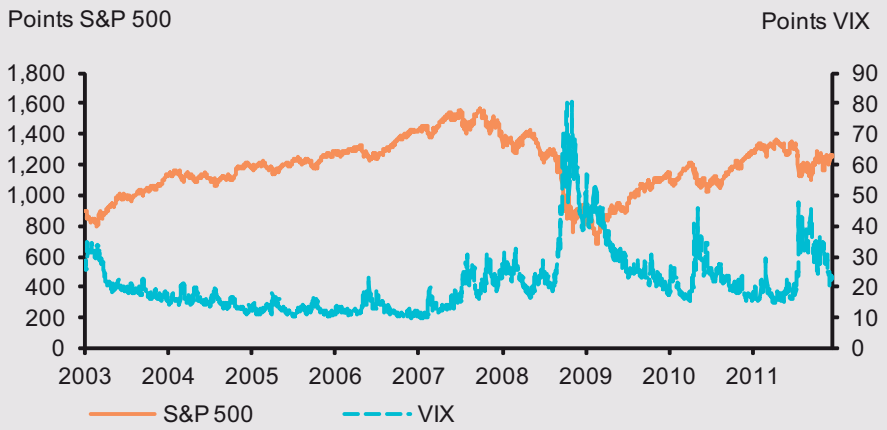
Source: Bloomberg

Graph 1.7 – Total Assets at Central Banks



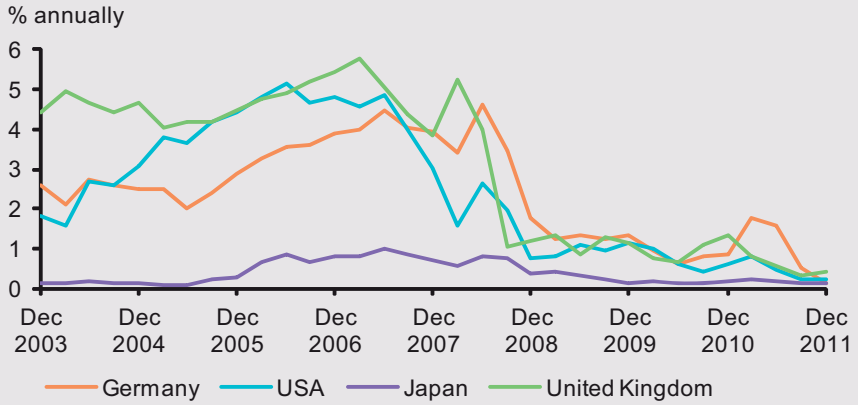
Sources: Bloomberg and Central Bank of Brazil

Graph 1.8 – S&P 500 e VIX



Source: Bloomberg

Graph 1.9 – Sovereign Yields (2 years)[1/]

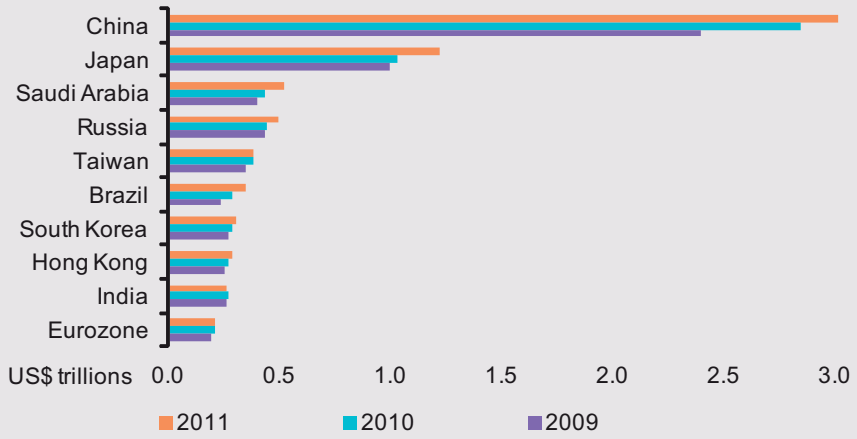


Source: Bloomberg
1/ Quarterly data.

1.4 Evolution of the international reserves

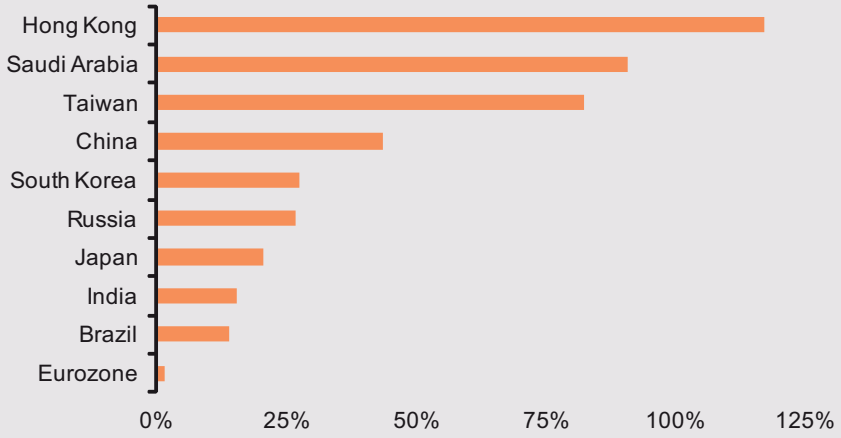
On 12.31.2011, Brazil's international reserves, liquidity concept, amounted to US$352.01 billion, 21.9% higher than on 12.31.2010. The accumulation of international reserves during 2011 was a policy adopted by several countries, as might be seen on graph 1.10. Brazil holds the sixth largest international reserves in the world; however, presents the second lowest proportion of reserves in relation to GDP, among the same peer group, holding approximately one third of the average[1] (graph 1.11).

Graph 1.10 – Economies with highest volumes of international reserves



Source: Bloomberg

Graph 1.11 – Reserves shown as GDP ratio



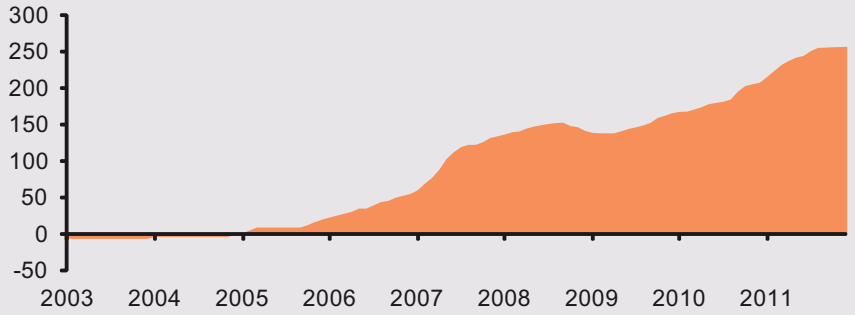
Sources: Bloomberg and IMF

[1] Reserves/GDPBR= 13.8%; Reserves/GDPaverage= 46.6%.

Brazil has been an attractive market for international investors, registering a positive flow of foreign currency. The BCB acted to buy the long term flow. Graph 1.12 presents the evolution of BCB's interventions in the foreign exchange spot market.

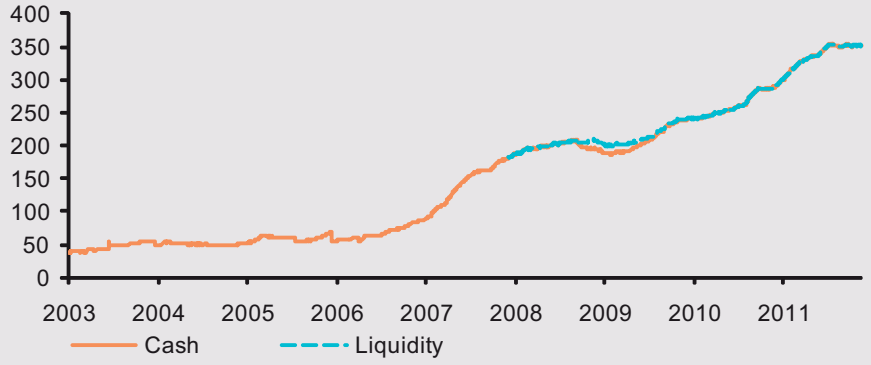
The BCB publishes the volume of international reserves according to two concepts: cash and international liquidity. The international liquidity concept includes the United States dollars that BCB has to receive from banks due to loans in foreign currency performed during the recent international financial crisis.[2] In the cash concept, these operations are not accounted. Graph 1.13 presents the evolution of the international reserves volume in the cash concept, since 2002, and in the liquidity concept, since January 2008. The international reserves accumulation is also a trend observed in the countries that join the Brics (Brazil, Russia, India, China and South Africa). The graph 1.14 shows the growth rate of the international reserves for these countries since 2003.

Graph 1.12 – Central Bank's intervention in foreign exchange spot market[1/]



Source: Central Bank of Brazil
1/ Acumulated data since Jan 2002.

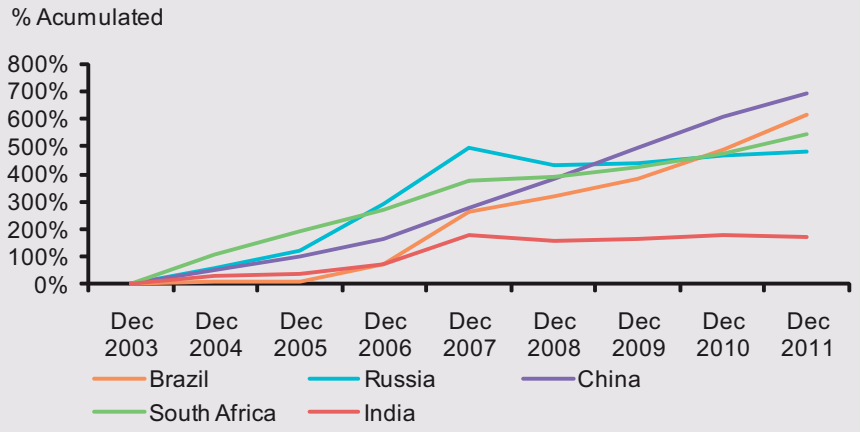
Graph 1.13 – International reserves volume



Source: Central Bank of Brazil

[2] The last operation was settled on May 2010.

Graph 1.14 – Acumulated ratio of international reserves growth – Brics



Source: Bloomberg

2 Investment policy

The investment policy reflects the risk preference of the investor.

The international reserves investment policy is a function of the long term strategic objectives. In this way, the concern with sovereign external liabilities and with reducing the country's exposure to foreign exchange fluctuations have led the BCB, since July 2001, to adopt a philosophy of sovereign external liabilities currency hedge. At that time, the international reserves represented approximately 40% of the sovereign external debt and, thus the currency hedge considered only the short term debt.

Since 2004, a decrease of the sovereign external debt has been observed while an increase has been recorded in the volume of the international reserves. This enabled the implementation of the total currency hedge of all the sovereign external debt.

In September 2008, with the increase of the volume of reserves, it was possible to extend the concept of sovereign debt currency hedge to the total registered external liability currency hedge. Since then, once fulfilled the hedge condition, still considering liquidity and security, it is aimed a higher diversification of the investments of the international reserves, considering the BCB's risk preferences.

The Board of Directors defines an investment portfolio as a reference for the operations, with a strategic profile and long term investment horizon, which reflects the BCB's institutional preferences regarding risk and return. Short term fluctuations in the components that affect the assets' prices, such as the foreign exchange rates and interest rates, do not affect the long term decisions.

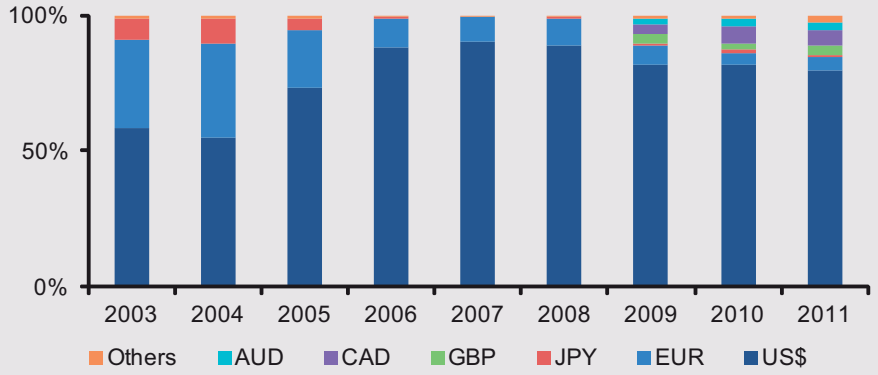
Minor intentional deviations from the benchmark portfolio due to the changes of the market conditions may be taken and are daily monitored by internal control systems. In other words, the international reserves are actively managed, being allowed to marginally deviate from the benchmark within the limits previously defined by the Board of Directors.

The following sub-sections describe the fundamental aspects of the international reserves investment policy. In a broad view, we can segment this investment policy in terms of currency distribution, asset classes and average maturity of investment.

2.1 Distribution by currencies

As mentioned before, one of the objectives of the international reserves is the reduction of the country's exposure to foreign exchange risk. Therefore, the goal is a diversified portfolio that ensures the foreign exchange hedge of the total registered external liabilities. In December 2011, the currency allocation was the following: 79.6% in US dollar, 6.0% in Canadian dollar, 4.9% in Euro, 3.1% in Australian dollar, 3.0% in Great Britain pound, 1.0% in Japanese yen and 2.4% in other currencies, such as Swedish krona and Danish krone. Graph 2.1 presents the evolution of the currency allocation (end-of-period data).

Graph 2.1 – Foreign currency allocation[1/]



Source: Central Bank of Brazil
1/ Reserves in cash concept (end of period data).

Between 2003 and 2005, the currency distribution of the international reserves was influenced by the loan obtained from the International Monetary Fund (IMF), in special drawing rights (SDR), the reference currency of the Fund composed by a basket of currencies. With its full repayment, the sovereign external debt composition was changed, with a greater concentration in US dollars, fact that reflected, consequently, in the distribution by currency of the international reserves.

In 2011, it may be seen that the currency diversification of the international reserves was kept, with a slight decrease of the volume allocated in US dollar and the inclusion of two new currencies: Swedish krona and Danish krone. The allocation changes in the remaining currencies are due to market movements and active management.

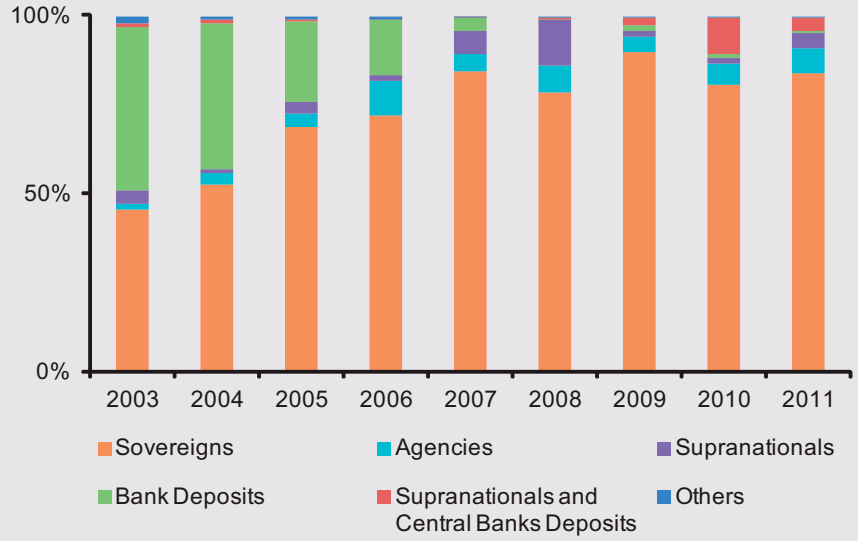
2.2 Asset classes

The international reserves investments are done in fixed income instruments, notably in sovereign bonds, government agency bonds, supranational bonds and bank time deposits. In December 2011, the allocation was as follows: 83.5% in sovereign bonds, 4.4% in supranational bonds, 7.1% in government agency bonds,

3.8% in central bank and supranational time deposits, 0.3% in commercial bank time deposits and 0.8% in other asset classes, such as gold.

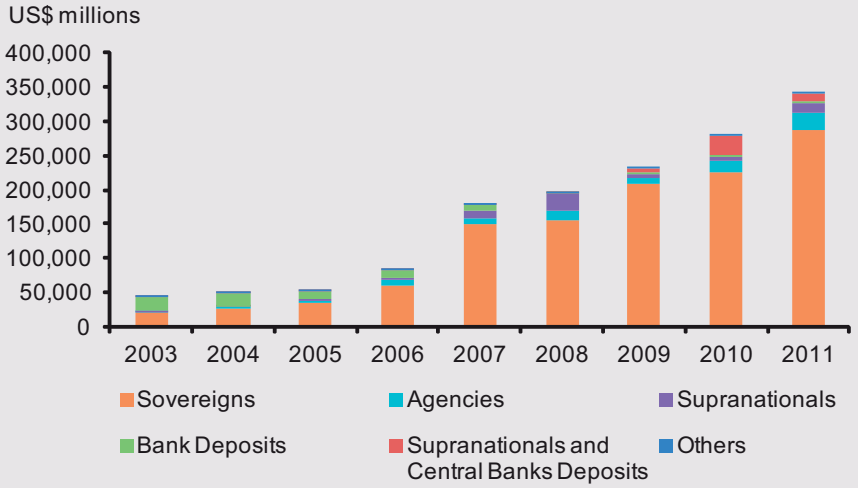
Graph 2.2 presents the percentage distribution, per asset class, observed for the period from December 2003 to December 2011 (end-of-period data). An increasing allocation in bonds compared to time deposits is observed, as a result of the investment policy and of a preference for reducing commercial bank credit risk taken by the BCB.

Graph 2.2 – Asset allocation[1/]



Source: Central Bank of Brazil
1/ Reserves in cash concept (end of period data).

Graph 2.3 – Asset allocation[1/]



Source: Central Bank of Brazil
1/ Reserves in cash concept (end of period data).

In 2011, indeed, an increase in the allocation in sovereign bonds and a decrease in the allocation in time deposits in commercial banks is observed, due to a change of the benchmark defined by the Board. The increase in government agencies and supranational bonds is a result of active management and/or cash management during the year. Graph 2.3 shows the distribution in terms of financial volume allocated in each of the classes of assets (end-of-period data).

2.3 Average maturity of investment

The choice of the BCB's international reserves average maturity of investment reflects the risk preference of the Board of Directors, meeting criteria of security, liquidity and profitability. Graph 2.4 presents the historical reserves' average maturity of investment from December 2003 to December 2011 (end-of-period data).

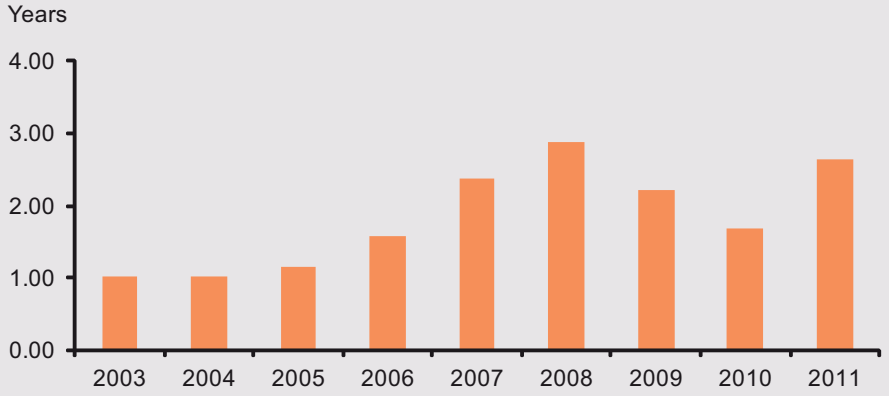
Graph 2.4 – Average term of investment – End of period[1/]

Source: Central Bank of Brazil
1/ Reserves in cash concept (end of period data).

From 2003 to 2008, we can see an increasing trend in the average term of maturity, initially due to a decrease of the time deposit portfolio and lately as a consequence of changes of the benchmark bond indices. The main benchmark indices grew from one to three years to one to five years and finally to one to seven years due to reserves accumulation and search for greater expected return, without jeopardizing the investments' liquidity and security. In 2009, aiming to reduce the international reserves exposure to market risk, the portfolio's average maturity of investment was shortened, which may be observed in graphs 2.4 and 2.5. At the end of 2010, the reference index changed from one to three to one to five years in order to meet liquidity risk preferences.

At the end of 2011, with the extension of the reference index observed in the end of 2010 and an increase of the diversification in assets classes, there was an increase of the average maturity of investment, which reached an approximate value of 2.75 years, as observed on graph 2.4. When considered the annual average maturity of investment (graph 2.5), it is also observed an increase compared to 2010. In 2011, the average maturity of investment was of 2.65 years.

Graph 2.5 – Average term of investment[1/]



Source: Central Bank of Brazil
1/ Reserves in cash concept (annual average).

3

Risk management

Market risk, credit risk, liquidity risk and operational risk are daily monitored in the international reserves investment process.

The risk analysis related to the investment process is a key aspect to understand the financial performance and to make the benchmark portfolio adequate to the investment objectives.

As mentioned before, the different risks assumed in international reserves investments are daily controlled by a management system developed internally by the Central Bank of Brazil (BCB). This system includes the credit and market risks calculations, operational losses registration, and several other operational limit controls.

The market risk of a portfolio is the risk of financial loss due to market price variations of portfolio's assets.

Liquidity risk refers to the risk of not being able to sell an asset or closing a position when desired, without incurring in significant costs.

The operational risk may be defined as risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events.

The credit risk is the risk of an institution not being able to meet payments due to the securities issuance, deposits or any other contractual obligation or financial commitments made to investors.

3.1 Market risk

There are several sources of market risk related to the international reserves management. The main sources are the risk of change in exchange rates and interest rates. It is important to highlight that the reference currency (numéraire) used by BCB for the international reserves management is the US dollar. In order to measure the reserves market risk, the BCB uses the Value at Risk – VaR, as can be seen on next section. Additionally, stress tests are used for measuring the reserve's sensitivity to risk factors, as can be seen on section 3.1.2.

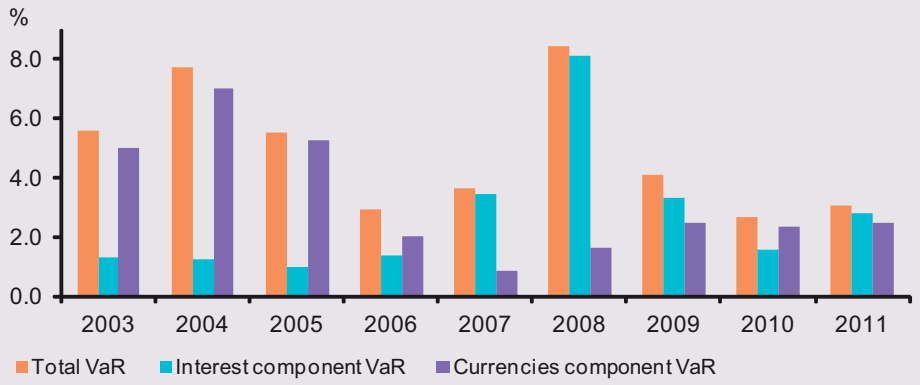
3.1.1 Value at Risk

The main market risk measure used by the Central Bank of Brazil for the international reserves is the Value at Risk (or VaR), which shows the expected loss of a portfolio for a certain time horizon, at a given confidence level.

The BCB daily estimates the total reserves and active management VaR for a time horizon of one day and a confidence level of 95%. Besides the total VaR, it is also calculated the VaR for two major components: currency and interest rate.

Graph 3.1 presents the international reserves average annualized VaR measured in percentage terms. Besides total VaR, the graph also presents the interest rate and currency VaR. The interest rates' component of the reserves VaR increased significantly from an 1.6% annual average in 2010 to 2.8% in 2011. This was mainly due to an increase of the investment average maturity in 2011 compared to 2010. The foreign exchange VaR remained relatively stable, even though there was some change in the currency distribution. The total VaR, which includes both components considering the diversification effect, increased from 2.64% in 2010, which is the lowest value since 2003, to 3.08% in 2011. However, this level is still below the historical average since 2003.

Graph 3.1 – International reserves VaR[1/]



Source: Central Bank of Brazil
1/ Annual average.

3.1.2 Stress tests

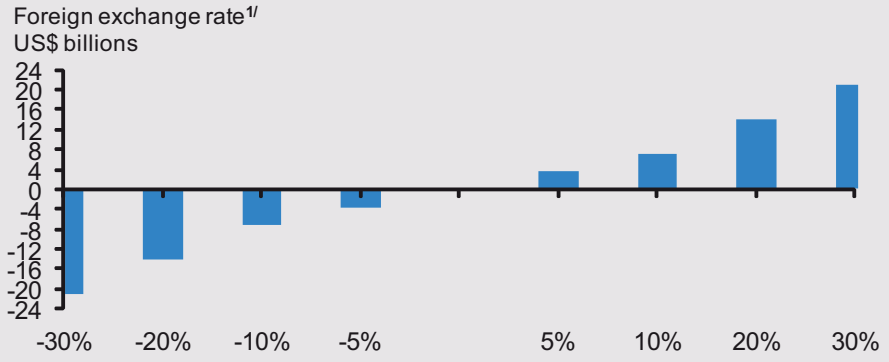
The stress test is another tool used for measuring the market risk of international reserves holdings. It is a tool that attempts to quantify the negative impact of shocks and events which are unfavorable to an institution's holdings. Therefore, stress scenarios are designed to the main risk factors to which the reserves are exposed and, thus, the potential loss is calculated.

The tests are performed considering the BCB's holdings at the end of 2011, and the risk factors used are the yield curves and exchange rates of the US dollar against

the other currencies of the reserves. Graph 3.2 shows the impact in international reserves of exchange rate depreciations ranging from 0% to 30% of all currencies against the US dollar.

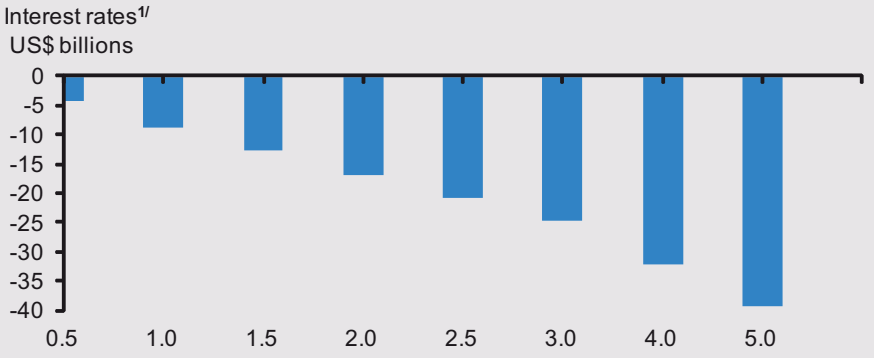
Graph 3.3 presents impact in international reserves of a parallel shift in all yield curves ranging from 0.5 to 5.0 percentage points. An increase of the international interest rates may result in significant reductions of the international reserves market value.

Graph 3.2 – Stress test



Source: Central Bank of Brazil
1/ Reserves variation due to foreign exchange rates fluctuation, in 12.31.2011.

Graph 3.3 – Stress test



Source: Central Bank of Brazil
1/ Reserves variation due to yield curves parallel shift. Position in 12.30.2011.
Percentual points

3.2 Liquidity risk

Liquidity is one of the three pillars of international reserves investments. To mitigate liquidity risks, limits to asset classes' positions are considered in the asset allocation process. The liquidity risk corresponds to the risk of not being able to sell an asset or closing a position without incurring in significant costs.

In order to guarantee an adequate liquidity to the international reserves, the BCB has guidelines that limit holdings' size and investment maturity. For sovereign, supranational and agency securities, there is a maximum purchasing limit over the total amount issued and a maximum ratio limit of each issuance in the portfolio. These limits aim to make that an eventual sale of these securities by BCB do not severely change its price due to the lack of liquidity and also aim to limit the impact of a certain issuance in the portfolio's result.

Additionally to the controls already mentioned, the BCB monitors the portfolio's liquidity risk using some liquidity cost indices. These indices consider the spread between the bid and ask values for all the portfolio holdings.

3.3 Credit risk

This section aims to present the evolution of the credit risk exposure of the international reserves since 2003. Furthermore, some concepts in credit risk and the distribution of assets are presented according to three criteria: type of counterparty, geographical region and credit quality.

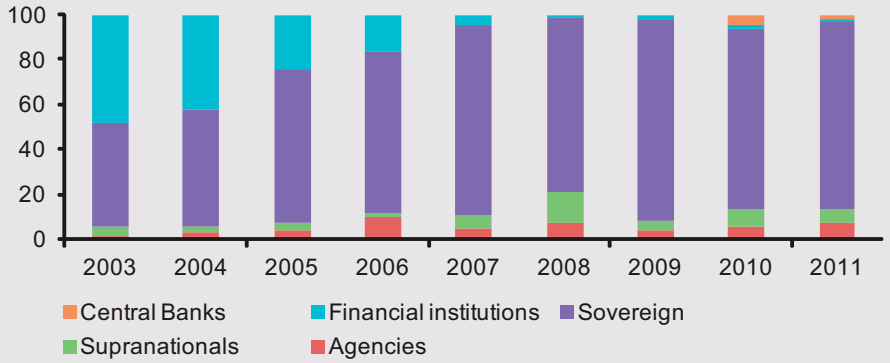
Credit risk is defined as the uncertainty related to the occurrence of a credit event (downgrading or default), in any counterparty, which results a loss in holdings linked to this counterparty. An event of credit occurs when a counterparty do not fulfill assumed obligations of payment. BCB's counterparties which are considered to have credit risks are the ones which have liabilities with the BCB, such as, agencies, central banks, central governments, financial institutions and supranational organisms.

Agencies are entities sponsored by a national government created with the objective of supporting certain sectors of the economy by the issuance of securities. The central governments issue sovereign debt securities for financing governmental activities. The supranational are multilateral organisms, such as the World Bank and the Bank for International Settlements (BIS), which issue bonds and, in some cases, act as financial intermediaries. The financial institutions' category includes commercial banks and investment banks. The following graphs show that most part of the international reserves is allocated in sovereign bonds, whereas, in this category, the US treasuries represent the largest part.

The evolution of the distribution per type of counterparty may be observed on graph 3.4. In this graph, it is noticed that, in the years in analysis, the increase of the share of sovereign bonds followed the reduction of financial institutions' participation. In 2011, there was a relative reduction of participation in central banks and a relative increase of sovereign bonds compared to 2010.

The portfolio's credit risk level is due to the composition of the portfolio and the counterparties' credit quality. The individual credit risk of agencies and supranational organisms authorized by BCB is low due to the limits established, which enable only investments in instruments of fixed income with the best possible quality of credit, according to a credit rating agency.

Graph 3.4 – Allocation by asset class



Source: Central Bank of Brazil

For the credit risk control of financial institutions, it was established two types of limits: one per transaction and other for the portfolio as a whole. Each transaction is subject to limits which define credit's minimum quality (rating), maximum volume of exposure per counterparty and maximum term of this exposure. The objective of the aggregated limits for the portfolio is to constrain the total credit risk exposure. To this end, it is used a statistical model for measuring the credit risk developed by the BCB.

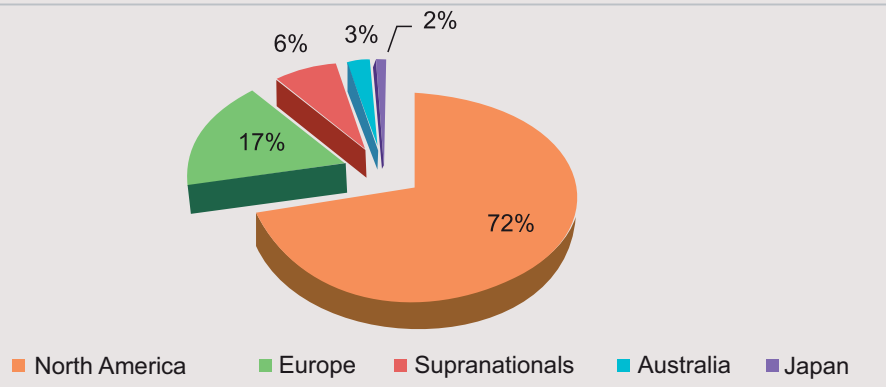
Graphs 3.5 and 3.6 show data from the end of 2011. The distribution of the assets with credit risk per geographical region is shown on graph 3.5. The major part of the allocation (72%) is in the United States of America (USA). As mentioned before, this happens due to the exposure to US government bonds, as consequence of the prevalence of the US dollar in the distribution per currency of the reserves. Graph 3.6 presents the average distribution of the assets per credit risk rating and shows that 97% of the exposure displays Aaa rating.

Graph 3.7 presents the evolution of the total volume of credit risk exposure of operations with money market instruments. It is worth mentioning that this exposure derives from time deposit operations, repurchase agreements and/or derivatives, such as swaps and forward operations, with commercial banks, central banks and supranational organisms, and do not include operations with bonds. The volume allocated in 2011 in bank deposits in financial institutions represented 8% of the total exposure to credit risk with money market instruments.

3.4 Operational risk

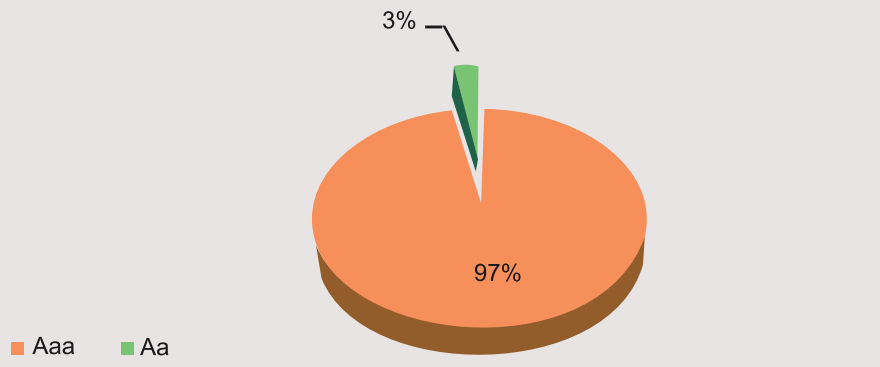
Operational risk can be defined as the possibility of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events. In the past, this kind of risk was controlled using qualitative management practices. Currently, operational risk measurement also includes quantitative models as a strong complement of robust internal controls.

Graph 3.5 – Allocation by geographical areas



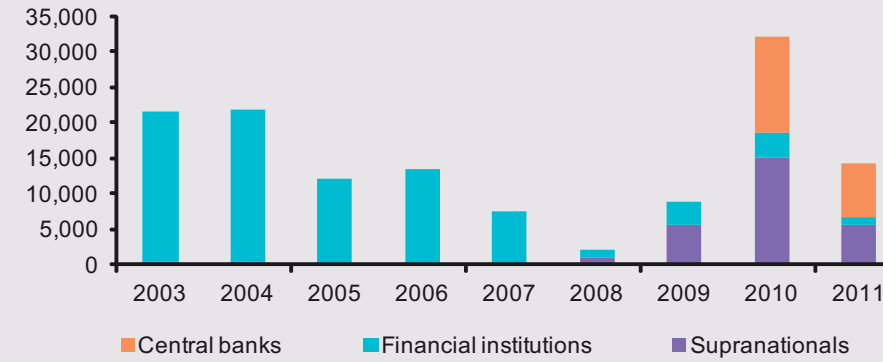
Source: Central Bank of Brazil

Graph 3.6 – Allocation by rating



Source: Central Bank of Brazil

Graph 3.7 – Total exposure to credit risk through money market[1/2/]



Source: Central Bank of Brazil
1/ Values in US$ millions (end of period data).
2/ Deposits, repurchase commitment and Forex.

In this context, in 2002, a risk event register tool was developed to build a database with operational failure information of the international reserves management operations.

Regarding operational aspects, international reserves management involves trading, compliance and operations settlement processes. Compliance and settlement are considered critical as they may affect security, settlement and profitability in an environment with different currencies, countries and time zones.

For compliance and settlement processes, transactions volume and assets diversification are as important as the reserves amount. In 2011, turnover reached US$ 4.07 trillion, with 11,345 transactions, 108,290 SWIFT messages exchanged and 712,422 accounting records.

4 Results

The results evaluation allows the verification of the strategies suitability of the vis-à-vis *the defined strategic objectives.*

The analysis of returns arisen from international reserves investments must be done considering the different mechanisms used for the calculation. The Central Bank of Brazil (BCB) considers the accounting result to produce its balance sheet and the data from the management system developed internally to support the investment decisions and the internal controls.

The accounting result, however, is not the most appropriate metric by the point of view of investments decision making, as the returns are not calculated relatively to the amount invested, which changes due to purchases and sales of foreign currency. Besides, as the exchange reserves are invested in the international market, the measures in Brazilian Real incorporates the foreign exchange rate fluctuation between the Brazilian Real and other currencies, which makes the analysis of profitability among the markets difficult. In order to solve these problems, the BCB calculates the reserves profitability using a managerial system internally developed, which allows the portfolio's evaluation on a daily basis, according to international standards, which enables the monitoring of strategic investments in different markets.

The international reserves are invested in different currencies in the international market and the results of the management system are evaluated using as base currency (*numèraire*) the US dollar. Therefore, the adoption of this criterion implies that the returns calculated include the variation of the dollar exchange rates against other currencies of the international reserves.

The data for evaluation of the result provided by the management system are available since July 2001 and may be followed since 2003 in graph 4.1. The return registered in 2011 was 3.6%. Despite being higher than the result registered in 2010, the value is below the annual average of 4.7% for the period. The higher prudence of BCB, with shorter average terms of investment, associated to an environment of low interest rates in the international financial market, caused this lower profitability compared to the historical average value.

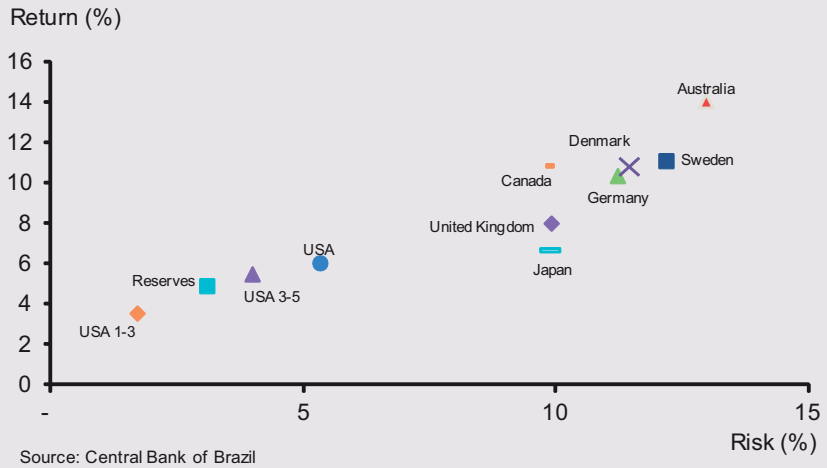
Graph 4.1 – International reserves returns[1/]

Source: Central Bank of Brazil
1/ Calculated from managerial system and external managerail program. US Dollar is the base currency.
2/ Annual average from 2003 to 2011.

4.1 Risk return profile

This section compares the risk and return profile of the international reserves investments within the period from July 2001 to December 2011 with some classes of assets. The BCB has a long term investment horizon and the analysis of the risk return profile is performed based on monthly values with data from the managerial system. Graph 4.2 presents the annualized average return and the standard deviation based on monthly data. The US treasury bonds are presented by the indices from one to three years maturing dates (USA 1-3), from three to five years maturing dates (USA 3-5), and the whole curve (USA). It is also presented government bond indices from Germany, United Kingdom, Canada, Denmark, Sweden, Australia and Japan. In this graph, it is possible to verify the risk and return profile of the International Reserves investment and compare it to the indices listed, with US Dollar as the base currency.

Graph 4.2 – Risk (%) vs. return (%) profile[1/]



Source: Central Bank of Brazil
1/ Average return compared to standard deviation (% anually) from Jul/2001 to Dec/2011.
US Dollar is base currency.

Annex

Note

This annex presents tables with data used for the graphs presented in this report. It does not include the data of chapter 1, as they come from historical series publically released.

The tables use management data with respect to the operations performed by the Foreign Reserves Department (Depin).

Table 2.1 – Foreign currency allocation

Period	US$	EUR	JPY	GBP	CAD	AUD	Others
2003	58.3%	32.9%	7.8%	0.0%	0.0%	0.0%	1.0%
2004	54.6%	35.1%	9.3%	0.0%	0.0%	0.0%	1.0%
2005	73.2%	21.3%	4.4%	0.0%	0.0%	0.0%	1.1%
2006	88.3%	10.3%	0.7%	0.0%	0.0%	0.0%	0.7%
2007	90.0%	9.5%	0.0%	0.0%	0.0%	0.0%	0.5%
2008	89.1%	9.4%	1.0%	0.0%	0.0%	0.0%	0.5%
2009	81.9%	7.0%	0.8%	3.7%	3.5%	1.9%	1.2%
2010	81.8%	4.5%	0.9%	2.7%	6.1%	3.1%	0.9%
2011	79.6%	4.9%	1.0%	3.0%	6.0%	3.1%	2.4%

Table 2.2 – Asset allocation[1/]

Period	Sovereigns	Agencies	Supranationals	Bank deposits	Supranational deposits	Others
2003	45.6%	1.5%	3.5%	45.9%	0.9%	2.6%
2004	52.5%	3.2%	0.8%	41.1%	1.2%	1.3%
2005	68.6%	3.7%	3.4%	22.7%	0.3%	1.4%
2006	71.8%	9.5%	1.8%	15.4%	0.2%	1.2%
2007	84.4%	4.3%	6.5%	4.0%	0.1%	0.6%
2008	78.5%	7.1%	13.0%	0.4%	0.5%	0.6%
2009	89.8%	4.0%	1.9%	1.2%	2.4%	0.6%
2010	80.2%	5.9%	1.8%	1.2%	10.2%	0.7%
2011	83.5%	7.1%	4.4%	0.3%	3.8%	0.8%

1/ Reserves in cash concept (end of period data).

Table 2.3 – Asset allocation[1/]

US$ millions

Period	Sovereigns	Agencies	Supra-nationals	Bank deposits	Supranational deposits	Others
2003	20,311.89	679.72	1,540.91	20,459.13	380.46	1,164.48
2004	26,273.81	1,594.69	405.02	20,551.40	578.79	635.09
2005	35,450.33	1,905.86	1,735.15	11,755.39	151.60	704.62
2006	60,260.94	8,009.93	1,498.29	12,933.57	152.07	1,032.24
2007	150,794.73	7,757.58	11,670.38	7,090.81	151.93	1,127.59
2008	154,511.58	13,915.91	25,516.99	785.14	990.22	1,199.83
2009	208,014.34	9,176.61	4,481.27	2,779.93	5,665.67	1,468.41
2010	226,098.54	16,584.11	5,120.38	3,334.38	28,714.64	2,053.62
2011	287,583.91	24,522.50	15,167.37	1,150.16	13,196.73	2,767.35

1/ Reserves in cash concept (end of period data).

Table 2.4 – Average term of investment[1/]

Period	Years
2003	0.97
2004	1.05
2005	1.37
2006	2.05
2007	2.77
2008	3.04
2009	1.63
2010	1.85
2011	2.75

1/ Reserves in cash concept (end of period data).

Table 2.5 – Average term of investment[1/]

Period	Years
2003	1.03
2004	1.01
2005	1.16
2006	1.58
2007	2.38
2008	2.88
2009	2.21
2010	1.68
2011	2.65

1/ Reserves in cash concept (annual average).

Table 3.1 – International reserves VaR[1/]

Period	Total VaR	Interest component VaR	Currencies component VaR
2003	5.6	1.3	5.0
2004	7.7	1.2	7.0
2005	5.5	1.0	5.3
2006	2.9	1.4	2.0
2007	3.6	3.5	0.9
2008	8.4	8.1	1.7
2009	4.1	3.3	2.5
2010	2.6	1.6	2.4
2011	3.1	2.8	2.5

1/ Annual average.

Table 3.2 – Currencies stress test[1/]

Variation	Result US$ billions
-30.0%	-21.07
-20.0%	-14.05
-10.0%	-7.02
-5.0%	-3.51
5.0%	3.51
10.0%	7.02
20.0%	14.05
30.0%	21.07

1/ Reserves variation due to foreign exchange rates fluctuation compared to US Dollar, position in 12.31.2011.

Table 3.3 – Interest rates stress test[1/]

Variation	Result US$ billions
0.5%	-4.4
1.0%	-8.7
1.5%	-12.8
2.0%	-16.9
2.5%	-20.9
3.0%	-24.8
4.0%	-32.3
5.0%	-39.5

1/ Reserves variation due to yield curves parallel shift. Position in 12.30.2011.

Table 3.4 – Allocation by asset class

Period	Agencies	Supranationals	Sovereign	Financial institutions	Central banks
2003	1.5%	4.3%	45.6%	48.6%	0.0%
2004	3.2%	2.0%	52.5%	42.3%	0.0%
2005	3.7%	3.6%	68.6%	24.1%	0.0%
2006	9.5%	2.0%	71.8%	16.6%	0.0%
2007	4.3%	6.6%	84.4%	4.6%	0.0%
2008	7.1%	13.5%	78.5%	1.0%	0.0%
2009	4.0%	4.4%	89.8%	1.8%	0.0%
2010	5.9%	7.2%	80.8%	1.2%	4.8%
2011	7.2%	6.1%	84.2%	0.3%	2.2%

Table 3.7 – Total exposure to credit risk through money market [1/ 2/]

Period	Supranationals	Financial institutions	Central banks
2003	380	21,174	-
2004	579	21,186	-
2005	152	11,906	-
2006	152	13,283	-
2007	152	7,317	-
2008	990	1,045	-
2009	5,666	3,073	-
2010	15,155	3,350	13,560
2011	5,624	1,152	7,573

1/ Values in US$ millions (end of period data).
2/ Deposits, repurchase commitment and Forex.

Table 4.1 – International reserves returns[1/]

Period	Returns (%)
2003	9.61
2004	5.02
2005	-3.58
2006	6.03
2007	9.35
2008	9.33
2009	0.83
2010	1.82
2011	3.60
Average	4.67

1/ Base currency is US dollar.

Table 4.2 – Risk return profile[1/2/]

Index	Risk (%)	Return (%)
USA 1-3	1.71	3.55
Reserves	3.09	4.91
USA 3-5	3.99	5.49
USA	5.33	6.04
Sweden	12.19	11.10
Australia	12.98	14.06
Canada	9.81	10.86
Japan	9.88	6.69
United Kingdom	9.91	8.01
Germany	11.23	10.35
Denmark	11.45	10.82

1/ Annualized return (US dollar is base currency).
2/ Standard deviation of monthly returns (Annual %).

Glossary

The definitions present the unique objective of helping the general understanding of the concepts described in the report.

Active management
Particular way of financial management in which it is tried to anticipate movements of market, variations of liquidity and other dynamic facts, with the objective of obtaining a better risk adjusted return in relation to the benchmark.

Bank risk
Credit risk with origin in operations in which the counterparty is a bank.

Basis point (b.p.)
A basis point represents 0.01%

Benchmark
It is a reference portfolio that is typically used as representation of the choice of risk and return of the investor.

CDS
Credit Default Swap. Financial instrument through which it is possible to buy or sell insurance against default of assets issued by companies or countries.

CRB
Commodity Research Bureau. Commodities index price daily evaluated by Thomson Reuters/Jefferies.

Default
Technical situation in which the debtor does not fulfill a contractual obligation.

Duration
It is approximately the weighted average maturity of investment of an asset or portfolio.

ECB
European Central Bank.

Embi
Emerging Markets Bond Index. Market index calculated by JPMorgan, it reflects the funding cost for emerging countries.

Fed
Federal Reserve, the Central Bank of the United States.

Governmental agencies
They are agencies sponsored by governments with the objective of supporting strategic areas of the economy as construction, education etc.

Hedge
Strategy of investment performed with the objective of neutralizing or at least reducing certain type of risk.

Ibovespa
Benchmark of BM&FBovespa S.A. – Stock Market, Goods and Futures calculated from a hypothetical basket containing the most negotiated Brazilian stocks.

Money market
Segment of the financial market compounded by short-term assets (until one year) and usually of major liquidity, such as commercial papers, certificates of negotiable deposits (CDs), treasury bills, buybacks agreements (repos), etc.

Rating
Grade given by a risk agency which expresses the credit risk of institutions, countries and assets.

Rating Agencies
They are agencies, usually private, which rate the credit risk of institutions, countries and assets.

Spread
Price difference between the quotations for buying and selling an assetor between quotations of two different assets.

Supranationals
Papers issued by multilateral organisms, such as the International Monetary Fund (IMF), the Interamerican Bank for Development (BID), the Bank for International Settlements (BIS), the World Bank (Bird) etc.

Swift
Society for Worldwide Interbank Financial Telecommunications. It is a global system of telecommunications whose main objective is to provide message service, which enables the Central Bank of Brazil to liquidate operations with international reserves.

Treasuries/T-bills
Debt instruments issued by the North American Treasury. Treasury bills (T-bills) are issued with up to one year term and do not pay coupons before maturity. The other treasuries (bonds and notes) are issued with a higher term and pay coupons periodically.

Value at Risk
Estimated value for the investment loss, in a certain time horizon, with a given confidence level.

VIX
Implicity volatility index, based upon S&P500 calls.

Volatility
Degree of prices variability or assets returns.

Yield
Profitability. Dividend or interests paid as percentage of the current value.

BANCO CENTRAL
DO BRASIL