

INTERNATIONAL FOREIGN EXCHANGE RESERVES



BULGARIAN
NATIONAL
BANK

Celebrating the BNB 130th Anniversary

INTERNATIONAL FOREIGN EXCHANGE RESERVES

Edited by Tsvetan Manchev,
Doctor in Economics



BULGARIAN
NATIONAL
BANK

2009

Abbreviations

BNB	– the Bulgarian National Bank
GDP	– gross domestic product
BIS	– the Bank for International Settlements
b.p.	– basis points
EIB	– the European Investment Bank
EC	– the European Commission
EU	– the European Union
ESCB	– the European System of Central Banks
ECB	– the European Central Bank
LBNB	– the Law on the Bulgarian National Bank
M1	– narrow money
M2	– M1 plus quasi money
M3	– broad money
IMF	– the International Monetary Fund
ERMII	– Exchange Rate Mechanism II
Fed	– the Federal Reserve System

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Introduction

This book caters to a growing public interest in the principles, organisation, and results of foreign reserve management at the BNB. It took some four years to write. The process of managing foreign reserves does indeed deserve interest! The fact that it is manifest testifies to the march of democracy, the opening of Bulgaria's economy to the world, and to growing awareness of the concept of public wealth. The period since currency board launch – one of the most successful in Bulgaria's new economic history – saw the accumulation of significant foreign reserves. In late 2007, the BNB held some 12 billion euro of them, worth some 41 per cent of Bulgaria's GDP. Globalisation and information technology offer ever greater opportunities for economic analyses and comparisons, boosting both competition and the development of civil society.

We began working on the book in 2004, just as the BNB successfully completed the World Bank's RAMP¹ foreign reserve management programme. The certificate we received after three years with the World Bank Treasury² encouraged us to present to the public the sequence of complex theoretical and practical economic and financial issues which central banks tackle in managing their foreign reserves. Thus, this book is also a gesture of gratitude to the World Bank for the reserve management support it offered and continues to offer the BNB. We cannot fail to mention current World Bank Treasury Vice President Kenneth G Lay, a friend of Bulgaria down the years through posts he has held, and RAMP and Sovereign Investment Partnerships Director Jennifer Johnson-Calari. They sent the specialists who worked with us, encouraged us to pose difficult issues and to resolve them constructively and openly in managing the substantial portion of public wealth that foreign reserves represent.

¹ *Reserve Advisory and Management Programme.*

² *World Bank Treasury.*

In striving to be a modern European central bank, the BNB has to stay abreast of global and national trends in foreign reserve management. The Bank recently gained access to the expert potential of the European System of Central Banks (the ESCB) and worked with the central banks of France, the Netherlands, and Italy on foreign reserve management in the Euro System. The Bank's cooperation with the Bank for International Settlements in Basel and the International Monetary Fund (the IMF) is particularly beneficial to building administrative capacity and improving employees' theoretical grasp and professional qualifications. Not least, daily management of the foreign reserve has meant direct BNB involvement on international financial markets, building additional expert potential.

All this made us identify a problem not unknown to other countries which have accumulated foreign reserves through reform and the liberalisation of the world economy. This problem is the lack of a basis for national debate. The public, politicians, media, even many economists in these countries lack the theoretical basis for such a debate. This is why we published the theoretical part of the book in 2005. In the two years that followed, we offered additional information on how the BNB understands and applies the theory of foreign reserve management under a currency board through BNB Annual and Semianual Reports. We trust that this book will lend added impetus to debate as the public, politicians, and leading economists have accumulated a basic body of knowledge. The BNB has the will for this, sensing as it does that public wealth and attitudes to it exceed the purview of a central bank.

This is the place to express my gratitude to the BNB Governing Council and to Governor Ivan Iskrov for their strong and continuing support in resolving the complex theoretical, practical, and purely operational or organisational issues of foreign reserve management. While adhering strictly to the Law on the BNB (the LBNB) and its definitions of their purviews and duties, they have offered this help in the earnest hope that it would strengthen and develop foreign reserve management capacity and assist the young specialists of the Treasury and Risk Control and Analysis Offices.

Part Two, then, outlines the BNB's current practice in managing foreign reserves under a currency board. It shows how the public interest is safeguarded to the utmost by national legislation and recommended international practice, and how Bulgaria and its central bank honour their commitments to the EU and the ESCB. This practice rests on theoretical grounds whose soundness was proven by recent uncertainties on international markets and the global economy. BNB practice, however, is not final and immutable: life is much richer than any theory and things can never stand still.

Foreign reserve management has the character of a social contract. We feel that the book manages to show how economic theory and practice develop to cater for the changes which life invariably imposes. The purpose of this study is to highlight knowledge accumulated at the BNB as a basis for continuing public debate on our attitude to the public wealth that the central bank's foreign reserves are. The book aims to send echoes among politicians, economists, the media, and civil society on managing this wealth in a manner which must:

1. Rest on principles derived from modern theory and practice;
2. Demonstrate at all times international standards of accountability and transparency;
3. Rest on legal instruments which exclude any possibility of political pressure to trample principles and skew accountability.

Much attention in Part Two is devoted to the match between Bulgaria's monetary regime, the currency board, and foreign reserve management theory. In an example of Bank accountability and transparency, financial results from foreign reserve management for the entire period after 2000 are presented. They are all the more valuable since they surpass the scope of Annual and Semiannual Reports. This highlights cyclicity on international financial markets, financial leverage in reserve management, and the distinction between reserve management and the Bank's disbursement role. The last chapter presents the meaning and significance of sovereign investment funds in today's economy and their link with foreign reserves as a platform of debate on efficient public wealth management. The BNB reserve management information platform, live since 2006, is also explained.

The book was written by a team of authors:

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The major conclusions we offer the reader are:

1. Foreign reserve management is a complex financial, business, public, and political process which ought to be vested into the central bank through modern theory and practice set in legal terms as exemplified by the LBNB.

2. The BNB acts on the basis of clear and transparent, hierarchically arranged foreign reserve management principles. They must endure in any future legislation governing the monetary and foreign exchange regime, national debt, and public wealth.
3. The currency board places liquidity as a priority of BNB foreign reserve investment in order to maintain the Bank's standing and public confidence in the monetary regime.
4. Safeguarding and boosting the value of BNB capital involves important tasks and constraints in foreign reserve investing and decisionmaking. Adhering to them helps maintain and improve the BNB's standing as the nation's monetary centre.
5. A flexible internal organisation to manage foreign reserves to legal principles, clear and unambiguous internal rules at all levels, strict accountability, and public visibility, is an important condition for continuity in the Bank's investment policy and for its reputation.
6. The long term outcomes of reserve management are strongly dependent on the theoretical soundness of the investment process and on the categorical clarity of statutory principles.
7. The results of foreign reserve management since 2000 confirm the dependability of statutory instruments and of BNB investment policy.
8. BNB entry into the ESCB did not entail changes to foreign reserve investment policy. Change will come with BNB entry into the Euro System, and the Strategy for BNB Development between 2004 and 2009 provides for staff retraining and preparation.
9. The emerging public debate on managing public wealth to recommended international practice and principles and obtaining higher yield touches on foreign reserve management. We regard foreign reserves as part of public wealth. The manner in which this wealth is managed is a political matter for the National Assembly.
10. Only the National Assembly may set a theoretical business and political extent on the foreign reserves which the BNB requires

to maintain monetary regime stability until Bulgarian accession to the Euro System.

11. Upon such an assessment, the National Assembly may legislate on that portion of public wealth which is currently part of BNB foreign reserves, but which may exceed the amount needed for monetary cover and currency board stability. The Bank has the capacity and will to assist the legislator.

All opinions and comments will be received with interest. Readers may contact us through bnb.bg or treasury@bnbank.org. We trust you will enjoy the book.

Tsvetan Manchev

*Doctor of Economics, Deputy Governor,
and Member of the Governing Council of the BNB*

December 2008

Sofia

PART ONE
**THE THEORETICAL
FOUNDATIONS**

Chapter One

Nature and Function

1. Definition

Foreign reserves³ include gold and/or other central bank assets which come entirely within its control and are easy to trade on international financial markets. According to the Fifth Edition of the IMF's Balance of Payments Manual "*reserve assets consist of those external assets that are readily available to and controlled by monetary authorities for direct financing of payments imbalances, for indirectly regulating the magnitude of such imbalances through intervention in exchange markets to affect the currency exchange rate, and/or for other purposes*".⁴

The IMF description is clear on the role and significance of reserves, and on the motives for owning and using them. Except in special and closely defined circumstances, the monetary authorities in the definition are national governments and central banks. Depending on organizational and legal arrangements, the government and central bank may either manage their portions of foreign reserves independently, or have them managed by one or the other on behalf of the nation. World practice tends to favor central banks as managers of these reserves and, as the law stands, Bulgaria is no exception. Hence our definition treats foreign reserves as a central bank province.

Another important element of the proposed BNB definition, in line with the IMF one, is the necessity to hold reserves in foreign exchange and foreign financial assets which are easy to trade on international financial markets. Ease of trading implies that assets and currencies are quoted at all times, enabling transaction immediacy with no significant departures from current market quotes.

³ We use 'foreign reserves' or 'reserves' for brevity instead of 'international reserves'.

⁴ *Balance of Payments Manual, Fifth Edition, the International Monetary Fund, 1993, p. 97.*

and exchange, and commonly accepted in foreign trade. Since it is not issued by a country, gold is not subject to national crises, as distinct from money issued by a country or economic community. Historically, this circumstance has boosted gold prices amid political, military, or socioeconomic crises, and/or geopolitical tension.

Harmston (1998)⁷ shows that gold has retained its real purchasing power over very long terms in the USA, Britain, France, Germany, and Japan. Regardless of any long term price fluctuations, the purchasing power of gold swings back to parity with other commodities such as petroleum, sugar, grain, and metals. This determines one of gold's major functions as a hedge against inflation. The same study shows that gold may be used to diversify an asset portfolio.

Some central banks in manage their gold reserves more actively. Doran (1997)⁸ shows lending in gold growing dynamically, with developing country central banks playing the major role, though they only hold some 17 per cent of world public sector gold. In 1996 these banks disbursed about two thirds of gold loans, or some 2750 tonnes. Intermediaries in this business are banks with a very high international rating (AA or better), since they tend to be the only private banks with whom central banks work. The most common financial instruments are deposits whose interest is paid in gold.

Other authors see the role of gold in foreign reserves declining. Bordo and Eichengreen (1998)⁹ show that central banks' commitment to price stability, which has ushered a significant curb on world inflation, would cut the future monetary role of gold. Other factors in this trend include the greater mobility of capital, the falling significance of tradition, foreign factors, and legal requirements for gold.

Today's central banks continue to be positive on gold. This is gleaned from the so called Washington Agreements. The first such accord dates from September 1999 when the price of gold (USD250 per troy ounce) was at a low since 1980. The agreement was between

⁷ Harmston, S. Gold as a Store of Value, World Gold Council, Research Study No 22, November 1998.

⁸ Doran, A. Trends in Gold Banking, World Gold Council Research Study No 19, June 1997.

⁹ Bordo, M., B. Eichengreen, The Rise and Fall of a Barbarous Relic: The Role of Gold in the International Monetary System, National Bureau of Economic Research Working Paper 6436, March 1998.

15 European central banks, of which 14 (all except the Swiss) were in the ESCB. The BIS¹⁰ monitored this gentlemen's agreement lacking the legal force of an international treaty. The parties owned about half of world official gold. The USA and Japan undertook not to sell or lend gold. The BIS and the IMF supported the agreement. The accord limited gold sales to 2000t over five years: some 400t per annum. Switzerland accounted for 1300t of the total, and Britain for 365t. Other parties had 335t between them, with the Netherlands and Belgium seen as the keenest sellers.

A central part of the agreement limited the amount of gold for lending. The parties contracted not to increase it, and not to boost futures and options volumes. The accord injected clarity into the fate of a large amount of gold which was practically removed from the market for its duration. This largely relieved world gold markets from uncertainty as to the behavior of such major market participants as central banks, cutting price fluctuations.

In March 2004, before the expiry of the Washington Agreement, central banks signed a new gold accord. Again covering five years, it came into force as the prior agreement lapsed on 27 September that year. Annual sales by parties to the agreement will not exceed 500t, limiting overall gold sales to 2500t over the life of the accord. Gold lending and gold futures volumes are kept at former levels.

Main factors governing gold prices over the past two years include:

- reduced hedging positions by gold producers;
- geopolitical instability;
- the weak US dollar;
- low interest rates;
- equity market volatility;
- the slow growth of gold supply by mining companies.

Record low international market interest in gold denominated financial instruments is expected to remain set over the medium term. Main drivers here are the cutting of hedging positions by gold pro-

¹⁰ The Basle based Bank for International Settlements.

ducers (the main demand factor), and the readiness of central banks to lend large amounts of gold (the main supply factor). Nevertheless, as the second Washington Agreement expressly states, gold remains an important part of global reserves.

Amid these worldwide trends, the BNB position is that existing monetary gold will continue forming a part of its reserves in the long term. At the close of the last century the Bank took the strategic decision to manage some 60 per cent of its gold reserves by allowing it outside Bank vaults. This sensible move allows revenue to offset a significant part of gold maintenance costs while staying within LBNB statutory risk requirements. Gold reserve liquidity increases, and (last but not least) the BNB is accumulating experience in managing gold reserves on international markets.

3. Reasons to Own and Use Foreign Reserves

The motivations for any country to own reserves have always been liquidity and insurance: a hedge against the unforeseen. The IMF definition clearly states that foreign reserves serve foremost for:

- financing foreign payment disbalances;
- maintaining a set exchange rate level.

Each country faces constant demands for foreign payments on demand for trade purposes, necessitating a reserve to accumulate and disburse foreign payments. Foreign trade and domestic policy also often lead to the accumulation of foreign debt which is serviced with foreign exchange. Normally, the debtor country manages to generate a revenue stream with which to settle its obligations. Unreasonable economic policies or shock falls in foreign revenue can cause payment difficulties. Reserves then become a source of liquidity.

Foreign reserve amounts and composition also affect exchange rates. All exchange policy classifications¹¹ stress that entirely free floating exchange rates are rare exceptions across the world. Even countries internationally acknowledged to have floating exchange rates own reserves.

¹¹ See IMF, Annual Report on Exchange Arrangements and Exchange Restrictions, 2004.

4. The Functions of Foreign Reserves

The main purposes of foreign reserves are:

- to act as a monetary policy instrument;
- to act as an exchange rate instrument helping cut fluctuations in the exchange rates of the national currency against foreign currencies, or maintain a set exchange rate;
- to act as a liquidity buffer in case of an international financial market crash;
- to reduce vulnerability to external factors and safeguard against crises;
- to boost stability and confidence in financial markets, since reserves are among the foremost indicators monitored by international ratings agencies;
- to act as a source of subsidiary revenue derived from managing them.

The above list is most general and detached from theoretically possible exchange rate policies and the degree of national development; the significance of foreign reserves varies according to specific circumstances. Financial history offers as few grounds for simple assessments of foreign reserve management as it does examples of more successful central banks. Interventions in support of an exchange rate or of other monetary policies appear appropriate only in the short term. Pragmatic thinking puts them alongside other monetary policy levers, with success dependent on their combined use. Alan Greenspan¹² states the general principle that foreign reserves should be kept in currencies seen as stronger than the local one. The proof by default is that the Fed has used gold as a foreign reserve for a lengthy period. Whenever the dollar has weakened, the Fed has boosted the shares of yen and marks (euro).

The process of managing foreign reserves increases knowledge of developments in the economy and on international financial mar-

¹² Greenspan, A. Currency Reserves and Debt: Remarks before The World Bank Conference on Recent Trends in Reserves Management, Washington, D.C., April 1999.

kets, thus assisting one of the central bank's basic functions: attaining financial stability.

The example of New Zealand is indicative of the functions of foreign reserves today. Since 1985, this country's currency has floated freely, the central bank not intervening at all on the forex market; yet it continues maintaining reserves¹³. The bank's entire reserve is disbursed as loans on the international markets. New Zealand has an AA credit rating, yet its foreign reserves yield something just below the AAA rating mark¹⁴. By 2000 reserves came to USD2.5b, while the total maintenance spend on them came to USD2.5m. Despite these expenses, the Reserve Bank of New Zealand does not intend to renounce foreign reserve maintenance and management, foremost arguments being:

- liquidity in case of a collapse of international financial markets;
- cash in hand to meet foreign debt repayments;
- honing staff know how and skills as regards the global economy;
- a reserve fund in case of natural disasters;
- a monetary policy instrument amid stable national budget surpluses and cuts in government bond issues.

Another reason why central banks have to maintain additional liquidity in the form of foreign reserves lies in the nature of international forex markets which appear more adept at spreading shocks than at absorbing and controlling them.

This is borne out by the dynamics of bid/offer spreads: traders' basic transaction cost. Where fluctuations and uncertainty grow, the spread broadens, cutting market liquidity. Forex market brokers always have a swift retreat ready when crisis looms. Central bank intervention becomes necessary in such cases, since decisions are longer term and planning horizons are broader.¹⁵

¹³ Archer, D., J. Halliday, "The Rationale for Holding Foreign Currency Reserves," Reserve Bank of New Zealand Bulletin, December 1998.

¹⁴ Sherwin, M., Foreign Reserves: Some Observations in an Asian Context: Current Issues, Address to a Conference of the World Bank Treasury, Thailand, May 2000.

¹⁵ For a more detailed insight into forex market structure and participant behavior (including central banks), see Goodhart, C., M. Glugale, "Some Evidence on Daily Trading Activity in the London

5. Exchange Rate Policy, Monetary Policy, and Foreign Reserves

Choices facing central bank managers when combining monetary policy with government's chosen exchange and capital controls are hard and controversial, even in theory. The theoretical debate on exchange policy alone dates back a couple of centuries and, economic theory advances notwithstanding, has not reached an unconditional conclusion on the dilemma between a fixed or floating (flexible) exchange rate. It is endless, for the choice of exchange policy entails balancing current and expected spending and revenue, while they in turn depend on specific points of departure, structural and behavioral peculiarities, as well as on economic shocks that are as inevitable as they are unpredictable. Each exchange policy change is subject to at least two further constrictions. The first comprises manifold legislative, structural, and institutional adjustments in the state, and especially its central bank, which would back exchange policy stability. To some extent these changes determine how long the economy adapts to the chosen exchange policy. The second involves several years' settling down; precisely how many years depends on the country and historical juncture.

Harvard professor Frankel, a universally acknowledged exchange policy authority, stated in 1999 that "no single foreign exchange regime is right for all countries in all times."¹⁶ Choosing between fixed and floating exchange rates is not a simple matter of selecting one opposite, but rather a multilayered decision surmounting a multiplicity of institutional choices and policies. Moreover, it is not isolated, but forms a part of an overall exchange and monetary policy framework, with implications for the free movement of goods and capital¹⁷.

Foreign Exchange Market," *Journal of International Securities Markets*, Summer 1989; Flood, M., "Market Structure and Inefficiency in the Foreign Exchange Market," *Federal Reserve Bank of St. Louis Review*, Working Paper 91-001B; Bollershev, T., M. Melvin, "Bid-Ask Spreads and Volatility in the Foreign Exchange Market," *Journal of International Economics*, Vol. 36 (1994).

¹⁶ Frankel (1999), NBER Working Paper No 7338.

¹⁷ The degree of autonomy in selecting an exchange policy remains an open issue outside the scope of this study.

Formulating a monetary regime is even more complex, both theoretically and in practice. Several types have emerged¹⁸:

1. A central bank entirely independent from government and pursuing monetary policy with price stability as its aim.
2. A relatively independent central bank whose monetary policy, alongside price stability, aims at currency stability under the chosen exchange policy and/or attaining set economic growth rates.
3. A currency board.
4. The gold standard.
5. The gold/dollar standard.

Each historic regime features a different institutional framework. Currently, the top two are most widespread worldwide. Typical examples of the first include the USA and the eurozone, with the Fed and the ECB enjoying independence both statutorily (formally) and in practice (based on democratic tradition and experience) to conduct monetary policies whose major aim is price stability. Some new EU members from the 2004 expansion wave also have regimes of the first type: Poland and the Czech Republic. Typical of the second regime are India, China, and Russia, as well as most developing nations in South East Asia and Latin America.

The currency board is a very rare regime considered especially successful in countries with small open economies striving to balance their state finances and remove all hindrances to the movement of capital. The model calls for suitable legislation which also encourages flexibility in the movement of goods, people, and services. Typical of the regime are the central banks of Bulgaria, Estonia, Hong Kong, and Lithuania.

The gold and gold/dollar standards rest on a direct or indirect peg between the national currency and gold, with local money wholly or partially covered by gold¹⁹. The classic gold standard reigned world-

¹⁸ For a detailed discussion on monetary regimes, see **Mishkin, F.**, *International Experiences with Different Monetary Policy Regimes*, National Bureau of Economic Research, Working Paper No. 7044, 1999.

¹⁹ Gold standards are reviewed in detail in, inter alia, **Desquilbet, J.B., N. Nenovsky**, *Credibility and Adjustment: Gold Standards Versus Currency Boards*, Bulgarian National Bank, DP/39/2004, 2004.

wide between 1880 and 1914 with no administrative fiat, but rather because of market forces²⁰. It featured automatic adjustments to shocks while maintaining complete capital mobility. Monetary gold reserves were distributed among participating countries according to their demand for money. Balance of payments disbalances were overcome automatically. Gold moved from countries with balance of payments deficits to those with surpluses, balancing the money market and price levels. The gold standard imposed strict rules and could be viewed as a counter to discretionary monetary policy. Much criticism may be leveled against the regime. The main ones which led to its demise addressed: the development of financial intermediacy and the growing role of broader monetary aggregates and money multiplier which mean a reducing cover; political problems and the need for large money issues (the two World Wars); the high transaction costs of basing the system on a noble metal; insufficient gold supply; and international contagion for shocks and financial crises.

The choice of a stable currency and monetary regime for Bulgaria in the periods until EU accession, ERMII membership, and eurozone entry, has to be viewed in the context of the above resume. The choice would affect the role of foreign reserves in these periods. The brief theoretical discussion below aims to outline the realistic bounds of such a choice and inform readers' personal conclusions as to the stability and adequacy of the currency board regime with its lev euro peg.

The link between monetary and exchange regimes is reviewed by Schuler (2005)²¹. The choice before a central bank, given a set currency and monetary regime, is also theoretically constrained due to the so called impossible trinity principle. This dictates that decision makers have to sacrifice one of three possible, yet conflicting, aims: monetary policy independence aiming at price stability, exchange rate stability, or freedom of capital movement. This principle is the natural extension and conclusion of the existence and application of

²⁰ A detailed description of the gold standard is contained in **Bordo, M.**, *Monetary Standards: An Essay written for the Oxford Encyclopedia of Economic History*, <http://econweb.rutgers.edu/bordo/encyclopedia.doc>.

²¹ **Schuler, K.**, *Classifying Exchange Rates*, <http://users.erols.com/kurrency/classifying.pdf>, 2005.

the so called Mundel²² (1968) Fleming²³ (1962) Model²⁴.

The two cases below illustrate the impossible trinity in a market economy, with foreign reserve dynamics an important variable in the model²⁵.

First let us assume a central bank which maintains a fixed exchange rate and does not intervene to maintain a constant money supply. Initially there is balance between supply and demand for the local currency. If demand falls amid a liberal capital movement policy and the central bank continues maintaining a fixed exchange rate, local money oversupply results. Excess local currency is changed at the central bank for foreign currency, cutting foreign reserves. Foreign exchange replaces the local currency in economic agents' portfolios, causing a fall in the monetary base, which, assuming an unchanged exchange rate, leads to reduced money supply and the restoration of equilibrium. The adjustment is at the expense of falls in foreign reserves and nominal money supply. The opposite obtains where demand for local money grows, with adjustment resulting in increased foreign reserves and money supply. Here there is no conflict between the objectives: the central bank maintains its fixed exchange rate, capital moves freely (is convertible), yet independent policy is absent inasmuch as managing the monetary base is not a central bank objective and falls outside its purview.

Second, let us assume a flexible exchange rate and an initial balance between money supply and demand, with a central bank conducting monetary policy which does not include interventions to maintain the exchange rate. Once again there is no conflict between objectives. If money demand falls, there is excess local currency, causing its rate to fall against foreign exchange. Adjustment takes the form of exchange rate changes, with the local currency falling without

²² The model develops the Keynesian IS/LM model for a small open economy. It was initially designed for the IMF, from whence the analysis of the effectiveness of monetary and fiscal policies under various exchange rate regimes comes. The authors' basic contribution is in the stress laid on the role of capital flows in policy success.

²³ Mundell, R., *International Economics*, New York, Macmillan, 1968.

²⁴ Fleming, M., *Domestic Financial Policies Under Fixed and Floating Exchange Rates*, IMF Staff Papers 9, 3 (Nov.), pp 369-379, 1962.

²⁵ The link between foreign reserves, exchange regimes and monetary policy is examined in detail in Schuler, K., *The Problem with Pegged Exchange Rates*, KYKLOS, Vol. 52, Issue 1, 1999.

changes to the monetary base or foreign reserves. The corollary is that greater demand for local money would cause its rate to rise.

Incongruities under a fixed exchange rate regime arise where the central bank begins conducting independent monetary policy. If demand for local money fell then, the bank would sell foreign reserves against money it issued, but for which there was no demand. This would continue until the central bank had reserves left. When their level got critically low, the likeliest outcome would be a successful speculative raid on the fixed rate, causing a sharp drop in the local currency, often combined with the loss of the remaining reserves. In this case, the central bank is not allowing money supply to adjust and keeps it at an artificial level: something impossible over a long term. In order to maintain the fixed exchange rate and yet not sacrifice any foreign reserves, the bank has to relinquish control over money supply, i. e. to cede monetary policy independence.

Incongruities under a floating exchange rate arise where the central bank attempts to set and maintain a given trajectory for this rate.

The Mundell Fleming Model allows the above scenarios to be made more complex and analyses to be made of various balancing options in an economy with freedom of capital movement and fixed or floating exchange rates, depending on how much stress falls on independent discretionary monetary (or rather fiscal) policy²⁶. Economists such as Krugman (1979)²⁷ and Dornbusch (1976)²⁸ have deepened and developed this analysis.

Over the 1990s' transition to a market economy, Bulgaria acquired experience of two different monetary and foreign exchange regimes. Assessments of their success or otherwise must rest with economic historians.

Ultimately, in 1997 Bulgaria relinquished independent monetary policy and undertook, under the LBNB, to peg the lev against the euro under a currency board. In view of Bulgaria's approaching Eu-

²⁶ Thorough explanations and diagrammatic representations of the various balancing options are contained in Пилбийм, К., *Международни финанси*, FTP, Sofia, 1995.

²⁷ Krugman, P., *A Model of Balance-of-Payments Crises*, *Journal of Money Credit and Banking*, Vol. 11, Issue 3, pp 311–325, 1979.

²⁸ Dornbusch, R., *Expectations and Exchange Rate Dynamics*, *Journal of Political Economy* 84, pp 1161–1176, 1976.

ropean Union accession in 2007, it matters that the ECB²⁹ sees the currency board with a lev peg to the euro as within ERMII membership requirements. Bulgaria can also use the accumulated positive experience of other countries opting for similar regimes (Estonia and Lithuania), which are now ERMII members.

Today Bulgaria enjoys overall theoretical, political, and practical consensus on the benefits of free capital movement and the positive technological changes³⁰ it brings, as evidenced by the 2000 Currency Law and the many statutory instruments and Bank Ordinances under it. The Bank feels that limiting the freedom of capital movement is not only undesirable but even dangerous in the run up to full EU membership. Hence any possibility of capital movement restrictions is seen as justified only in extremis. Such circumstances are usually defined as events preceding a crisis.

6. Foreign Reserve Adequacy

The question of what level of reserves would allow a central bank to discharge its basic tasks of financing disbalances in foreign payments, and maintaining the foreign exchange regime and exchange rates has been widely deliberated since the 1960s³¹ as the “adequacy issue.” Adequate reserve levels are seen as ones which allow the maintenance of international financial system stability. Plans exist to reform the still functional, albeit much modified, 60 year old Bretton Woods system and create an additional source of international liquidity. Countries fearing contagious global recession in case the Bretton Woods institutions (the IMF and the World Bank) fail to guarantee liquidity elect to have greater reserves than others³². Transiting to predominantly floating ex-

²⁹ See *Some ECB Views on Accession Process*, a Speech delivered by Christian Noyer, Vice-President of ECB, on the occasion of The Central and Eastern European Issuers and Investors Forum, Vienna, on 17 January 2001, <http://www.ecb.int/press/key/date/2001/html/sp010117.en.html>.

³⁰ For greater detail, see Edison, Klein, Ricci, Sloek, *Capital Account Liberalization and Economic Performance: Survey and Synthesis*, NBER Working Paper 9100, 2002.

³¹ A chronological progression of developments in the foreign reserves adequacy and demand issue may be found in Bird, G. and R. Rajan, *Too much of a Good Thing?: The Adequacy of International Reserves in the Aftermath of Crises*, CIES Discussion Paper 0210, April 2002.

³² A review of the literature addressing the problems of international liquidity and reserves during this period is contained in Machlup, F., *Plans for the Reforming of the International Monetary System*, Special Papers in International Economics No. 3, Princeton University, 1964.

change rates at the close of the 20th Century did not curtail demand for foreign reserves. Studies show that reserve adequacy varies between countries and historical junctures and depends on national macroeconomic specifics.

The liberalization of world trade at the close of the 20th Century increased the significance of the balance of payments current accounts for individual countries, and this read across into one of the earliest indicators of reserve adequacy. Expressing reserves as a number of months' worth of imports of goods and services is a traditional way of linking foreign assets with foreign trade. Its explanation is clear and logical: the number of months over which the country can continue servicing its current level of imports if all other revenue and spending were to end. The indicator only helps monitor and secure adequate reserves to cover foreign trade disbalances. It is particularly relevant to countries with a limited access to international financial markets and is strongly sensitive to downturns in investor expectations. Three months' worth of imports is the traditional critical low.³³

The adequacy issue resurfaced in the 1990s and the early 21st Century after several serious currency crises, primarily in emerging markets like Mexico, South East Asia, Russia, Argentina, and Bulgaria. There the traditional ratio of foreign reserves to months of imports failed to give early warning of crisis³⁴. The main reason for this was the removal of constrictions to the free movement of capital and the integration of emerging countries into international financial markets. This boosted the importance of indicators linked with the balance of payments capital account, and hence with monetary aggregates and foreign debt.

The monetary aggregates to foreign reserves ratio shows the degree of cover of a set aggregate (reserve money, M1, or M2) by foreign reserves. Adequacy indicators resting on ratios between mon-

³³ See Fischer, S., *Opening Remarks*, IMF/World Bank International Reserves: Policy Issues Forum. Washington D.C., April 2001.

³⁴ For some empirical studies confirming this, see Bussiere, M., C. Mulder, *External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion*, IMF Working Paper No. 99/88, 1999; Edison, H., *Do Indicators of Financial Crises Work? An Evaluation of an Early Warning System*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, No. 675, 2000.

etary aggregates and reserves actually predate import ratios. Most central banks which adhered to the gold standard in the Interwar period strove to maintain a set ratios between their gold reserves and foreign exchange holdings and the banknotes and short term paper they issued³⁵. Narrower aggregates such as reserve money and M1 read across directly to the currency board regime³⁶ and show the extent to which a country's foreign exchange holdings can meet demand for highly liquid means (money in circulation and overnight deposits) at any one time.

The M2/foreign reserves ratio has a bearing on possible capital runs in unfavorable circumstances and shows the extent to which the banking system is ready to deal with such a development.³⁷

The ratio between foreign reserves and short term foreign debt is classically required to be at unity at least. It determines the ability to meet the shortest term obligations in case of hindered access to new foreign currency sources. Authorship of the indicator is ascribed to former Argentine finance minister Pablo Guidotti³⁸. Where balance of payments current account deficits are high, the part of deficit seen as unstable and unsustainable in the long term boosts the ratio. A related indicator is that of foreign debt service/foreign reserves. Apart from measuring reserve adequacy by the Guidotti ratio, Alan Greenspan³⁹ proposes that the mean maturity of a country's foreign obligations be at least three years. Greenspan also speaks of a new method of assessing a country's relative foreign positions, called liquidity-at-risk. Foreign liquidity position is assessed on the basis of a broad circle of possible values of related financial variables (exchange rate, basic commodity prices, and debt interest, inter alia). Thus foreign reserves are adequate where they ensure a great prob-

³⁵ *Debt and Reserve-Related Indicators of External Vulnerability*, IMF, March 2000.

³⁶ A certain analogy with the gold standard may be seen here.

³⁷ The M2/reserves ratio has been a good indicator of currency crises in many studies such as Kaminsky, G., S. Lizondo, C.M. Reinhart, *Leading Indicators of Currency Crises*, IMF Working Paper, No. 97/79, 1997; IMF, Chapter IV, *Financial Crises: Characteristics and Indicators of Vulnerability*, World Economic Outlook, 1998; Edison, H. *Do Indicators of Financial Crises Work?: An Evaluation of an Early Warning System*, Board of Governors of the Federal Reserve System, International Finance Discussion Papers, No. 675, 2000.

³⁸ De Beaufort, J. Wijnholds, A. Kapteyn, *Reserve Adequacy in Emerging Market Economies*, IMF Working Paper No. 01/43, 2001.

³⁹ See footnote 13.

ability (e.g. 95 per cent) of foreign liquidity being sufficient to meet obligations without drawing new loans for a year.

Tables below present the state of some of the aforementioned indicators.

Table 2 **Developing Country Reserve Adequacy**

Exchange Regime	Reserves/ Weeks of Imports	Reserves/Short Term Foreign Debt, per cent
Free Floating		
Brazil	35	83
Chile	50	200
Colombia	40	134
India	38	327
Indonesia	57	126
South Korea	32	162
Mexico	11	119
Peru	56	131
The Philippines	22	145
Poland	28	316
Russia	11	70
South Africa	12	43
Thailand	43	206
<i>Mean</i>	33	159
Controlled Floating or Fixed		
China	49	655
The Czech Republic	23	225
Hungary	20	154
Malaysia	24	336
Turkey	30	93
Venezuela	43	235
<i>Mean</i>	32	283
Currency Board		
Argentina	53	62
Bulgaria	25	258
Hong Kong	28	103
<i>Mean</i>	35	141

Source: *De Beaufort, Wijnholds and Kapteyn* (2001).

Note: Data relate to the close of 1999, with BNB data for Bulgaria.

At the close of 2004 Bulgarian reserves covered 26 weeks' imports, while the reserves/short term debt ratio stood at 205 per cent.

Table 3 **Developed Country Reserve Adequacy** (%)

	Reserves/Short Term Debt, per cent	Reserves/ Weeks of Imports	Reserves/M2, per cent
<i>Mean</i>	22	24	13
Canada	17	9	7
France	13	19	6
Germany	20	16	7
Italy	16	16	8
Japan	21	43	4
The Netherlands	15	13	11
Spain	33	34	14
Sweden	14	14	15
Switzerland	21	48	16
Britain	2	7	3
The USA	65	11	3

Source: IMF (2000).

Note: Data relate to the close of 1998.

These indicators give a most general idea of the state of international reserves, yet they cannot be viewed in isolation from each other, or from a country's economic and institutional framework. They are an important part of the overall analysis of financial stability.

Chapter Two

Financial Asset Risk and Return

Foreign reserve management by modern central banks is a process which employs financial asset investment theory, and this Chapter presents a basic set of the concepts and terminology used by the BNB. The Chapter systematizes the Bank's understanding of financial assets, the nature of financial risk, and factors influencing the yield curve. A resume summarizes accumulated modern knowledge in investment portfolio management and yield curve theories.

1. Financial Assets

Chapter One explained that central banks keep reserves in foreign currency, financial assets, and gold. This Chapter presents BNB views on financial assets. Financial assets have tangible expressions one may see or touch, such as land, buildings, or other chattels. They are paper, and ever more electronic, records of certain ownership (title, holder) rights. In essence these rights concern the distribution of income from diverse origins and forms. Financial assets distribute and redistribute income created by business, within households, or arising from government.

Financial assets defer consumption by some economic agents, and hasten current consumption by others. They are a conduit between those agents who create deficits in their business and those who create current surpluses. They may serve as ways of assuming risk or guarding against it, since the income generated and distributed among agents may be dependent on a certain event.

The simplest financial asset features fixed interest. It sets up a relationship where a party is obliged to pay a defined sum on a defined date. What distinguishes fixed interest financial assets is that income from them, or the method of its generation, is known before-

hand. This makes them particularly suitable for investment by central banks in view of the latter's functions and the role of reserves in discharging them.

Fabozzi (2000)⁴⁰ lists two main subgroups of fixed interest income assets: debt and privilege shares. Debt includes bonds, mortgages, equity backed bonds, and bank loans. Bonds may give income through a coupon and/or discount. In managing foreign reserves, central banks traditionally invest in fixed income financial assets, and moreover in tradable debt most often issued or underwritten by foreign governments or supranational bodies. Naturally, some central banks and other public bodies may also invest in assets not featuring fixed income. For instance, the Hong Kong central bank has invested in foreign equity and in the Norwegian Petroleum Fund.

2. Types of Asset Risk⁴¹

Central banks face manifold risks when investing foreign reserves. They stem from the objective natures of financial assets and the international financial markets where they are traded. Financial risks ought to be thoroughly understood, defined, quantitatively classified, and managed. This is an ongoing and complex process. Below we restate that, in the broadest sense, risk for financial market participants arises from the conditions of insecurity under which they have to implement investment decisions.

Investment risk reflects the degree to which an asset or a portfolio of assets is open to risk.

Risk factors are reasons for uncertainty as to the eventual income at the close of the investment horizon. They are parameters which determine the probable distribution of return. Main risk factors for assets in central bank portfolios include:

- sudden exchange rate changes;
- sudden interest rate changes (i.e., changes in yield curves);

⁴⁰ *Fixed Income Analysis for Chartered Financial Analysts*, Frank Fabozzi Associates, 2000.

⁴¹ On risk theory related to investment on financial markets, see for instance Mishkin, F., *The Economics of Money, Banking and Financial Markets*, *Mishkin Economics*, or Боди, Кейн, Маркърс, Инвестиции, Натурела, 2000.

- sudden changes in the ability clients' or debt issuers' ability to pay.

These risk factors define the main risks to which a financial asset or asset portfolio is subject: currency risk; interest rate risk, and credit risk. Currency and interest risks are varieties of market risk, being functions of evolutions in important market variables such as exchange rates or base rates. Market risks may lead to (occasionally temporary) falls in the market value of an asset. Each participant in the financial markets is subject to the risk of imbalance between the structures of his assets and liabilities.

Below are definitions of the most widespread types of risk in financial asset or portfolio management.

Currency Risk. This is the danger of losses resulting from a change in the exchange rate of the currency in which the asset is priced against the base currency in which financial results are accounted. Currency risk for each financial institution stems largely from the difference between the currency structures of assets and liabilities, and ought not to be linked exclusively with assets, as is often done. The greater the currency structure disparities between assets and liabilities, the greater the risk the institution courts.

Interest Rate Risk. This is the danger of falls in the market value of fixed income paper (bonds) stemming from changes in the yield curve. Modified duration⁴² is a basic measure of interest rate risk. It assesses the extent to which a given asset or liability's market value may change with minor changes in interest rates and concomitant changes to the yield curve. Since interest risk is undoubtedly the most significant risk factor in bond portfolio management, we examine it in detail further below.

Credit Risk. This is the danger of an irrecoverable partial or complete loss of the market value of a given asset resulting from insolvency or bankruptcy on the part of the issuer or debtor. Due to its irreversibility, credit risk is seen as one of the gravest risk factors in asset management. It is impossible or very hard to determine quantitatively. On the basis of a complex of criteria and in-depth credit

⁴² We use "duration" in the identical sense below.

analyses, ratings agencies assign credit ratings to public companies, and especially to financial institutions. These ratings are measures of the credit risk an institution carries. Alongside this, ratings agencies prepare and publish comparative tables on credit rating evolution. These matrices comprise the probability of a credit rating cut or of direct bankruptcy over a set period (say, a year) for companies grouped by credit ratings. Probabilities are extrapolated from historical data. Ratings are crucial in central bank asset management credit risk analysis and assessment.

Spread Risk. This is the danger of loss stemming from changes in the yield curve spreads of assets subjected to credit risk against the benchmark (government bond) yield curve. All fixed interest paper not issued by a government is subject to spread risk. Some analysts view spread risk as market related, while others see it as credit related. We feel it is essentially much closer to market risk.

Apart from the aforementioned risks, many other and often no less significant dangers attend financial asset or portfolio management (and foreign reserve management in particular). They affect liquidity, operations, the law, the model used, and reputation.

Liquidity Risk. This is the danger of a company, and particularly a financial institution, not having enough liquidity to meet its obligations. Liquidity risk management is particularly important in every central bank. Under a currency board, the need for a high liquidity of foreign reserves is imposed by the central bank's duty to offer unlimited quantities of the reserve currency on demand.

The second expression of liquidity risk is in the danger that a financial institution may not be able to sell its assets at fair prices, or within set or reasonable timescales. Because of this, central banks usually keep the greater part of their assets highly liquid (and low risk).

Operational Risk. Most generally this is the risk of partial or full loss (mostly irrecoverable) of asset market value due to, *inter alia*: (1) badly drafted rules and procedures; (2) unintentional lapses from set rules and procedures, and omissions and errors in the payment process; (3) breakdowns in information and communications systems; (4) natural disasters, acts of terrorism and other exceptional events; or (5) intentional violations of rules and procedures, and at-

tempts at fraud or abuse of privilege. Operational risk is regarded as among the most hazardous forms of risk; it is hard to quantify and there are as yet no widely accepted models of measuring and managing it. History shows that where operational risk rears its head, large companies can go to the wall. Operational risk is mostly managed by implementing clear rules, separating payments from transactions, establishing independent control and internal audit, accounting independence, and clear organizational structures preempting conflicts of interest.

Model Risk. This is the danger stemming from models which fail to describe reality well enough. Relying on such models and using them in practice would lead to wrong conclusions and potential financial loss. Model testing is particularly important in managing this type of risk. Literature very often classifies it as part of operational risk.

Reputation Risk. This is the danger of events hitting an institution's standing domestically or internationally. This type of risk indirectly affects a company's market value (its market capitalization). As regards central banks, it would manifest itself in the partial or complete loss of confidence in a central bank, in turn eroding confidence in the local currency and boosting demand for foreign currencies. Internationally, reputation risk would complicate relations with business partners and lower market quotations or cause them to be withheld.

Legal Risk. Broadly present in every business, this type of risk is the danger of losses as a result of poor awareness of legislation governing transactions. Central banks are exposed to legal risk in managing foreign reserves because some or all transactions are subject to foreign statutes which may not dovetail with national ones. This calls for detailed study of specialist foreign legislation.

Communications advances in the 1990s put financial markets across the world into a single information environment. Financial liberalization and the fall of barriers to the movement of capital since the 1980s make today's markets a global system of interconnected vessels which cannot tolerate long term disbalance. World trade in goods is growing even faster than world GDP. Regional diversification is ever harder to sustain, with most institutional investors seeking diversification based on asset and financial product groups.

Structural changes to world financial markets since the 1990s set new challenges in the form of systemic financial crises. Systemic crises combine high exchange rate fluctuations and banking and economic crises with sudden switches in financial asset liquidity. Thus the past seven years witnessed events whose financial market consequences were unprecedented in scale. Two South East Asian and Russian financial crises of 1997 and 1998 caused record asset price and exchange rate fluctuations, as well as record risk spreads. To protect financial markets from further contagion, in 1998 the Fed cut interest rates by 25bp and led the rescue of the Long Term Capital Management hedging fund⁴³ whose foreign positions (including off-balance sheet ones) had reached over USD120b. The largest US equity market correction since 1897 came in 2000. After the dotcom bubble burst alongside related irrational expectations of future high tech sector earnings, equity investors lost almost half the value they had accumulated. The credit for the failure of such a huge loss to cause serious shocks in the global business cycle goes to the energetic Fed policy of cutting interest rates by a record 475bp in a year, starting at 6.25 per cent. Aggressive 150bp cuts by the ECB accompanied this.

3. Financial Asset Return. The Yield Curve

3.1. Return

When on international financial markets a decision to invest in a particular financial asset or to create a portfolio of financial assets is made, there exists great uncertainty as nothing more than “an expectation of the return” can be conjectured, i.e. the expected return on the asset or portfolio of assets. It is calculated based on the assumption that, theoretically, the returns are normally distributed.

After the end of the investment horizon, it may turn out that the actual or so-called realized return differs from the expected. The probability to realize return different from the expected one is called

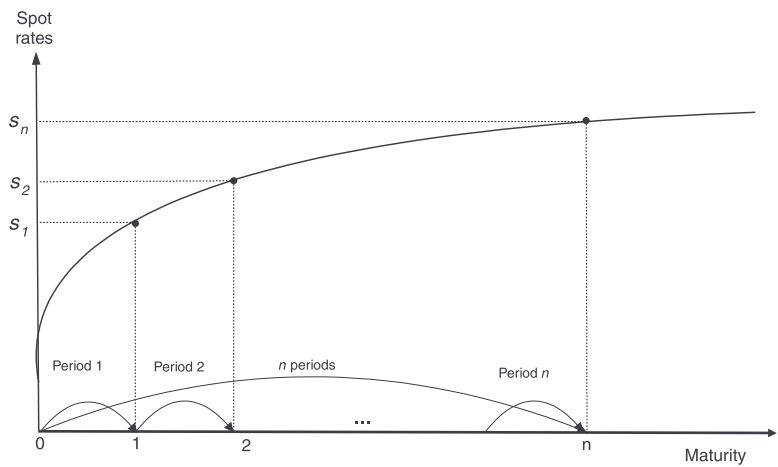
⁴³ LTCM was a closed type investment fund managed by Nobel Prize winning economists Robert Merton and Myron Scholes.

investment risk and is measured by standard deviation (volatility of the return), or other risk measures. In case some particular return, specified in advance in the investment objectives of a given portfolio, need be attained – the so-called target return, naturally the investment risk comes to be the probability to receive return different from the target one.

3.2. Yield Curve

A key concept for the fixed income assets markets is the yield curve. It is comprised of a set of points defining the relation between the return on a financial asset and its time to maturity. A starting point for all parties involved in the investment process is the so-called benchmark yield curve – the one which shows the yields of the most recently issued government bonds. The Eurozone benchmark curve comprises French government bonds for the maturity sectors up to one year and German government bonds for the maturities longer than one year. The current yield levels of the curve are also known as spot yields in order to differentiate them from the so called forward yield curve, another important concept on the fixed income markets, which shows the announced (or contracted) future yields of the same type fixed income securities which are to be issued.

Figure 1 Yield Curve



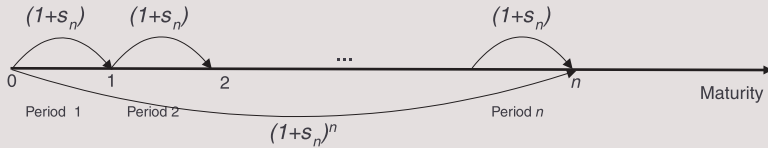
There exist mathematical relations between the spot and forward yield of securities.

Box 1 Derivation of yield using spot and forward interest rates

Spot rate (s_n) – this is the rate we negotiate today and which we will receive as income from today on for each period of an n number of periods if we issue a security with fixed time to maturity. This means the if we issue an n -period security of USD 1 today at spot rate s^n , after n periods we will have income of $(1 + s_n)^n$ USD.

Figure 2

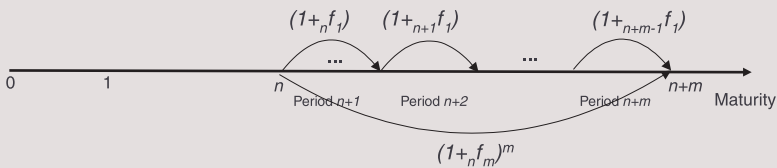
Spot rates



Forward rate (${}_nf_m$) is the rate which we negotiate today and which we will receive each period in the course of m periods if we give out a loan commencing after an n number of periods. This means that if we announce today an m -period security of USD 1, which will be issued after an n number of periods, at a forward rate of ${}_nf_m$, after $n + m$ periods we will have an income of $(1 + {}_nf_m)^m$ USD.

Figure 3

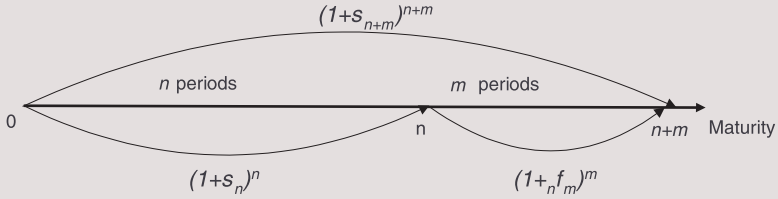
Forward rates



Forward rates can be derived from spot rates using the following relation:

$$(1+s_n)^n(1+{}_nf_m)^m = (1+s_{n+m})^{n+m} \quad (1).$$

Figure 4 Relationship between spot and forward rates



Formula (1) tells us that lending for n periods today at spot rate s_n and, after its expiration, reinvesting the proceeds into a new loan for the next m periods at forward rate of f_m is equivalent to lending for $n + m$ periods today at spot rate s_{n+m} (see Fig. 3).

On the other hand, the spot rates can be derived from the forward rates using the following relationship:

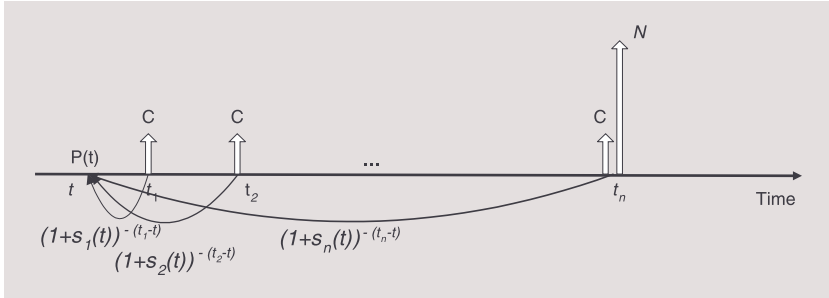
$$(1+s_n)^n = (1+s_1)^1(1+f_1)(1+f_1) \dots (1+f_{n-1}) \quad (2).$$

Formula (2) shows that the spot rates are in fact the geometric mean of the single-period forward rates. From formulas (1) and (2) follows that we can define forward rates using spot rates and *vice versa*.

The yield curve is used to determine the prices of the bonds traded on the financial markets because the spot rates are used in forming the discount factors for calculating the present value of the cash flows. Formula (3) below shows how, at a given moment t ($0 \leq t < t_1$), the price of a coupon bond with coupon C , time to maturity n periods (e.g. years), and face value of USD N depends on the shape of the yield curve at that moment (see also Fig. 4).

$$P(t) = \frac{C}{[1+s_1(t)]^{-(t_1-t)}} + \frac{C}{[1+s_2(t)]^{-(t_2-t)}} + \dots + \frac{C+N}{[1+s_n(t)]^{-(t_n-t)}} \quad (3).$$

Figure 5

Price of a coupon bond at moment t 

In the formula, the variable t is an independent variable both for the price of the bond and the level of the spot rates in order to underscore that the latter change with time. The relative change in the price of a bond between two moments in time, t_0 and t_1 , determines the return on that bond R_{t_0, t_1} ⁴⁴:

$$R_{t_0, t_1} = \frac{P(t_1) - P(t_0)}{P(t_0)} \quad (4).$$

It is obvious from formulas (3) and (4) that, if we are at moment t_0 , in order to calculate the return on the bond at moment t_1 , it is necessary to forecast the yield curve at that future moment. Because of this, the market participants use the expected return on the bonds in formula (4) in order to determine the expected price of the bond $P(t_1)$ at moment t_1 .

Within a future, even if particularly defined, investment horizon, however, the yield curve is only probabilistically determined and depends on different factors. In the first place, these are the expected changes in the short-term interest rates. The latter are controlled by the leading central banks in the world – The Federal Reserve System of the USA, the European Central Bank, and the Bank of Japan. The aforementioned central banks make decisions with respect to the interest rates based on the expected deviations of the current inflation levels from the implicitly or explicitly defined inflation target. Another

⁴⁴ This formula is valid when there is no coupon payment in the period under consideration.

factor that informs their decisions regarding the short-term interest rates is the extent of deviation of the current GDP level from the potential one or the so-called output gap⁴⁵.

The second factor that determines the yield curve is the level of uncertainty embedded in the expectations of the market interest rates. This uncertainty stems from the fact that the future levels of the short-term interest rates are unknown and from the reaction of the central bank to shocks. The uncertainty leads to an increase of the term risk premium for the different maturity sectors.

Thirdly, the yield curve is also affected by a host of factors related to the long-term interest rates. These are the expectations for: the long-term inflation rate, the productivity of labor in the economy, the potential rate of economic growth, the demographic features of the population and the structural fiscal position of the governments in the USA, EU and Japan (the so-called structural deficit). The changes in the above-listed factors affect the long-term interest rates – usually in the sectors over 5 years.

In the last decade, a couple of persistent trends in the factors determining the yield curve became salient. In the first place, there is a tendency for a global reduction of inflation rates related to the enforcement of rules on monetary policy of central banks, the focus of the central banks, mandate on price stability, and an increase in the monetary policy know-how. With the introduction of stricter discipline and of subordination of the fiscal policy to dynamic rules in most industrialized nations, a reduction of the structural fiscal deficits was accomplished. At the same time, the ubiquitous financial liberalization induced globalization of the financial markets and flows, which, in turn, contributed to the lasting reduction of the long-term interest rates and an increase in the interdependence of the prices of financial securities in the different parts of the world.

The unprecedented decrease in interest rates to record lows over a very short period of time that was undertaken by the two leading central banks spurred a record increase in the value of fixed income securities investments worldwide. Since the beginning of 2001 till April

⁴⁵ Potential GDP (Potential economic activity) is the one at which the economy has full utilization of its production capacity, including labor and capital (author's note).

2004, the return from investment in the Morgan Stanley World Bond Index measured in USD⁴⁶ is 37.8%. This is an unprecedented value compared to the historical return realized from investing in fixed income instruments. It is the result of an extraordinary clustering of events related to the aggressive reaction of the central banks and the congruence in the cycle of the world interest rates observed in that period.

As mentioned above with regard to the factors determining the monetary policy of central banks, the short-term interest rates have procyclical behavior. In times of boom the interest rates rise, and in times of recession they fall. Because of that we cannot expect investors in fixed income securities, especially central banks, to always realize such a high return for such a short time. In case of reversal in the cycle of interest rates in the next years, the return from investment in fixed income bonds is bound to decline. The extent of this decline depends mostly on how fast the interest rates go up and on how prolonged this increase is.

3.3. Yield Curve Theories and Empirical Evidence

Several theories have been created to explain the changes in expected return on bonds. The most popular of these are the pure expectations hypothesis, the liquidity preference theory, and the preferred habitat theory.

Pure Expectations Hypothesis

One of the earliest theories that comes to explain the shape of the yield curve, as well as to predict the future spot rates, is known as the Pure Expectations Hypothesis (PEH)⁴⁷. According to it, the expectations of the market participants are reflected in the current yield curve and can be extracted from it using forward rates. More precisely, a key assertion of this theory is that the forward rate for a given future period, which is embedded in the yield curve today, equals the expected future spot rate for the same period.⁴⁸

$${}_n f_m(t) = E[s_m(t + n)] \quad (5).$$

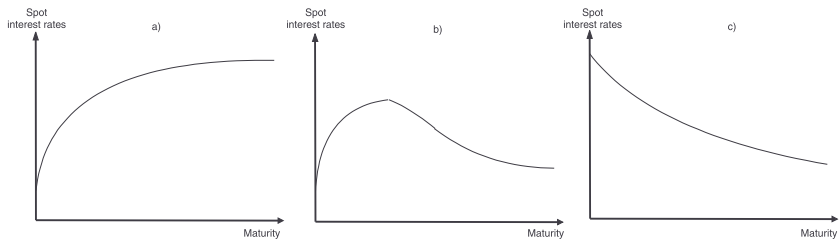
⁴⁶ Morgan Stanley World Bond Index.

⁴⁷ An alternative name in financial literature for that theory is Unbiased Expectations Hypothesis.

⁴⁸ The transformation E designates mathematical expectation.

From formula (5) follows that the expected change in the m -period spot rate (i.e. $E[s_m(t+n)] - s_m(t)$) after an n number of periods is derived as the difference between the forward and the current m -period rate (i.e. $f_m(t) - s_m(t)$). Moreover, by the shape of the yield curve we should be able to determine what the future behavior of spot rates would be. In Fig. 6, the three most frequently observed shapes of the yield curve are shown.

Figure 6 Shapes of the yield curve



Based on formulas (2) and (5) it can be shown that when the yield curve grows with maturity (Fig. 6a), the future spot rates are expected to be higher than the current spot rates. When the yield curve has a shape similar to that in Fig. 6b, the expectations are for an initial rise in the future spot rates to a certain moment and a subsequent fall. When the yield curve has a shape as in figure 6c, according to PEH, the market participants expect future spot rates to fall.

Another key corollary of PEH is that the expected return on all bonds is one and the same regardless of their maturity. Thus, for example, if we make a simplified representation of the market using two bonds – one long-term and another short-term, the latter assertion can be succinctly shown as:

$$E(R_{long-term}) = E(R_{short-term}) \quad (6).$$

In other words, according to this theory, the investors will require one and the same return, no matter the maturity. In this sense, the long-term and short-term bonds are viewed as perfect substitutes. This very conclusion of the theory, however, does not seem plausible since, if true, it would imply that either markets operate under com-

plete certainty or that investors are indifferent to the market risk they take. As both conditions are unrealistic, another hypothesis which does not necessitate these assumptions is later proposed.

The Liquidity Preference Theory

The liquidity Preference Theory (LPT) introduced by Hicks (1939) asserts that the forward rates contain additional information apart from the expectations of the market for the future interest rates. According to this theory, investors are not indifferent to risk but try to avoid it unless compensated for taking it. The theory assumes that for short investment horizons⁴⁹ the long-term bonds are riskier than the short-term bonds since the latter are more sensitive to changes in the interest rates. That is why for the investors to be willing to invest in long-term bonds, they need to receive a positive premium added to the expected return in order to make higher income. Using this theory, we can modify formula (6) in the following way:

$$E(R_{long}) = E(R_{short}) + \text{risk premium } P(N), \quad P(N) > 0 \quad (7).$$

An alternative interpretation of the higher expected return sought after is that investors seek compensation via positive income because of loss of liquidity due to investing in a longer-term bond.

$$f_m(t) = E[s_m(t+n)] + \text{liquidity premium } L(m), \quad L(m) > 0 \quad (8).$$

The reasoning for both formula (7) and (8) is built around the fact that they both depend on the time to maturity of the long-term bond or, respectively, on the number of periods m over which interest is compounded. The longer the bond, the greater the premium since the probability for change in the short-term interest rates is greater. According to LPT, however, the premiums are constant over time. Unfortunately, though this theory does specify the sign of the premiums, it does not say anything as to how determine their size.

A chief source of criticism against this theory is the fact that although the long-term bonds are riskier than the short-term bonds for a short horizon due to the greater capital risk of the former, the case may be just the opposite for long-term horizons. This stems from the

⁴⁹ I.e. holding period of the bond.

fact that the strategy of buying short-term bonds on a rolling basis till the end of the long-term horizon has reinvestment risk which, depending on the length of the horizon may be greater than the capital risk of the strategy of holding the long term bond to maturity.

Preferred Habitat Theory

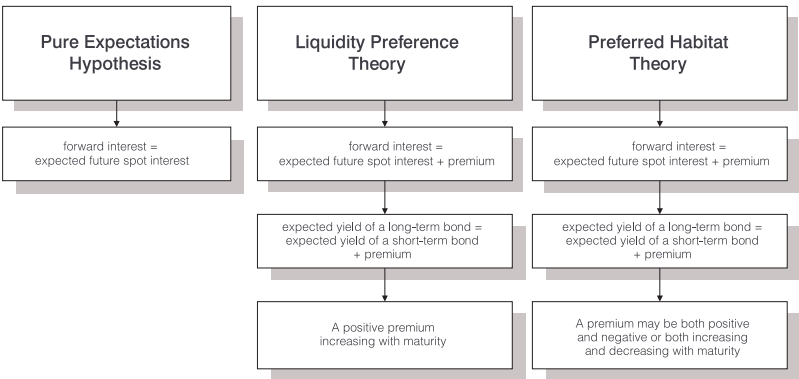
The Preferred Habitat Theory (PHT) was introduced by Modigliani and Sutch (1967). It generalizes the Preferred Liquidity Theory by changing the assumptions for the sign of the premiums as well as the theory's dependence on the time to maturity and number of periods. The PHT allows either positive or negative premiums and their size is determined by the demand and supply of bonds in a given maturity sector. For instance, the institutional investors such as pension funds usually prefer bonds in the long-term sectors whereas banks could prefer the short-term sectors. Moreover, if an institutional investor is to move from one preferred maturity sector to another, it would seek higher return.

Figure 7 schematically summarizes the three theories and their assertions.

As of late, the view that both types of premiums are essentially risk premiums is gaining momentum; hence both the size and the sign of the premiums depend on whether, at a given moment, the investors deem the longer-term bonds riskier than the shorter-term bonds or *vice versa*.

Figure 7

Yield Curve Theories



Empirical Evidence

Classical empirical tests of the theories reviewed above have been conducted by Fama and Bliss (1987)⁵⁰, Campbell and Shiller (1991)⁵¹, and later again Fama (2004)⁵².

In an attempt to verify the theoretical conclusions using monthly data on the spot and forward rates spanning a period of nearly 40 years, Fama and Bliss establish that for short periods (up to 1 year) the forward interest rates do not possess significant prediction power over the realized spot interest rates. With the increase of the length of the period forecast to an interval from 2 to 4 years, the one-year forward interest rate inferred from the four- and five-year spot rates significantly increases the precision of its prediction. The authors explain the behavior observed with the presence of a risk premium which is variable over time but averages to a constant. The process of returning to this “normal” level, however, is slow, and this is namely from where the precision of the predictions over longer forecast period comes.

However, the recent empirical research conducted by Fama (2004), which wields monthly data over a considerably longer period – observations span the period 1953–2002, rejects the former findings of Fama and Bliss. The period can be factored into two subperiods. During the first period (1953–1985), there is a marked trend for rise of the spot rates, which peak in late 1981. During the second period (1985–2002), the reverse trend of fall in spot rates is observed. Within each subperiod, the quality of predictions using PEH for long-term horizons is comparable and indeed good, but when the whole period is taken under consideration, the quality of predictions considerably deteriorates. Fama (2004) explains this fact alleging that although interest rates do have the property to tend to some mean level, this very level is not stationary but changes over

⁵⁰ *Fama, E. and R. Bliss* (1987) *The Information in Long-Maturity Bond Rates*. American Economic Review, Vol. 77, Issue 4, September 1987, pp. 680–692.

⁵¹ *Campbel, J. and R Shiller* (1991) *Yield Spreads and Interest Rates Movements: A Bird's Eyes View*. The Review of Economic Studies, Vol. 58, Issue 3, Special Issue, The Econometrics of Financial Markets (May, 1991).

⁵² *Fama, E.* (2004) *The Behavior of Interest Rates*, unpublished manuscript, Graduate School of Business, University of Chicago.

time. Because of that the spot rates locally tend to the current long-term interest rate level. The lack of stationarity is due to the influence of unforeseeable shocks on the current mean level caused by structural changes in the economy or monetary policy which have taken place in the meantime. These shocks have been previously discussed in the text above. Due to the unpredictable nature of these shocks, the market participants cannot reflect them neither in the expected changes of the spot rates, nor in the requisite risk premium.

Campbell and Shiller (1991) in research similar to that by Fama and Bliss use monthly data for the period 1952–1987 and prove that the spread between long-term and short-term interest rates does not possess prediction power for horizons shorter than 3–4 years. Hence the empirical evidence rejects the Pure Expectations Hypothesis for short-term horizons. For long-term horizons, similarly to the findings by Fama and Bliss, the empirical evidence does not reject the Pure Expectations hypothesis. In order to explain the inability of the Pure Expectations Hypothesis to account for the realized interest rates, the authors assume that the size of the term risk premium between the long- and short-term interest rates varies over time depending on the changes in short-term interest rates.

Another classical empirical study analyzing the factors deriving the yield curve dynamic was conducted by Knez, Litterman and Scheinkmann (1994)⁵³. Using principal component analysis, they show that over 90% of the variations in the yield curve with two independent and directly observable factors. The first one, which explains 80% of the yield curve dynamic, is its level and the second one is its slope. This fact naturally turns the yield curve level and slope into candidates for variables in the estimation of the expected yield curve changes. Thus, information conditional on the current market information on these two variables should be sought.

Other variables oftentimes used for conditional estimation of the expected change in spot rates are the difference between forward and spot rates or the combination of forward rates.

⁵³ Knez, P., R. Litterman and J. Scheikman (1994) *Explorations into Factor Explaining Money Market Returns*. The Journal of Finance, XLIX, No 5.

For short-term horizons ranging from a few months to a year, however, most of these models cannot manage a statistically significant improvement of their prediction power compared to the simplest econometric model – random walk. According to that model, the yield curve has an expected change of 0, i.e. it cannot be forecast, and the best forecast of the future spot rates are the current ones. This makes the random walk model often used for estimating the expected return on bonds.

4. Fundamentals of the Contemporary Portfolio Management Theory

Harry Markovitz (1952)⁵⁴, (1959) is the founder of modern portfolio theory. In his article, and later – book, on the topic, he for the first time formulates the optimization problem for portfolio management. According to him, we have a choice between two alternative approaches when constructing an investment portfolio of securities. The first alternative is to maximize the expected return given a fixed level of risk (variation); the second alternative is to minimize the expected risk given a level of expected return.

Later, portfolio theory undergoes further development. A host of authors – Lee (1977), Litzenberger and Kraus (1976) – introduced second and third moment of the return, and others, including Fama (1969), Elton and Gruber (1974) strived to use more realistic distributions of the return on assets for optimization process purposes. The model by Markovitz is based on a single period optimization and is based on the assumption that economic agents make decisions in each investment interval regardless of the actual return in the preceding interval. In practice, however, the actual returns and variations in the different time intervals are interconnected. Due to that fact, Markovitz's method undergoes development in order to encompass more than one temporal interval, and thus the so-called dynamic optimization models were introduced. They are based on multiperiod

⁵⁴ Markovitz, H. (1952) *Portfolio Selection*. Journal of Finance, Volume 7, Issue 1, March 1952, pp. 77–91.

optimization. Fama (1970)⁵⁵ and Mossin (1969)⁵⁶ show that under certain restrictive assumptions the multiperiod optimization reduces to a single period one, and in this sense Markovitz's model is a particular case of the multiperiod optimization method.

On the whole, despite the various modifications and development, the optimization based on risk and expected return forms the core of nowadays portfolio theory as well.

⁵⁵ *Fama, E.* (1970) *Multiperiod Consumption-investment Decisions*. *American Economic Review* 60, 163–174.

⁵⁶ *Mossin, J.* (1969) *Optimal Multiperiod Portfolio Policies*. *Journal of Business* 41, pp. 215–229.

Chapter Three

Process Organization

As the prior Chapter shows, foreign reserve management by a modern central bank is a routine investment process. Yet however routine it may be, central banks need appropriate legislative and regulatory frameworks and suitable internal organizations due to the nature and function of reserves (see Chapter One) and the attendant risks (see Chapter Two) in the constantly changing conditions of international financial markets.

Legislation should define exchange and monetary rules clearly and unambiguously: they are the limits the public sets the central bank in its monetary policy. At the same time legislation must be sufficiently flexible to afford the central bank leeway to react to international market trends.

The complexity and public significance of the process also call for legislation to define the central bank's accountability mechanism and its public communications as regards results, thus ensuring that risk management as regards foreign reserves follows acceptable policy and stays within publicly set bounds.

Managing foreign reserves became routine during the 1990s subsequent to an analysis of the experience of the international financial community, as well as experience within individual countries and their central banks after the Second World War. Cukierman (1992)⁵⁷ shows unequivocally that inadequate legislative definition of monetary policy and the rules for managing foreign reserves, as well as of accountability, limits the scope for clear cut public assessment of central bank performance. This creates an environment of uncertainty, increasing room for political conjecture at central bank expense, and further limiting the bank's ability to use reserves in accordance with their intrinsic nature and function.

⁵⁷ *Cukierman, A. Central Bank Strategy, Credibility and Independence: Theory and Evidence.* The MIT Press, Cambridge, MA, 1992.

Rising to the above challenges, modern central banks took the initiative for a gradual unification of investment decision standards and of accountability as regards foreign reserves as part of international financial accountability standards. These steps boosted the volume, regularity, and quality of information to the public and to unbiased analysts.

Comparability between central banks in foreign reserve management at the close of the 1990s became an important basis for assessing their investment process skills. The BNB is part of this initiative. The Bank's foreign reserves accountability is entirely in line with adopted international standards. In evidence of this, statistical compendia by all reputable international financial institutions such as the IMF, the WB, and the ECB regularly publish BNB information.

The establishment of the ECB with its legal standing as an institution independent of national governments and the EC, had a positive bearing on all accession states. Legal regulation of the performance of accession state central banks became uniform, including foreign reserve management. All these changes set new and higher requirements before national central banks which are members of the ESCB, requiring regular, clear, unambiguous, and highly detailed accountability before the broad public.

The above challenges apart, central banks constantly face the eternal dilemmas of whether to put up with lower yield on their assets, or to give head to their appetite for greater risk by broadening its definitions (naturally, within legal bounds). Made at the highest management level within the central bank, this choice is a strategic one (Fig. 9). This decision making level also defines the margin of tolerance from this strategic portfolio choice as part of tactical positioning. Strategic and tactical positioning are elective factors, affecting anticipated yield directly (see Chapter Two, Item 3).

In recent years central banks improved and largely standardised decision making approaches on strategic and tactical positioning in foreign reserve management. The objective was to limit the influence of subjective assessments by managers at various levels of reserve management in favor of modern probabilistic analysis methods, and of harnessing bank and academic institution analytical potential as

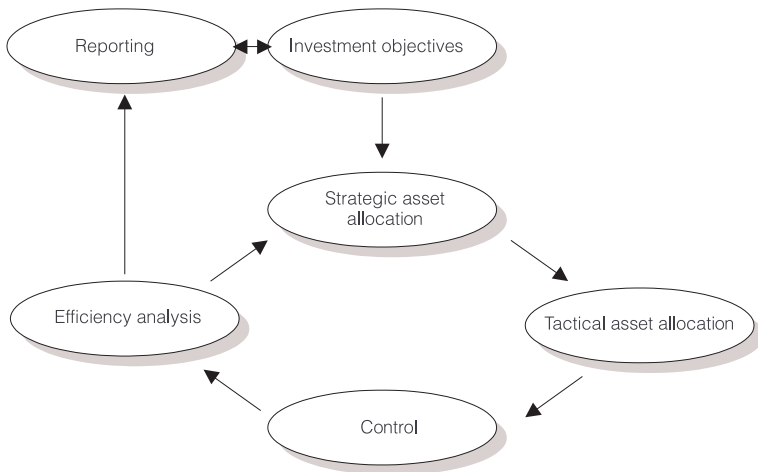
committed in formulating and analyzing monetary policy. Assessing diverse factors and risks within a set investment horizon became the job of teams whose terms of reference differ from those of portfolio managers.

1. Stages

Within any legislative framework foreign reserve management comprises several stages (Fig. 8).

Figure 8

The Investment Process



The first basic stage is for central bank management to set the investment objectives of foreign reserve management. At this stage sees public policy as encoded in legislation translated into the operational jargon of employees dealing with foreign reserves. The strategic structuring of reserves includes delimiting maximum risk appetite (risk tolerance) by central bank management. This sets bounds to foreign exchange structure and financial instruments and portfolios, sets benchmarks, and outlines possible other investment limits forming the overall framework of tactical reserves management⁵⁸. Tactical reserve positioning is a stage which encompasses the actual invest-

⁵⁸ Operational management and tactical asset structuring as used below may be taken as synonymous with tactical management.

ing of foreign exchange by individual portfolio managers. The control stage involves comparing the results of tactical allocation with strategic allocation. This generates information for the next stage. The reporting stage includes preparing reliable data on the outcomes of this particular central bank business for bank managers and the public. Analyses of reserve management effectiveness, assessments of the degree to which investment objectives have been fulfilled, and feedback are obligatory here.

2. Central Bank Investment Objectives

After the 1990s changes to central bank status and performance, maintaining and managing foreign reserves became one of the most important and significant central bank functions. Though the political and economic environment continue to affect this function, national peculiarities bow to the consensus on the three basic investment objectives in foreign reserve management⁵⁹:

- security: guaranteeing adequate reserves to fulfil their defined functions and retain their value;
- liquidity: ensuring a set proportion of reserves is available for the operational objectives of monetary policy;
- yield: generating a return on investment within the medium and long term horizons while consistently maintaining security and liquidity.

While for most European central banks the security objective has the leading priority, all three objectives are very closely linked as shown in the theoretical overview of the investment process in Chapter Two.

This current understanding stems from the new imperative to provide financial stability which independent central banks and the ECB discharge within the European economy. The rise of security as a priority since the 1990s entailed major consequences for the process of managing reserves. Trends there are the increase of those resources (analytical tools, information and financial technology, and people) which analyze, plan, control, and provide accountability, at

⁵⁹ IMF (2003) *Guidelines for Foreign Exchange Reserve Management*, <http://www.imf.org/external/np/mae/ferm/eng/index.htm>.

the expense of those which conduct international financial market operations.

Liquidity follows security closely due to the nature and significance of foreign reserves as reviewed in Chapter One.

Changes in the priority of investment objectives also stemmed from the effort of independent central banks to gain deeper awareness and more knowledge of the objective nature of financial risk in managing foreign reserves. The new priorities meet growing public requirements for transparency and accountability in the performance of today's independent central banks amid growing haziness on the international financial markets.

3. Strategic Asset Allocation

As with all investors, central banks have differing subjective views of risk, with some being less, and others more, tolerant to it. Hence balancing between subjective decisions and the application of theoretical probabilistic models (Chapter Two) are serious issues in organising the investment process.

Theoretically, structuring the foreign reserve portfolio of a central bank comprises solving an optimisation riddle whose solution is the optimum structure of a portfolio from the standpoint of maximum yield⁶⁰ within a set risk tolerance. Certain assumptions need to be made to make the riddle solvable, some of which are inevitably subjective and thus within the ambit of senior management.

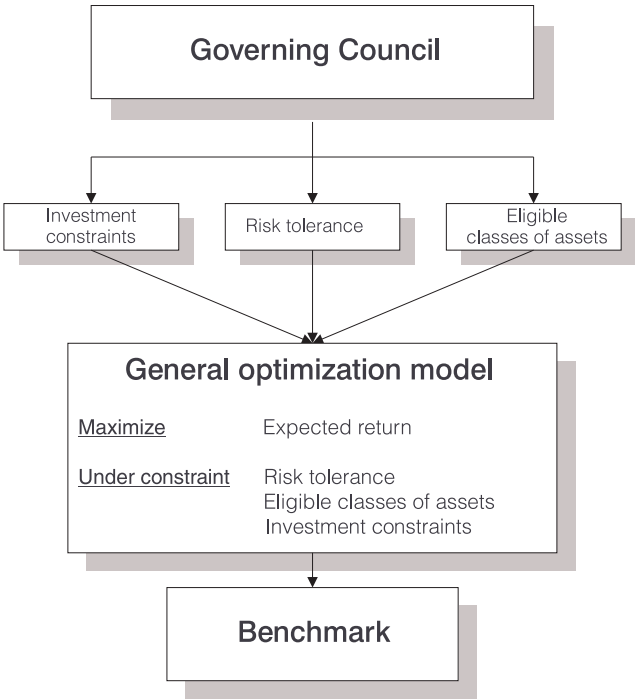
Strategic asset allocation (SAA) reflects the central bank's long term policy on investment. It is formulated at the highest management level, most often at board or governor level, or by a deputy governor in charge of foreign reserves.

SAA traditionally defines three basic input components in the optimization task (Fig. 9). First of these is central bank investment risk tolerance: the degree to which potential loss is acceptable. Second is the classes of asset into which the central bank would invest within its statutory leeway. Third come subsidiary investment constraints, if

⁶⁰ This entails a mathematical expression (i.e., a mean) of the given value.

any, governing the aforementioned classes of asset; these are usually limits to minimum and maximum portfolio shares for a given asset class or minimum and maximum exposures to a given risk⁶¹. Once set, all three components tend to stick for lengthy periods; given no sharp anomalies on international markets and no significant innovation, they may be reviewed annually or less often.

Figure 9 Basic Elements of Strategic Asset Allocation



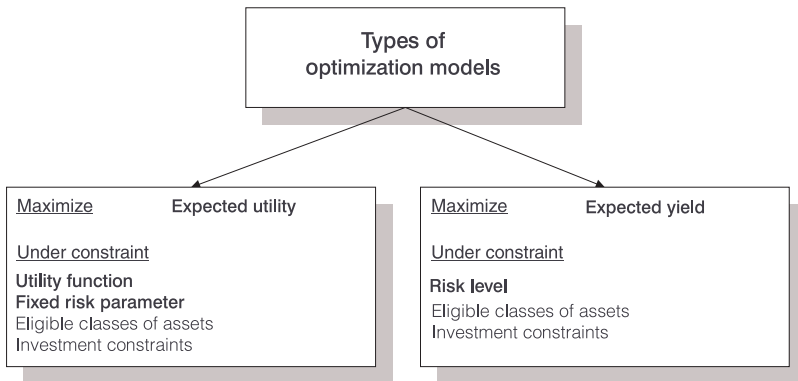
Once these three components are specified by senior management, the optimization problem may be tackled. Its solution is a portfolio featuring the asset allocation which may bring the investor the maximum reward within the investment horizon, in line with the set risk tolerance and investment limitations. Such a portfolio is called a

⁶¹ Exposure to a given risk factor means the sensitivity of the portfolio's market value to changes in that risk factor. Thus a bond portfolio's exposure to yield curve level risk is measured by modified duration.

benchmark or a model portfolio. Its parameters are reassessed at set times, e.g. quarterly or annually.

There are two basic approaches to solving the optimisation task when designing a benchmark. They differ in their definitions of reward (yield) and their risk tolerance, and may lead to different solutions: different optimum benchmark structures (Fig. 10).

Figure 10 Portfolio Optimisation Approaches



The Expected Utility Model

Under this approach investor behaviour is modelled by a utility function dependent on asset yield. Reward is measured in abstract utility units derived from the utility function and asset yield. Risk tolerance is set by the analytical utility function, its level controlled by the risk aversion parameter, a factor of the utility function.

Since future asset yield is a random value, the usefulness of keeping a given combination of assets is also a random value. Hence the overall optimization task under this approach comes down to maximizing anticipated usefulness under a utility function relevant to a given investor and a risk tolerance ratio set by him. For more on the expected utility model, see Harvey (1995)⁶² and Kroll, Levy, Markowitz (1984)⁶³.

⁶² Campbell, I., R. Harvey (1995) *Optimal Portfolio Control*, unpublished manuscript <http://www.duke.edu/~charvey/Courses/ba350/control/opc.htm>.

⁶³ Kroll, Y., H. Levy and H. Markowitz (1984) *Mean-Variance Versus. Direct Utility Maximization*. Journal of Finance 39 (1), 47–61.

The benefits of the approach lie in its deep link with the fundamentals of classical economics, and in the single solution it offers for single period optimization, involving optimum weights for individual assets over a broad range of utility functions. Another very important benefit is that the approach is sufficiently flexible for use in significantly more complex multi period optimizations.

The expected utility model also has serious drawbacks. One is that all too often the expected utility function has no apparent analytical expression, rendering optimization difficult and calling for simulation techniques. A second and more serious drawback is that setting specific utility functions to describe individual investor risk appetites is not easy, while defining individual investor risk tolerance ratios is even harder. The difficulties this approach entails limit its practical use greatly compared with the second optimisation approach.

The Expected Return Model

Under the expected return model the overall optimization task is solved directly using yield and risk. As distinct from the expected utility model, this approach defines investor reward as anticipated yield, with risk tolerance assigned a risk measure. Solving the overall optimization task comes down to maximising anticipated portfolio yield while keeping risk within limits corresponding to central bank risk tolerance. For more on the expected yield model, see Haugen (2001)⁶⁴ and Kroll, Levy, Markowitz (1984)⁶⁵.

Diverse forms of the approach may be applied depending on risk measure. Widely applied risk measures include fluctuation, value at risk (VaR), and conditional value at risk (CVaR) (see below). Risk measures are functions of the probabilistic distribution of asset yield and show the probability of variation in actual versus anticipated portfolio yield.

⁶⁴ Haugen, Robert A. (2001) *Modern Investment Theory*. Pearson Higher Education, 5th edition, 2001.

⁶⁵ Kroll, Y., H. Levy and H. Markowitz (1984) *Mean-Variance Versus. Direct Utility Maximization*. Journal of Finance 39 (1), 47–61.

Box 2

Main Statistical Parameters of the Model

Fluctuation, the standard deviation of portfolio yield, characterises the degree of yield variance from expectations (i. e., mean yield value). Thus when portfolio yield has a normal probabilistic distribution, it could be claimed that for some two thirds of the time yield would fall between plus and minus one standard deviation (fluctuation) of expectations.

Risk value (Value-at-Risk or VaR_α) is an α -per cent quintile of probabilistic yield distribution. Its interpretation is that in $(1 - \alpha)$ per cent of time actual portfolio yield would be greater than or equal to risk value. Usually α is set at lower values such as 5 per cent or 1 per cent, this ensuring that VaR_α is the most the portfolio would lose over $(1 - \alpha)$ per cent of time.

Conditional Value-at-Risk or CVaR_α is the expected yield variation from VaR_α assuming that actual yield is less than VaR_α . The parameter shows how much greater than VaR_α the average loss may be, provided it actually exceeds VaR_α .

Where the yields of different portfolio assets are evenly and normally distributed, the above three risk measures give equivalent optimum asset structures. Where portfolio yield is probabilistically distributed and differs from normal, optimal portfolio structure would depend on which risk measure expresses investor risk tolerance. Where yield distribution is strongly asymmetrical, VaR_α or CVaR_α are recommended, since they only quantify unfavourable investor outcomes (losses), while fluctuation treats loss and profit symmetrically.

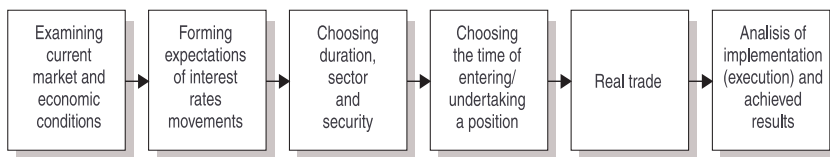
Compared with the expected utility model, the expected return model offers a more logical, tighter approach, allowing risk tolerance to be expressed by explicitly setting maximum portfolio risk. This advantage has made the model preferred by central banks. The basic noted drawback is that optimum solutions are likely to be localized: that a true global solution for the optimization task is elusive. Moreover, the approach is hard put to solve multi-period optimization problems.

A drawback shared by both models is their undue sensitivity to input data such as expected yield and asset covariance structure. This means that minor changes in input data lead to significant changes in optimum weights, rendering optimization exceptionally dependent upon the quality of assessment of these asset parameters.

4. Tactical Asset Allocation

The tactical asset allocation is the actual portfolio creation and maintenance under the adopted investment limits and the benchmark. It targets shorter term objectives reflecting mostly short term changes in market expectations of returns on asset classes or using temporary market anomalies. Its conduct assumes that the risk tolerance of a central bank remains constant. As a process, tactical asset allocation comprises the steps of taking and implementing investment decisions shown in Fig. 11.

Figure 11 Steps in Operational Portfolio Management



Tactical management comes down to passive or active strategies by central bank portfolio managers. Passive strategies aim at attaining the portfolio structure, return, and risk of the selected benchmark. An active strategy sees the taking of relatively long or short positions as regards certain benchmark risk parameters with a view to attaining higher relative return. The benchmark is taken as a risk neutral position, or as defining absolute risk and hence expected return from portfolio management. In order to attain higher income, and in compliance with his or her risk appetite and investment limits, a portfolio manager may assume additional risk (relative risk) over benchmark settings. This risk may be with interest, credit, coupon income, or sectoral distribution related, or of another nature.

Investment decisions are taken under one of two approaches: top-down or bottom-up. The former sees portfolio managers conduct analyses and forming expectations as to the future of the economy, then determining that yield curve sector or that asset class into which he or she will invest (government bonds or spread products⁶⁶), and

⁶⁶ In principle the debt of non-government issuers is called spread debt since it is often quoted with a spread against a given benchmark yield curve (e.g., for government bonds or swaps).

finally defining the actual paper he would buy. The bottom-up approach sees portfolio managers focus primarily on analyzing and forming expectations as to future bond yield, with less significance assigned to economic conditions.

Choosing one of the two approaches depends upon the manager's strategy. An active position on duration primarily calls for the top-down approach, while a passive strategy may rest on a bottom-up approach. The two approaches may be applied simultaneously, for instance in combining an active strategy as regards duration and relative trading (buying bonds seen as underpriced and selling ones seen as overpriced).

Tactical positioning of bond portfolios combines investment decisions with horizons of between one day⁶⁷ and one or more weeks⁶⁸. Adopting short or long term positions depends on expectations as to interest rate levels and temporary market anomalies. As new information on the economy or the market becomes known, portfolio structure scenarios are reviewed. Possible repositioning follows, given acceptable transaction costs, with a view to utilizing any new investment opportunities.

In taking long or short positions *vis-à-vis* benchmark⁶⁹, tactical management assigns greater importance to interest rate changes than to reinvestment risk, since the latter has bigger effect under long term (over one year). Future interest rate movements depend on a multitude of factors as shown in Chapter Two: economic conditions, new debt offers, technical factors, market fluctuations and the readiness of market participants to assume risk. Future interest rate levels may be glimpsed from, *inter alia*, forward interest rates (as seen in Chapter Two); information on positions and cashflows between market participants; market expectations; relationships between forex, equity, and bond markets; and macroeconomic models of interest rates.

⁶⁷ From a portfolio manager's standpoint, these are long term investment decisions.

⁶⁸ From a portfolio manager's standpoint, these are short term investment decisions.

⁶⁹ A long position against benchmark duration means that portfolio duration is longer than benchmark; short portfolio positions are shorter than benchmark.

The next step is determining the desired relative portfolio position regarding the yield curve. Long relative (higher weight) positions tend to be taken, in sectors seen as underpriced, and appreciation is awaited with frequent technical or collective analyses. Short or lower weight positions are taken in sectors seen as overpriced, their depreciation awaited in line with other sectors.

The next step in the investment process concerns the choice of specific paper. Buying or selling a given paper also involves assessing it as either rich with a potential fall, or cheap with a potential rise. Whether the paper is rich or cheap depends upon:

- its spread *vis-à-vis* the swap curve⁷⁰: a measure of the cost of financing a position in this paper⁷¹;
- the difference between its theoretical price (derived by discounting future flows by using a yield curve based on zero coupon bonds) and current market price⁷²;
- using z-scores (degree of standard deviation) or other similar models based on the assumption that interest levels tend to return to a mean level⁷³.

When choosing paper, its liquidity risk is taken into account, since lower liquidity leads to higher transaction costs, expressed as a larger bid offer spread.

Achieving a better diversification effect⁷⁴ often calls for making use of investment opportunities in the spread product trade. In principle, debt by non-sovereign issuers is called spread debt since it is quoted with a spread *vis-à-vis* one benchmark yield curve or another (of government bonds or swaps⁷⁵). More and more this debt tends to be

⁷⁰ See *Зви Боди, Алекс Кейн, Алън Маркъс. Инвестиции, Натурела, 2000, p. 4.*

⁷¹ The greater the positive spread *versus* swap (in spread products) or the smaller the negative spread (in government bonds), the cheaper a given paper is considered to be, and *vice versa*.

⁷² The greater this difference, the cheaper the paper is deemed to be, and *vice versa*.

⁷³ The greater the standard deviation (a generally accepted value is over 1.5 standard deviations), the cheaper a paper is deemed, and *vice versa*.

⁷⁴ This is expressed as attaining a simultaneous increase in income and decrease in risk, or attaining higher income while retaining risk levels, as well as cutting overall portfolio risk while retaining expected return.

⁷⁵ Swaps involve swapping fixed interest for floating interest debt; see *Зви Боди, Алекс Кейн, Алън Маркъс, Инвестиции, Натурела, 2000, p. 617.*

measured as a movement against the swap curve, and hence expected movements in this curve are seen as highly influential on the prices of these bonds. In turn, spread movements within a given class of paper may depend upon changes in anticipated sector creditworthiness, increased market sensitivity to worse general solvency in the economy as a whole, or changes in the methods of calculating some bond parameters within a sector (say a new benchmark curve or changing supply and demand conditions).

Once a given security is seen to fall within the set investment limits (as regards, *inter alia*, interest, credit risk, structure, and type), transaction timing is defined. Positioning the portfolio too early *vis-a-vis* anticipated market changes may hit overall relative portfolio yield. Attaining higher or lower relative overall yield is linked mainly with the vigor and duration of one of these: price changes, coupon income, and reinvestment income. Thus where interest rate cuts are anticipated, taking a relatively long position earlier may deny us higher reinvestment income, cutting overall relative income. A positive yield curve slope (where long term interest is higher than short term) is taken to show expectations of future interest rate hikes. Where interest rates are rising, shorter durations are better maintained. Taking up short durations, however, means occupying the short end of the yield curve, meaning lower incomes until maturity. If the interest rate hike is delayed or fails to take place, the end result of such a position would be lower relative income.

Comparing actual income and assumed risk with those of the related benchmark is an indicator of successful portfolio management. Where the portfolio structure fails to bring the expected results or new investment opportunities arise, the above process is repeated.

PART TWO

**EXPERIENCE OF THE BNB
IN MANAGING FOREIGN
EXCHANGE RESERVES
UNDER CURRENCY
BOARD ARRANGEMENT**

Chapter Four

The Nature and Significance of Foreign Reserves under a Currency Board Arrangement

1. The Definition of International Foreign Exchange Reserves in the Law on the BNB of 1997

The Law on the BNB of 1997 (the LBNB) is very precise and concrete in defining foreign reserves and in licensing operations with them. The law also provisions the general framework of transparency and accountability in which the BNB operates, also introducing control mechanisms. The instrument limits the scope of subjective management decisions, introducing a rule-based approach which manages reserves with a high degree of automatism. The quality of the legal definition makes reserve management predictable to market participants and observers, rendering central bank policy less likely to be volatile over a long term. These features of the definition of foreign reserves are an important factor supporting confidence in the currency board and the Bank.

Article 28, paragraph 3 of the law states that the gross international reserves of the Bulgarian National Bank shall be equal to the market value of the following assets of the Bank:

1. banknotes and coins held in freely convertible foreign currency;
2. funds in freely convertible foreign currency held by the Bulgarian National Bank on accounts with foreign central banks or with other foreign financial institutions, whereof obligations are assigned one of the two highest ratings by two internationally recognized credit rating agencies;
3. the Special Drawing Rights (SDRs) of the International Monetary Fund held by the Bulgarian National Bank;

4. debt instruments held by the Bulgarian National Bank and issued by foreign countries, central banks, other foreign financial institutions or international financial organizations, whereof obligations are assigned one of the two highest ratings by two internationally recognized credit rating agencies, and which are payable in freely convertible foreign currency with the exception of debt instruments given or received as collateral;
5. the balance on accounts receivable and accounts payable on forward or repurchase agreements of the Bulgarian National Bank, concluded with or guaranteed by foreign central banks, public international financial organizations or other foreign financial institutions, whose obligations are assigned one of the two highest ratings by two internationally recognized credit agencies, as well as futures and options of the Bulgarian National Bank, binding foreign persons and payable in freely convertible foreign currency;
6. the monetary gold.

The fact that the above definition has remained unchanged for almost eight years shows the precision and lack of ambiguity in the original 1997 draft. Amendments to the Law on the BNB in 2005 made but two changes reflecting growing confidence in the currency board, changes in global financial markets, and the Bank's growing institutional capacity and knowledge.

The first amendment (to Article 28, paragraph 3, item 6) introduced mark-to-market valuation to accounting and reporting monetary gold at the close of each day, instead of the former value cap of 500 Deutsche marks per ounce. Since at the time of the amendment the market price of gold was significantly higher than the previous nominal price, this constituted a positive valuation reserve forming an additional stability buffer for the currency board. The second amendment in the definition of foreign reserves (Article 28, paragraph 3, item 5) inserted greater precision into the BNB's entitlement to use futures contracts in response to financial market impetus and to apply its accumulated knowledge.

The definition of foreign reserves in the 1997 LBNB and subsequent amendments coincides with the theoretical meaning of the

term. First, the Law very clearly defined and classified the rights and duties of the BNB Issue Department as part of Bulgaria's monetary authorities, authorizing to it the management of foreign reserves. The BNB received the legal mandate for managing cash equivalents, deposits, and other foreign currency assets on the balance sheet. Effectively all of Bulgaria's foreign assets on the date of the Law's promulgation appeared on the BNB balance sheet. Second, the definition of foreign reserves called on the BNB to be proactive in pursuing very high asset liquidity and marketability. This followed from the Law's calling for cash, deposit accounts, and debt instruments to be:

- denominated in foreign currency;
- issued by central banks, governments and public or private foreign financial institutions with very high credit ratings.

Article 31, paragraph 3 of the Law introduced an additional requirement for "high marketability" linked to the restriction on currency mismatch between assets and liabilities for currencies other than the reserve currency (the euro) and the Bulgarian lev. The Law stipulated that currency mismatch in assets shall not exceed 2 per cent with respect to liabilities in the same foreign currency. The 2005 amendment redrafted the Article more tightly, the Issue Department being obliged to maintain the whole asset/liability mismatch in currencies other than the euro, lev, Special Drawing Rights, and monetary gold, at less than 2 per cent. The law was tighter with respect to the euro because that currency is the reserve of the Bulgarian currency board. It also reflected the growing use of the euro in asset management and international trade⁷⁶ and underlined the strategic Bulgarian goal of euro area accession. BNB adherence to the rule constrains currency risk in foreign reserve management.

The Article 31 requirement for high marketability and matching in the currency structure of balance sheet assets and liabilities states that foreign reserves may be invested only into the most developed European and United States' markets. Consequently, the currencies of denomination for foreign assets are the euro and the US dollar. Empirical evidence on the marketability of BNB foreign reserve assets

⁷⁶ See also Table 1 in Part 1.

follows below in the discussion on the specific features of the Bulgarian currency board and the description of the investment process at the Bank.

2. Peculiarities of the Bulgarian Currency Board as a Monetary and Foreign Exchange Regime

As is widely known, Bulgarian monetary and foreign exchange policy changed acutely in June 1997 following an economic and financial crisis. In place of discretionary central banking and a floating exchange rate, the BNB was legally obliged to adopt a currency board. The legal framework of the currency board was introduced by the Law on the BNB promulgated in the *Darjaven Vestnik*, issue 46 of 10 June 1997 and came into force on the same day.

A government policy of full liberalisation of the movement of capital accompanied the change in monetary regime. The major move in this direction was the adoption of the Currency Law in September 1999.

The Bulgarian currency board shared some typical features with traditional currency boards. The local currency was legally pegged to a stable foreign currency (the anchor currency); in this case the Deutsche mark and later the euro, at the fixed exchange rate of one lev (BGL) to one mark⁷⁷. The Law on the BNB foresaw an automatic transition to the euro when it became legal tender in 1999, based on the rate between it and the Deutsche mark at that instant⁷⁸. The BNB was legally bound to exchange local for foreign currency at the fixed exchange rate and *vice versa* on demand⁷⁹. The Law⁸⁰ precisely defined what constituted BNB foreign reserves and monetary liabilities, setting a minimum coverage rate of 100 per cent of BNB monetary liabilities with foreign reserves⁸¹.

⁷⁷ Prior to lev denomination in 1999, the fixed exchange rate was BGL 1000 to DEM 1; see the Law on Redenomination of the Bulgarian Lev, *Darjaven Vestnik*, issue 20 of 5 March 1999, amended and re-enacted in issues 35 and 60 of 1999.

⁷⁸ LBNB (the Law on the BNB) Article 29 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

⁷⁹ LBNB Article 30 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

⁸⁰ LBNB Article 28, paragraph 3 and Article 28, paragraph 2 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

⁸¹ LBNB Article 28, paragraph 1 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

The Bulgarian currency board also had certain features which were not typical of this type of monetary regime as adopted elsewhere earlier. First, BNB monetary liabilities included (alongside banknotes in circulation) other balances, including banking reserve accounts and fiscal deposits and accounts except IMF liabilities⁸².

Second, the strategic goal of political and economic convergence with the EU drove the choice of the Deutsche mark (and later the euro) as the reserve currency, unlike many other currency boards where this choice reflected economic agents' preferences in unofficial currency substitution or else the dominant currency of foreign trade. Indeed, research in 1997 showed that arguments for adopting the US dollar as the anchor currency in Bulgaria were dominant⁸³.

The 1997 Law on the BNB did not provide any legal mechanism for changing the currency board. Indeed, on the eve of board launch, a dominant view among its most prominent supporters was that inserting it into the Constitution⁸⁴ would be the ultimate safeguard of confidence in the currency system; the National Assembly deemed it sufficient to introduce the currency board through the Law on the BNB.

The main function of the currency board was to be performed by the Issue Department of the BNB⁸⁵. The Department was to be headed by a Deputy Governor elected by parliament for a six-year term at the nomination of the BNB Governor. The Deputy Governor was also to be a member of the BNB Governing Council⁸⁶. According to the Law on the BNB, the main duty of the Issue Department was to maintain full coverage of BNB monetary liabilities with foreign reserves and to manage these reserves effectively.

⁸² LBNB Article 28, paragraph 2, item 2 (2005).

⁸³ See *Манчев, Михайлов*. Паричен съвет, перспективи за растеж на икономиката и избор на разменно съотношение на лева, *Информационен бюлетин на БНБ*, 4/1997.

⁸⁴ See *Schuler, K.*, "The Importance of Being Orthodox," The Hong Kong Baptist University's International Workshop on Currency Boards, 9 October 1999.

⁸⁵ LBNB Article 19, paragraph 1 and Article 20, paragraph 1 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

⁸⁶ LBNB Article 10, Article 11, paragraph 1 and Article 12, paragraphs 2, 4 and 5 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

As shown in Table 4 with reference to Article 20, paragraph 1 of the Law on the BNB the Issue Department also performs some other functions typical of central banks. It launches and withdraws cash into/from circulation, maintains its quality, scraps it when unfit, monitors cash counterfeiting, and manages cash logistics. The Issue Department acts as government agent by servicing and managing the state's current and investment accounts. All this denies the widely held academic and public belief that there is parity between a traditional currency board and its Bulgarian instance.

The Issue Department reports its balance sheet weekly and monthly⁸⁷. The balance sheet includes foreign reserves on the assets side and all monetary obligations on the liabilities side. Despite being published separately, the Department's balance is part of the BNB balance sheet. The Department has no independent legal personality, and its part of the BNB underpins the integrity of the central bank.

Table 4 Issue Department Balance Sheet
(Structured to the 2006 Format)

Issue Department	
Assets	Liabilities
Cash and claims on banks in foreign currency	Banknotes and coins in circulation
Monetary gold	Banking reserves
Tradable foreign securities	Government and public body deposits
	Sundry clients' accounts
	Banking Department deposit

The Law on the BNB requirements on currency board function and management involved:

- holding reserve currency cash sufficient to satisfy all monetary obligations in cash on demand;

⁸⁷ LBNB Article 49, paragraphs 1 and 2 (1997, amended and re-enacted 1998, 1999, 2001, 2002 and 2005).

- guaranteeing free and unlimited exchange on demand between leva and the reserve currency at the fixed exchange rate and *vice versa* on an account-account basis;
- guaranteeing and servicing all government obligations in the reserve and other currencies on demand at the fixed exchange rate (for the reserve currency) or at market exchange rates *vis-a-vis* the reserve currency (Article 31, paragraph 3);
- banning any BNB lending to the government or any government-related body, except when borrowing from the IMF under Article 45;
- limiting any BNB lending to commercial banks domiciled in Bulgaria (Article 33, paragraph 1), except under the strictly defined circumstances (Article 20, paragraph 2, Article 33, paragraph 2 and Article 34) of a systemic liquidity crisis when the Banking Department may lend against collateral. The Banking Department, however, could lend to banks only up to the amount of deposits placed with the Issue Department under Ordinance No 6 on lending to commercial banks against security.
- banning BNB participation in open market operations (Article 56).

The market value excess of Issue Department assets against liabilities is equal to the balance of the Banking Department deposit. In practice, this is the net asset value of the currency board. This value comprises the excess cover of monetary obligations with foreign assets. It is this excess which may be employed for the above-mentioned secured lending to commercial banks in a crisis. The Banking Department deposit is the link between the balance sheets of those two relatively independent BNB departments; consolidated, they represent the BNB balance sheet.

The main duty of the Bulgarian currency board is to cover 100 per cent or more of the monetary base and government and public body reserve accounts with foreign reserves. The Issue Department has no rights and duties involving similar BNB liabilities. Under the Law on the BNB, the Issue Department and the Governing Council of the BNB share the conduct of monetary policy under a currency board.

At the same time, the Law on the BNB left government the option of quasi-monetary operations between its accounts and commercial banks through the liabilities of the Issue Department⁸⁸. The above specifics of the Bulgarian currency board render the BNB Governing Council and government the twin pillars of monetary stability and foreign reserve management. This invalidates the view of some academics and the public that foreign reserve management is the sole responsibility of the Issue Department Deputy Governor. Those specifics provide a certain balance between the entitlements of relevant bodies (the BNB and the Ministry of Finance) in managing foreign reserves.

3. Objectives and Major Functions of Foreign Reserves in the 1997 Law on the Bulgarian National Bank

The objects of holding and issuing foreign reserves are immanent in the above definition and in the specific legal features of the Bulgarian currency board. They comply with the theoretical objectives of all monetary and foreign exchange regimes reviewed in Part I. First, the obligation of the BNB to exchange leva for the reserve currency automatically on demand at the fixed exchange rate calls for foreign reserves to sustain that fixed exchange rate. Second, the structure of BNB monetary liabilities offers the opportunity of simultaneous attainment of the other object of foreign reserves: that of a buffer to finance foreign payment imbalances. The currency board ensures that all economic agents who own notes and coins issued by the central bank, or have cash at the BNB, may convert them into the reserve currency at the fixed exchange rate to service foreign liabilities. The third object of foreign reserves is to preserve the nation's wealth through investing fiscal reserves (the government deposit).

The central and most important function of Bulgaria's foreign reserves under the currency board has been to perpetuate the legal lev to Deutsche mark/euro peg since entry into force of the 1997 Law on

⁸⁸ For details, see *Манчев, Цв. Особенности на паричния съвет в България, Информационен бюлетин на БНБ*, 8/1997.

the BNB. Another very important function of foreign reserves is to curb vulnerability from external shocks and serve as a crisis shield. This is implicit in the rule that BNB monetary liabilities should never exceed the lev equivalent of foreign reserves⁸⁹.

The Law on the BNB assigns significantly lower priorities to the other theoretical functions of foreign reserves under a currency board. Since the BNB may not wage monetary policy and therefore cannot generate income from monetary instruments (as typical of other monetary policy regimes), its foreign reserves are its prime source of income. However, the Law on the BNB does not put priority on this Bank function: a significant circumstance in the Governing Council's setting of investment objectives and risk tolerance, as shall be seen in Chapter 7.

In a currency board, the extent, dynamics, and adequacy of foreign reserves are endogenous macroeconomic variables. They depend only on the desire of resident and non-resident agents to buy or sell national currency at the fixed exchange rate. As is clear from the distinctions between a currency board and other monetary regimes, the BNB cannot take any discretionary decisions on the extent of foreign reserves. Thus, their function as a liquidity buffer and bolster of stability and confidence in local financial markets depends on overall national economic policy.

At the same time, foreign reserve levels are determined to an extent by political will through government deposits at the BNB: predominantly prerogatives of the Finance Minister and the cabinet. Considering the importance of foreign reserve adequacy under a currency board, government decisions that could affect the foreign reserve are coordinated with the BNB under Article 3 of the Law on the BNB to safeguard the foreign exchange regime's normal function.

⁸⁹ LBNB Article 28, paragraph 1 (1997, amended and re-enacted 1998, 1999, 2001, 2002, and 2005).

Chapter Five

BNB Policy in Managing Monetary Gold

In late 2007 BNB monetary gold comprised some 39.8 tonnes/1296 million troy ounces (ozt) or 6 per cent of overall foreign reserves. This amount has been accumulated since BNB establishment in 1879. The Bank's attitude to gold has reflected the prevailing world trends and national policy on participation in international financial markets and world trade. During the Gold Standard era until the end of the Second World War, gold had a monetary function and served as a holding and backing reserve for money issue⁹⁰. This was the BNB's most active period of monetary gold operations, measured by transaction numbers and effect on the bank's balance sheet.

In the Socialist era, the BNB held a satte monopoly on handling the gold reserve, though it rarely did operations on international markets. A portion of the national wealth was kept in gold, and the Bank occasionally used this to regulate the currency or else financial relations within the Council for Mutual Economic Assistance (Comecon). Data on gold operations and national stocks were not publicly available during the period. At the close of 1990 the BNB gold reserve⁹¹ comprised 34.1 tonnes (1097ozt), 92.7 per cent of which was monetary gold.

When the National Assembly adopted the 1991 Law on the BNB, it recognized gold as part of foreign reserves and the Bank resumed regular reporting of gold holdings in Annual Reports and Information Bulletins⁹². Gold owned by the BNB was not, however, in the form

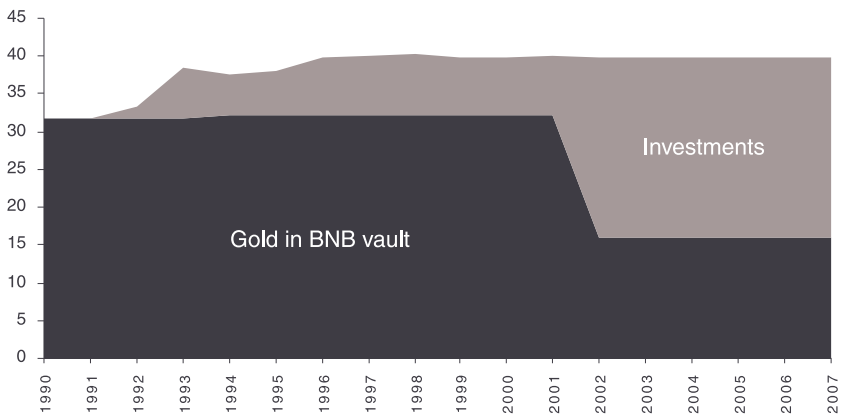
⁹⁰ For further details, see inter alia, 120 Years Bulgarian National Bank, 1879-1999, the BNB, 1999.

⁹¹ The BNB Annual Report, 1990.

⁹² See the BNB Information Bulletin issued biweekly between May 1991 and 1994. Later data appeared in monthly Bulletins, Semiannual and Annual Reports. This information is currently updated monthly on the BNB website.

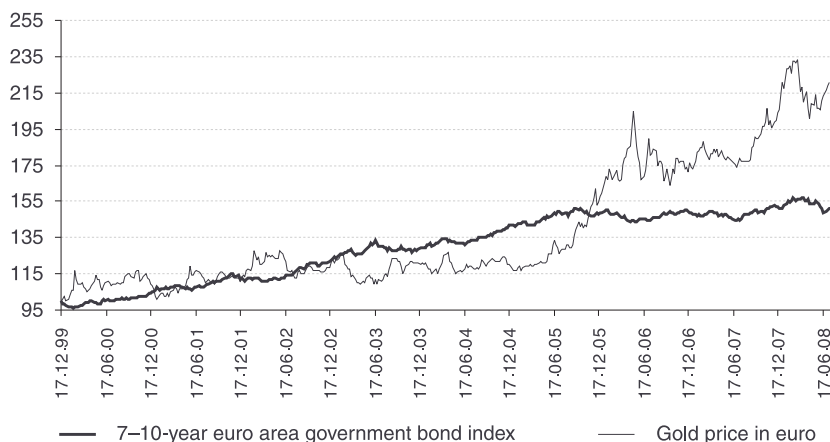
classified as bullion under the London Good Delivery Standard⁹³ in accordance with the IMF definition for international market transactions and statistical purposes. In the early Nineties, licensed world refiners smelted the BNB's gold into good delivery standard bullion, rendering it internationally equipollent. This explains the fluctuations in the physical quantities of monetary gold in Annual Reports after 1991.

Figure 12 Dynamics of Monetary Gold on the BNB Balance Sheet
(tonnes)



Since monetary gold is an international asset, as discussed in the Part I, the BNB applies the principles of security and liquidity to its management. Security has priority; it is the preservation of foreign reserves' long term purchasing power. Unlike other instruments, monetary gold can become a preferred foreign trade asset in crises which disrupt international financial markets: massive terror attacks, natural disasters, epidemics, inflationary shocks, and rises in oil or strategic world commodity prices. This renders gold a necessary balancing asset in BNB foreign reserves: events like those listed above cause the market price of gold to rise, offsetting possible price falls in other assets.

⁹³ The London Gold Delivery Standard comprises London Bullion Market Association criteria and a list of approved refiners.

Figure 13 Price of Gold and Euro area Government Bonds

In a currency board, the liquidity of monetary gold enables the BNB to sell it at any instant, guaranteeing continuing exchange of leva against euro at the peg rate.

Though the BNB was not among the European signatories of the Washington and Frankfurt Gold Agreements mentioned in Part I, the strategic aspects of gold reserve management cannot be analysed without reference to them. As the central bank of a country with a relatively small share of world trade and international financial markets, and the possessor of an insignificant share of global gold, the BNB does not manage its gold actively. This unwritten rule has obtained since the beginning of Bulgaria's market economy transition. Fluctuations in the market value of the BNB's monetary gold have been insignificant and due mainly to investment into international markets. Fluctuations in the market price of monetary gold on the BNB balance sheet and financial statements after the January 2005 amendment to the Law on the BNB have only reflected international market movements.

The sole important change to BNB monetary gold policy during transition was in 2001 when the Governing Council introduced a third fundamental principle of gold management: that of seeking return.

The Council set a limit to ensure that a policy change would not boost credit risk substantially. Eligible instruments were also constrained by the Law. The balance of risk and return versus discretion was attained by splitting monetary gold into two approximately equal parts. Exposing one to credit risk counterbalanced the lack of credit risk (yet zero return) from the other, within limits set by the Law. Under this arrangement long term returns from gold investment approximately covered the cost of maintaining vault gold in a merchantable state. Annual reviews of the effectiveness of this change show its sustainability over a long run, taking into account international gold market trends and their impact on the net market value of Issue Department assets.

Since this change the BNB has owned three types of monetary gold instrument. The first, monetary gold (as a physical asset in vaults), is not a source of credit risk since it does not constitute a claim on the BNB and cannot be blocked or withdrawn in a hypothetical debt moratorium. At present this amounts to some 513,000ozt or 42 per cent of the Bank's total monetary gold.

The second instrument, deposits denominated in physical gold, is deposited (as if it were cash) with highly-rated private commercial banks abroad for fixed terms, yielding interest on maturity dates. The deposits are usually negotiated on the London interbank bullion market, with delivery and settlement in Bank of England vaults. At the end of 2005, 609,000ozt were thus invested: 51 per cent of the Bank's monetary gold. During substantial market fluctuations such as that since October 2007, operations with gold deposits are temporarily suspended and the metal is stored at the Bank of England due to tighter credit risk constraints.

The third instrument, into which some 7 per cent of BNB gold was invested between 2003 and 2007, are debt securities denominated in gold. These are issued by international financial institutions and some highly-rated private foreign banks. Essentially, they entail an unconditional obligation to pay the principal in physical gold at maturity⁹⁴, plus fixed coupons payable semiannually. For the gold-denominated bonds into which the BNB has invested, the coupon has been pay-

⁹⁴ According to *London Good Delivery Standard*.

able in US dollars. Periodic coupon payments yield a modest interest income (usually under 1 per cent) against the assumption of a modest credit risk exposure. Interest on gold deposits is traditionally very low and reflects expectations of market price evolution and gold futures prices. The BNB assumes a credit risk exposure to the securities' issuers who are typically supranational financial institutions with the highest investment grade rating.

Table 5 **Realized Return from Monetary Gold Investments**

(%)

Year	Return from gold portfolio management	Return from gold valuation in euro	Total return
2002	0.13	6.70	6.83
2003	0.56	-1.39	-0.83
2004	0.33	-2.94	-2.61
2005	0.02	34.93	34.95
2006	0.08	11.41	11.49
2007	0.09	18.50	18.59

Few banks operate on international bullion markets and related instruments: an historical phenomenon due to the specifics of this market and the specialised intermediaries required. Most operations in Europe are in London, with a few in Zurich. London trading is dominated by eleven LBMA⁹⁵ market makers, five of whom quote daily. The principal Swiss participants are the two leading banks there plus smaller regional and private banks. Specific to the Zurich market is the fact that operations mostly service individuals who have deposited gold into their banks. Besides operations on international financial markets, the BNB trades gold with private banks whose credit ratings match minima in the Law on the BNB and who satisfy the Bank's internal rules on gold investing.

⁹⁵ The London Bullion Market Association was established in 1987 to represent participating banks' interests on the London gold market (Author's note).

Chapter Six

Institutional Arrangements of the Investment Process at the BNB

1. Organisational Structure

The introduction of a currency board by the 1997 Law on the Bulgarian National Bank (the LBNB) entailed an abrupt change in Bank structure. The establishment of the Issue Department with the legally-granted authority of taking “the actions necessary to manage international currency reserves in an efficient manner”⁹⁶ created conditions for the emergence and gradual institutionalisation of a contemporary standard investment process at the Bank. Another important factor promoting this process after the 1997 LBNB adoption was the trend for foreign reserves to grow as a result of national macroeconomic and financial stability. After 1998 reserves passed the levels necessary to maintain “full currency coverage of the total amount of BNB liabilities” operationally on a daily basis.

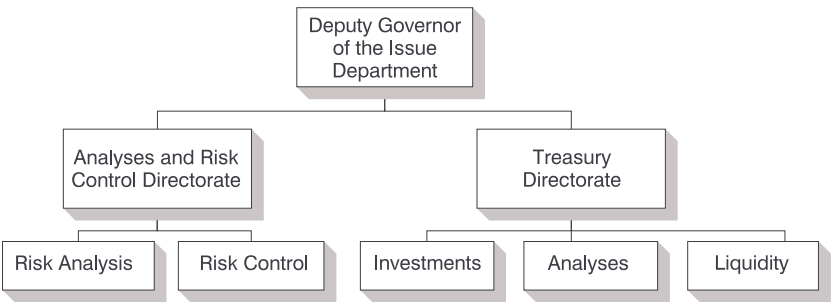
Since the above core function of the Issue Department is legally delegated to the Deputy Governor heading that Department,⁹⁷ the Deputy Governor plays a key role not only in maintaining the pegged exchange rate regime, but also in structuring the management of the foreign reserve. It depends entirely on the Deputy Governor whether the Governing Council opinion is sought and to what extent the Council determines the investment objectives and “the maximum risk appetite” (Bank risk tolerance). It depends on the Deputy Governor whether the public policy aspects of the LBNB concerning foreign reserve management would be regarded and assessed by the public as Bank policy or else as a matter of his or her personal choice and responsibility.

⁹⁶ LBNB Article 19.

⁹⁷ LBNB Article 18, paragraph 1.

The durability of the institutional framework described above and adopted in 1997 allowed the BNB to gradually introduce recommended international practice in foreign reserve management as presented in Part I, while accumulating practical experience. In 1999 two units were established at the Bank with the respective purpose to: 1. measure, analyse, and control risks related to the investment process; 2. operationally manage the foreign currency reserves portfolio (Figure 14). A number of changes were introduced in the range of their activities and responsibilities over the review period⁹⁸.

Figure 14 Organisations Structure



Currently the Risk Analysis and Control Directorate comprises the Risk Analysis and Risk Control Divisions. The Directorate's major tasks are to formulate investment objectives and strategic asset allocation proposals, to control compliance with investment limits, to analyse the effectiveness of currency reserve management, and to report. The Treasury Directorate has three Divisions: Investment, Analysis, and Liquidity. From the investment process point of view, the basic task of this Directorate is implementing the tactical asset allocation, presented in Chapter 9. The Directorate analyses and forecasts the interest rate dynamics in different maturity sectors in support of

⁹⁸ Thus, until 2003 the Risk Control and Analysis Division was part of the Risk Analysis and Control Directorate, though the Treasury Directorate did not handle cash and the Division did not relate to the investment process under consideration.

portfolios' tactical positioning against the benchmark over the investment horizon. It also forecasts the dynamics of liability components of the Issue Department balance sheet in support of investment objective setting and strategic asset allocation.

The Risk Analysis Division develops methodologies for determining and measuring BNB foreign reserve investment management objectives. The division also creates methodologies on which SAA is based. The main methodologies are: 1. risk measurement⁹⁹; 2. quantifying currency reserve investment limits, risk budgets, and optimum benchmark; 3. assessing expected risk factor values and covariance structure. Benchmark and investment limits are selected on these grounds. Once allocated to investment portfolios, they set the scope of tactical asset management. An important methodology being developed by Division risk managers will enable reserve management effectiveness to be measured through multiple indicators and return and market risk to be attributed by source¹⁰⁰.

The Risk Control Division exercises operational control over the investment process. The Division also develops the basic principles and rules for selecting, reviewing, and updating the list of foreign financial institutions – BNB counterparties and methodologies for setting counterparty, asset class and other credit limits. New financial instruments and asset classes in which to invest are analysed and proposed independently or jointly with the Risk Analysis Division. Another core function of the Division is to distribute to the society, the Governing Council of the BNB and the Deputy Governor of the Issue Department regular analyses and periodic reporting on credit exposure, the use of counterparty credit limits, and counterparty trading volumes by types of instruments etc. The Division also reports any limit violations to the Bank's management. Another important Division function is to develop and establish procedures and rules for limiting operational risk. The Division also double checks Treasury Directorate Liquidity Division SWIFT messages for all currency operations related to the BNB portfolio management and to the larger payment operations of the BNB clients.

⁹⁹ Credit ratings assigned by leading credit agencies are used as a basic measure of credit risk.

¹⁰⁰ Yield and risk attribution involves using models to quantify the effects of risk factors.

The Investment Division invests the foreign reserve assets by implementing the tactical asset allocation. The Division comprises teams of portfolio managers, each managing individual portfolios. The core task of each team is to obtain higher return than the respective benchmark within the allocated tactical risk budget and other relative to the benchmark limits. An associated goal is to achieve higher return per unit of assumed relative risk. Depending on their expectations, the portfolio managers prepare short-term market factor forecasts and assume or refrain from active exposures against the benchmark in pursuit of these objectives.

Core functions of **the Analyses Division** are to monitor and analyse financial markets and market expectations and forecast changes in market variables such as interest rates, exchange rates, the gold price and other. The forecasts are produced through econometric and other models and are presented to a broad range of users: the Issue Department Deputy Governor, the Investment Committee, and portfolio managers in the form of investment recommendations. These recommendations underpin adequate behavioural strategies against the benchmark for some days to some weeks ahead. The Governing Council and the Issue Department Deputy Governor decisions on investment objectives, risk tolerance, strategic asset allocation, and the BNB position rest on longer-range forecasts (quarters, years). The Investment Committee discusses these decisions before approval.

The Analyses Division specialists have developed methodology for forecasting the liquidity necessary to support the banking sector in Bulgaria, in case of a systemic liquidity crisis emerges. This variable is used in determining the foreign reserve investment limits. The average value and expected currency composition of the Issue Department liabilities for a set period (a quarter, an year) for which the benchmark is valid is also forecast and used as input information in the optimisation model for benchmark determination¹⁰¹.

The Analyses Division also prepares daily and weekly bulletins that review and analyze the key events influencing changes in the market value of Issue Department assets. The bulletins are publicly

¹⁰¹ See Chapter 9.

available and are posted on the BNB website. In addition, the Division takes part in preparing publications and the BNB evaluations on international financial markets and world economic development. The Head of the Analyses Division is BNB representative on the ESCB Market Monitoring Working Group.

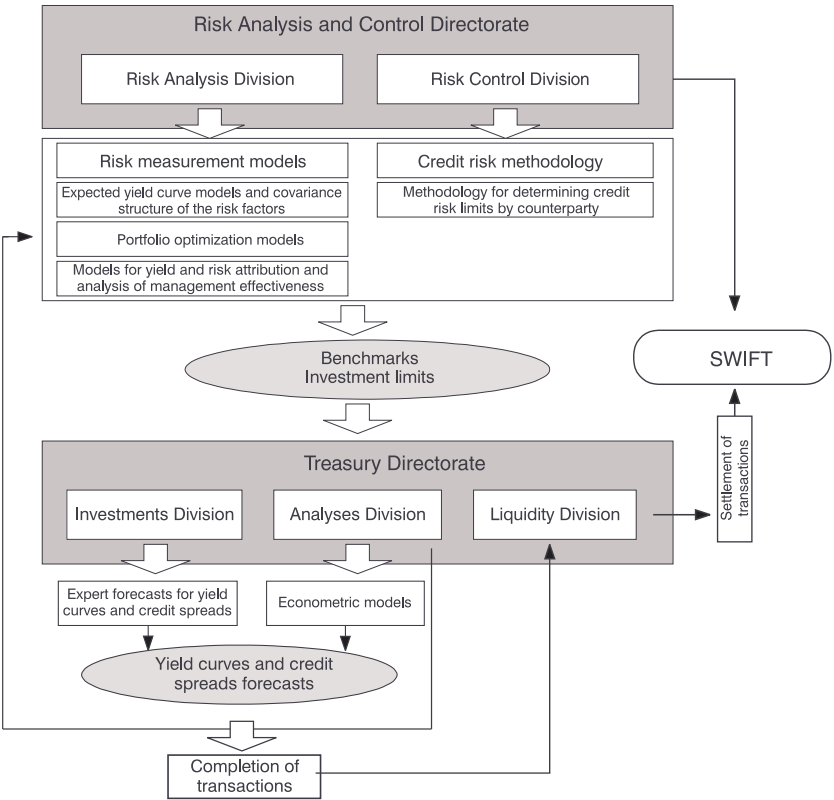
The Liquidity Division is responsible for the settlement of all foreign reserve transactions and for the necessary document finalization. An important task of the Division is to forecast BNB liquidity by currency types for daily payments execution purposes. When all details needed to settle a transaction are filled-in, the Division performs preliminary (so called: preliminary control) documentary checks for potential errors. This errors are removed as detected. SWIFT messages are transmitted after double (final) checking by the Risk Control Division.

The operations of risk control and analysis of international currency reserves management effectiveness are carried out by the Risk Analysis and Control Directorate. Its authority is to keep the fulfillment of every action, described in the “Manual with Currency Reserves Management Business Procedures”, and the compliance with all investment restrictions under surveillance. The Directorate has developed and is applying a Methodology for Measuring International Currency Reserve Management Effectiveness, approved by the Deputy Governor. The internal rules for foreign reserve management and the Manual allow the Director to report results from the risk control activity directly to the BNB Governing Council. This independence of the Risk Analysis and Control Directorate and its head stem from a 2000 Governing Council resolution according to which the Director is appointed directly by the Governing Council.

Foreign reserve management (Figure 15) is unthinkable without constant cooperation and exchange of information between the two Directorates. This process is regulated in detail in the BPM (Business Procedures Manual) adopted by the Governing Council in 2004. The document was developed with De Nederlandsche Bank experts under a bilateral programme and embodies modern practice in foreign reserve risk management. The BPM describes the authorities and responsibilities of each executive in the two Directorates as regards

every reserve management action. It also defines very precisely the employee’s authorities and responsibilities limits when interacting with other BNB Departments regarding the management of foreign exchange reserves.

Figure 15 Communications on Foreign Reserve Management



The Manual is an important document for the BNB institutional functions. It sets out core objectives, functions, tasks, organisational structure, and job and conduct rules for BNB Issue Department executives responsible for foreign reserve management. The reserve management actions and procedures for Treasury and Risk Analysis and Control Directorate staff are set out in written or verbal instructions by the Issue Department Deputy Governor. Reserve manage-

ment procedures for staff from other Bank departments fall outside the scope of the BPM. By using the Manual the two Directorates' staff, the auditors, and the Bank management handle and constrain operational risk more effectively.

The BPM is the basis for formulating foreign reserve management efficiency and effectiveness and consequently for unambiguous assessments by internal and/or external auditors. It also delineates individual Divisions' and executives' duties with respect to foreign reserve management. The document assists the adaptation of new Treasury and Risk Analysis and Control Directorate staff and their compliance with rules and procedures when operating with the foreign reserve.

The BPM is prepared and kept up-to-date by Treasury and Risk Analysis and Control Directorate staff. The Issue Department Deputy Governor endorses proposed changes in the manual. The changes to actions and procedures which require BNB Governing Council approval are clearly defined. The Manual is kept in paper and electronic formats. One employee from each Directorate compiles proposals for accepting new procedures or updating existing ones and redrafts the Manual on an ongoing basis. Employees investigate the need for amendments, coordinate them between the Divisions, describe procedures, and update the BPM after approval by the Issue Department Deputy Governor.

Each procedure (process, operation, and action) is assigned a name and brief description (textual, graphic, and tabular) as to purpose and sequence. Detailed work instructions have been developed to comprehensively describe the process implementation techniques and basic actions of foreign reserve management. These instructions are systematised in a uniform document obviating contradiction or repetition and ensuring compatibility. The result is that operational risk is kept to a minimum.

2. Decision Making and Compliance Control

After 1997 the process of making important foreign reserve management decisions gradually assumed the sequence shown in Figure

16. This forms part of the 2005 BNB Gross International Reserve Management Internal Rules.

The BNB investment policy is formulated at the highest management level: the Governing Council. The Council approves the optimisation model and sets maximum risk tolerance annually. The Investment objectives stem to a considerable extent from the Law on the BNB. The Law, however, can neither specify income from foreign reserve management, nor set a value on market risk. It is the Governing Council which sets the expected return in line with the reserve size and structure, the Issue Department balance sheet leverage, and market expectations for a year ahead.

The personal discretion which the 1997 LBNB grants the Issue Department Deputy Governor with regard to the foreign reserve reflects public sentiment after the political, economic, and financial crisis of late 1996 and early 1997. At the same time, the Law strikes a balance between that Deputy Governor's powers and duties. Thus, the Bank Chief Auditor (the Comptroller) appraises the utilisation of means and makes recommendations to the Governing Council where necessary. The Issue Department Deputy Governor is nominated by the BNB Governor for selection by the National Assembly. Both executives have identical terms in office which may generally be assumed to start and end at the same time, unlike those of other Governing Council members.

The Issue Department Deputy Governor sets the investment objectives and limits in consultation with other BNB units. While he or she may determine the Department's management style, it has to rest on approved rules or practices which cover every contingency.

The Investment Committee also plays an important role in BNB foreign reserve management. Created as an advisory body in 1997 under BNB Governor Ordinance 200-001344/7.10.1997, it is chaired by the Issue Department Deputy Governor. Initially the Committee comprised six representatives from the Risk Analysis and Control and Treasury Directorates, plus experts from the Deputy Governor's office. In early 2004 the Governing Council approved a proposal from the Issue Department Deputy Governor for an increase in Committee membership which gave senior managers from outside the Issue De-

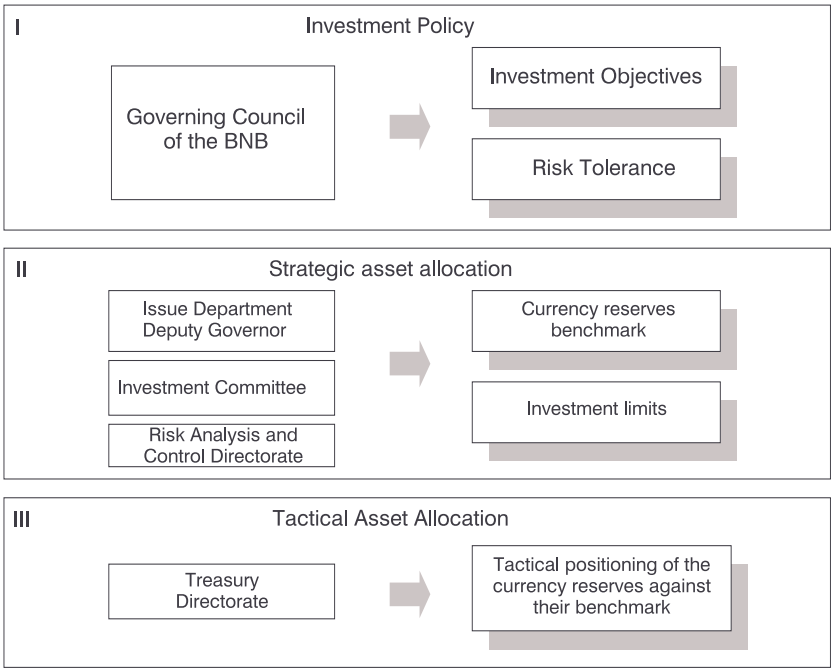
partment the right to vote. These executives are nominated by the Governor and the other Deputy Governors and provide a balance *vis-a-vis* Issue Department representatives. The Issue Department Deputy Governor continues to chair the Committee but has no vote. This reorganisation utilised BNB analytical and expert capacity better in preparing decisions on foreign reserve management. The Governing Council now receives a greater volume of more timely and more detailed information on the investment process and enjoys greater involvement in fixing investment objectives and setting the Bank's risk tolerance.

The Investment Committee has an advisory role in result assessments, the definition of strategies for international currency asset management, and risk factors related to Bank asset and liability management. The Committee's composition and changes in it are endorsed by the Governor upon proposal by the Issue Department Deputy Governor. The Committee comprises representatives of the Governor's office and of the Banking and Banking Supervision Departments, the Treasury Director, the Risk Analysis and Control Director, the Economic Research and Forecasting Director, the Heads of the Treasury Directorate Analysis and Investment Divisions, and the Heads of the Risk Analysis and Control Directorate Control and Analysis Divisions. The Chair may invite other Bank executives to sit on the Committee with no voting rights.

The Committee deliberates and adopts: A. strategic asset allocation from the Risk Analysis and Control Directorate; B. financial market reviews and expectations from the Treasury Directorate Analysis Division; C. quarterly and yearly foreign reserve management reports from the Risk Analysis and Control Directorate (on effectiveness) and the Treasury Directorate (on management reviews); D. counterparty reviews from the Risk Analysis and Control Directorate.

The Committee's Terms of Reference define its scope and organisation and its members' powers and duties, resolving a priori a number of procedural issues and improving its effectiveness. The Heads of the Internal Audit and Accounting Directorates are invited on the Committee as observers.

Figure 16 **Levels of Investment Decisions**



Investing foreign reserves is a complex process which, due to its significance, requires definite distribution of responsibilities. At the BNB investment decisions are taken at three levels (Figure 16). They are not independent but subordinated hierarchically. The Governing Council takes strategic decisions charting the investment policy pursued by the Deputy Governor and Investment Committee members. This is taken into consideration when making decisions at the next level down. The framework presented here is part of an internal document and also of international currency reserves management rules adopted by the Governing Council in 2005. This distribution of responsibilities and the interaction of the Issue Department Deputy Governor and other operating departments are shown on the flow chart in Figure 16.

Strategic asset allocation (SAA) takes place at the second management level. SAA turns the investment objectives and market risk limits set by the Governing Council into practical rules for optimal portfolio management and aggregate risk limits. The optimal portfolio, or benchmark in professional jargon, is really a choice of weights of various permitted asset classes which form a structure that ought to generate maximum return. The risk tolerance set by the Governing Council is key input information in SAA. This is nothing more or less than a core investment limit and is the most influential consideration in determining the selection of optimal asset classes. As reviewed in Part I, the choice of a benchmark portfolio in practice determines 90 per cent of risk and return.

The second task of SAA is to define the investment objectives in detail. This turns the overall investment limit set by the Governing Council into specific investment limits at the asset class and portfolio levels.

At the technical level, benchmark selection proposals are prepared quarterly by the Risk Analysis and Control Directorate. They are presented before the Investment Committee which reports its opinion to the Deputy Governor alongside a motivated benchmark selection proposal. The Deputy Governor expresses an opinion on the Committee proposals and tables them before the BNB Governing Council.

It is the Treasury Directorate which implements the Deputy Governor's decision on benchmark structure while adhering to set risk limits. This is the third stage of the reserve management decision making: tactical asset allocation (TAA). It is at this stage that reserves are invested against the benchmark. Because the benchmark is selected over a comparatively long period¹⁰², however, it may no longer be optimal, having deviated with market movements. TAA allows portfolio managers to interpret fresh information in adopting relative positions *vis-a-vis* the benchmark, thus generating higher return than it over three-month investment horizons, while staying within set risk limits. The decisions at this level can be individual, by one or a team of portfolio managers.

¹⁰² At the BNB SAA is performed quarterly.

The Treasury Director and the Head of the Investment Division control TAA, consulting where necessary the Risk Analysis and Control Director and the Risk Analysis Division Head. TAA is covered thoroughly in Chapter 9.

The LBNB assigns the BNB's Internal Auditor independent control over the currency reserve management. The Internal Auditor reports to the BNB Governing Council. His or her powers and independence are guaranteed additionally through election by the BNB Governing Council upon approval by the Chair of the Republic of Bulgaria National Audit Office.

Chapter Seven

Choice of Investment Objectives and Investment Constraints

1. Investment Objectives

As explained in Part I, central banks usually have three foreign reserve management objectives: liquidity, security, and return. Concrete prioritisation depends on specifics of national legislation, national currency and monetary regimes, the extent of foreign reserves, and central bank traditions and policies. The specifics of the Bulgarian currency and monetary regime, elaborated in Chapter 4, as well as the statutory frame of BNB objectives, allow easy prioritisation of foreign reserve management objectives. The connection between these three objectives and the Law on the BNB is shown in Table 6:

Table 6 Link between Investment Objectives and the Law on the BNB

Investment Goals	The Law on the BNB
Liquidity	Article 30: a requirement for unconditional exchange upon request of euro for leva at the pegged rate (at tills for economic agents or electronically for commercial banks).
Security	Article 28, Paragraph 3 and Articles 32 and 37: limits on maximum credit risk attending asset classes into which foreign reserves may be invested, and restrictions on operations with them (credit ratings of institutions with which assets are deposited, and operations the Bank is licenced to perform).
Return	No specific requirements.

Thus, the 1997 Law on the BNB unquestionably assigns priority to foreign reserve liquidity. The stipulation that leva and euro be freely exchangeable at the peg rate on request is explicit, regardless of how the foreign reserve may be managed. It is precisely this stipulation – fundamental to a currency board regime – that is one of the two paramount duties assigned the BNB by the Law. Attainment of this goal underwrites trust in the peg rate and the chosen monetary regime.

The second important goal of the BNB when managing the foreign reserves is security. As noted in Chapter Four, in Article 28, paragraph 3 of the Law on the BNB, explicitly are listed constraints regarding the asset classes and issuers with which the foreign reserves are to be invested. They show that the legislative body definitively and particularly requires that the BNB invest in financial assets with very low credit risk and engage in operations with no higher than moderate market risk. For ensuring the level of security in the management process, the legislative body has passed additional limitations. In Article 20, paragraphs 1 and 2 it is explicitly stated that only after the liquidity of the foreign reserves has been attained, i.e. the amount of reserves necessary for the normal at least 100% coverage of the monetary liabilities of the BNB at the fixed exchange rate, part of the reserves (up to the amount of the deposit of the Banking Department in the Issue Department) can be used to avert a liquidity banking crisis.¹⁰³

Last on the priority list according to the Law on the BNB is the goal of return on the foreign reserves. The legislative body is least specific on that goal. On one hand the Law does not point to a reference index (benchmark) that should serve as a guideline what return from the management of the foreign reserves is to be expected in principle. On the other hand, unlike the constraints for taking up credit risk, the Law does not specify the maximal acceptable market risk at which the foreign reserves could be exposed. The latter delegates upon the management of the Bank the opportunity to determine the

¹⁰³ The Law on the BNB also places the requirement that, in such a case, the use of foreign reserves be only against highly liquid collateral assets deposited by the commercial banks, and the collateral assets must comply with the same quality requirements that the Law imposes on the foreign assets held by the BNB itself.

investment policy of the Bank as a function of its risk tolerance¹⁰⁴. At the same time, the freedom given by the Law in this respect calls for the Bank to develop and announce its policy for achieving this goal in an unequivocal manner in order to avoid misunderstanding on the part of society and the government, which eventually would cause unsolicited pressure upon the institution.

A basic principle upon which the investment of the foreign reserves is based is the subordination of the goal of attaining return to the first two objectives, i.e. liquidity and security. In other words, the attainment of higher return is pursued only within the framework of internally imposed restrictions for maximal credit and market risk, which provide for the accomplishment of the first two objectives, and in compliance with all legal requirements. Because of this, it is appropriate to consider the third goal as fine tuning of the investment policy of the Bank for achieving maximal efficiency within the framework of the given constraints.

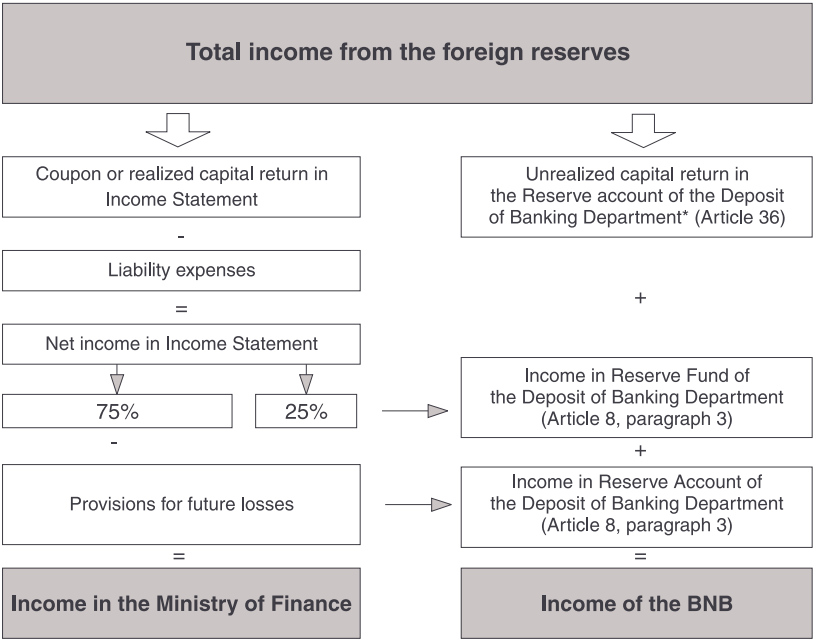
In finance, maximal efficiency is usually understood as reaching maximal return subject to a constraint for the maximal allowed level of risk. The two main types of optimization models solving this problem were described in Chapter Three, and the concrete realization for the BNB is the subject of the next chapter. For the choice of optimization model for the Bank though a number of peculiarities should be taken into consideration, the latter arising from the Law on the BNB, the accepted accounting policy following from the Law, and the methodology for accounting the financial results from securities operations that follow from this policy.

According to the Law on the BNB, the Central Bank is the sole and full proprietor of the foreign reserves but the BNB has the discretion to give the Ministry of Finance (MF) up to 75% of the income received from the management of the reserves according to Article 8, paragraph 4. The sum paid to the Ministry is written in the annual financial result in the Income Statement (IS) of the BNB. At the same time, Article 36 of the Law on the BNB requires all unrealized profits as a result of the market revaluation of the assets to be entered into a spe-

¹⁰⁴ As known from Part I of this book, the risk tolerance is the maximal acceptable risk that the management of the Bank deems reasonable to run in order to achieve a higher return.

cial reserve account and to be part of the Bank's capital, showing only on its Balance Sheet. According to the accounting policy adopted by the BNB, which is based on the International Accounting Standards (IAS) and the International Standards for Financial Reporting (ISFR), the total income from the management of securities, this including the income from coupon payments and the realized revaluations of the market value, is included in the Income Statement, as well as in the Balance Sheet, referred to the special reserve account for revaluation of monetary assets. Schematically shown below are the realization of the legislative decrees, the accounting policy, and the BNB's methodology.

Figure 17 Distribution between the Ministry of Finance and the BNB of the total income from the foreign reserves according to the Law on the BNB and the accounting policy and methodology



* The deposit of Banking Department in the Issue Department, or the net worth of the Issue Department.

The total income for the BNB from investment in securities consists of a coupon and a capital component. The coupon income consists of the received coupon payments on bonds in BNB's accounts, and because of this it is always positive. Moreover, for a given portfolio structure, it is always known. The capital income by definition is the difference between the total income and the coupon income and depends on the movements of the yield curve since it determines bond prices¹⁰⁵.

Table 7 **Formulas for the distribution of the total income from the foreign reserves**

$$R_{FXR} = C + K_R + K_U - L$$

$$R_{BNB} = 25\%(C - L + K_R) + K_U \qquad R_{MF} = 75\%(C - L + K_R)$$

R_{FXR} – total return of the foreign reserves

R_{BNB} – return for the BNB

R_{MF} – return for the MF

C – coupon income from the foreign reserves

K_R – realized capital return of the foreign reserves

K_U – unrealized capital return of the foreign reserves

L – liability expenses

The description in Table 7 of the distribution of the realized annual return derived by the Issue Department of the BNB from managing foreign reserves allows us to trace all links between components of the total return. This description is based on the assumption that the Governing Council of the BNB has not used its legal right (according to Article 8 (3) of the LBNB) to form provisions against future changes in market value of reserve assets.

The conclusion that can be drawn from the mathematically described accounting policy and methodology is that neither the income

¹⁰⁵ See Chapter 2, Section 3.2.

of the BNB, nor the income of the MF is proportional to the total income from the foreign reserves. Hence the important observation that, except for some special cases, each of the three types of income would be maximized for *different* structures of the foreign reserves. Furthermore, by analogical consideration follows that the distribution of risks between the BNB and the MF is not proportional to the risk of the foreign reserves either. As can be seen from the real data example given in Box 3, the same structure of the foreign reserves leads to different level of risk for the two institutions and to different (and sometimes with opposite sign) expected return. A corollary of the above is the fact that an constraint for the total risk of the foreign reserves does not entail a simultaneous constraint for the risk of the net worth of the BNB. Similarly, the maximization of the expected return from the foreign reserves does not entail a simultaneous maximization of the expected return for the BNB. This embedded incongruity between income and risk is depicted in a stylized fashion in Figure 18.¹⁰⁶

From the above interpretation, it becomes clear why the solution of the optimization problem that the BNB faces related to the quantitative definition of the investment goal is a non-trivial one and goes beyond the classical portfolio management theory. According to that theory, one expected return is maximized subject to one risk constraint. In BNB's case, three potentially contradictory returns could be eventually optimized, subject to three types of complexly intertwined risk. Such an optimization problem can be solved, but it is necessary to prioritize the expectations for the return on the foreign reserves (E_{FXR}), for the income for the BNB (E_{BNB}), and the income for the MF (E_{MF}). Formally, the optimization problem can be described as shown in Figure 19 by setting different weights for the three types of return.

In the target function of the optimization problem, all three types of return are maximized, but they are weighted with λ_1 , λ_2 and λ_3 . They are called weights figuratively because their sum need not be equal to one; what matters are their ratios – λ_1/λ_2 , λ_1/λ_3 and λ_2/λ_3 . Through them the different priorities of the respective objectives are

¹⁰⁶ Instead of the letter *R*, which stood for return, in this figure the letter *E* is used in order to underscore the fact that we are discussing the *expected* return, in the mathematical sense of the word “expected.”

Figure 18

Types of investment objectives and risks

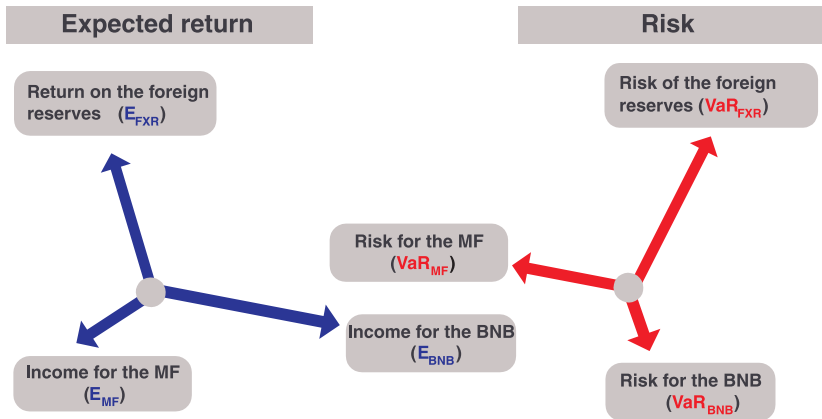


Figure 19

Target function and constraints for optimization

Maximize: $\lambda_1 E_{\text{FXR}} + \lambda_2 E_{\text{BNB}} + \lambda_3 E_{\text{MF}}$

Subject to the constraints:

$$\beta_1 \text{VaR}_{\text{FXR}} \leq \beta_1 c_1$$

$$\beta_2 \text{VaR}_{\text{BNB}} \leq \beta_2 c_2$$

$$\beta_3 \text{VaR}_{\text{MF}} \leq \beta_3 c_3$$

$$\lambda_1, \lambda_2, \lambda_3 \in \{0,1\}, \quad \beta_1, \beta_2, \beta_3 \in \{0,1\}$$

expressed. Although these weights can take all values, it will be assumed that λ_1 , λ_2 and λ_3 can only take values of 0 or 1¹⁰⁷. In the constraints of the optimization problem, the coefficients β_1 , β_2 and β_3 show whether we wish to impose some constraint on the risk of not achieving the respective goal¹⁰⁸. For λ_i and β_i , $i = 1, 2, 3$, all kinds of combinations of the values 0 and 1 are possible. For the optimization problem to be meaningful, it is necessary that at least one coefficient λ_i and at least once coefficient β_i be different from 0. Each combination of λ_i and β_i , $i = 1, 2, 3$ represents a particular optimization model. In this respect, the optimization problem shown in Figure 19 is a generalized presentation of the optimization problem that we are facing and contains within itself a multitude of particular optimization models.

The number of different optimization models given that there exist at least one goal and at least one constraint is 42. Fortunately, it is not necessary to review all of them and choose a model because it is possible to exclude a considerable number of models in advance for their being inappropriate. For easier interpretation the models under consideration are grouped according to the types of risk (*Var*) that are controlled.

None of the presented models are fully comparable with each other since all of them differ either in terms of the target function (i.e. the combination of objectives maximized) or in terms of the risk constraints. Hence, if, for example, one model outperforms relative to another model with respect to a given goal is due either to the fact that the former model exerts less control over a given type of risk compared to the latter model, or that the latter outperforms the former in terms of some other type of expected return. In this line of thought, the choice of whichever model achieves a lower level for some goal or has laxer control over some risk. It is also important to note that the maximization of any single return leads to suboptimal values for the other two types of return. The conclusion that can be drawn from the

¹⁰⁷ For example, the combination $\lambda_1=1$, $\lambda_2=0$, and $\lambda_3=0$ means that the only goal we pursued with the choice of an optimal benchmark is the maximum expected return from the foreign reserves.

¹⁰⁸ For example, $\beta_1=0$, $\beta_2=1$, and $\beta_3=0$ means that the only risk we wish to control when choosing a benchmark is the risk for BNB's net worth.

Table 8

Optimization Models

I Group of models – <i>Control over the risk of the foreign reserves</i>			
Subject to constraints for VaR_{FXR} ,			
Maximize	1) E_{FXR}	2) $E_{\text{FXR}} + E_{\text{BNB}}$	3) E_{BNB}
II Group of models – <i>Control over the risk of the foreign reserves and the risk of net worth of the BNB</i>			
Subject to constraints for VaR_{FXR} and VaR_{BNB} ,			
Maximize	4) E_{FXR}	5) $E_{\text{FXR}} + E_{\text{BNB}}$	6) E_{BNB}
III Group of models – <i>Control over the risk of the BNB net worth</i>			
Subject to constraints for VaR_{BNB} ,			
Maximize	7) E_{FXR}	8) $E_{\text{FXR}} + E_{\text{BNB}}$	9) E_{BNB}
IV Group of models – <i>Control over the risk of the BNB net worth and the installment to the MF</i>			
Subject to constraints for VaR_{BNB} and VaR_{MF} ,			
Maximize	10) E_{FXR}		
V Group of models – <i>Control over the risk for the installment to the MF</i>			
Subject to constraints for VaR_{MF} ,			
Maximize	11) E_{MF}		

theoretical analysis thus far and from the legal requirements is that the speciously straightforward choice of an investment goal for the BNB calls for a *management* decision.

The models laid out in Table 8 models were developed and tested with real data in Issue Department in the course of 2004–2005. They served as a basis for a discussion within the Board of Governors and for the willful and theoretically founded choice of investment goal for the management of the foreign reserves. Based on that, in 2006 the Board of Governors of the BNB decided that the total net expected return of the foreign reserves subject to the constraint for the level of their risk be the investment goal of the BNB. This practically concluded the eight-year long discussion within the BNB regarding the choice of investment goal. The Bank deems that in this way the public interest in the management of the foreign reserves is best served. The choice is absolutely consistent with the recommended international best practice, which excludes the possibility the distributional and the accounting policies to be factored in the decision-making

process concerning the reserve management and the positioning on the international financial markets. In this way, the maximum possible degree of autonomy of the reserve management process is guaranteed as well as its efficiency in the interest of the community. With its choice, the BNB clearly signals society that it recognizes the responsibility invested in the Bank as an institution independent of the Government.

At the same time the BNB is fully aware of the risk that any realized negative financial result from a fall in the prices of the investment grade fixed income government bonds would be absorbed against its net worth. This is done in order to guarantee the attainment of optimal total expected return with respect to the foreign reserves for their level of total risk. The risk of loss of part of the BNB's capital cannot be ignored, though. In order to contain it, the Bank's management has decided that it is more appropriate to avail itself of its legal right to make additional provisions in order to increase the capital before transferring its yearly installments to the MF. The aim is to compensate for the possible realization of the aforementioned negative effect. Thus in the course of the last five years a total of 342 million levs were provisioned in a specially created by a decision of the Governing Council Fund for Protection from Capital Losses. This policy protects from ex-post reduction of BNB's net worth. At the same time it does not preliminarily impose any theoretically unfounded additional constraints either on the determination of the Bank's investment goal or on the making of ex-ante decisions regarding the strategic asset allocation that would not be fully in line with the public interest.

Box 3 Example for the income distribution given zero income from the change in price of the government bonds¹⁰⁹

In order to illustrate the theoretical analysis for choice of return as laid out in the text, a numerical example is presented below. In this example it is assumed that the realized capital return K_R is zero. This would be the case, for instance, if the bonds are bought at par and are held to maturity without being sold before that. Although this is only one possible investment strategy, there is no qualitative change in the conclusions drawn below.

In Figure 20, the quarterly expected return of bonds of different maturity classes in EUR and USD is shown. These were the expected returns used as input data for the optimization of the model portfolio (benchmark) for the fourth quarter of 2005.

The main conclusion that can be drawn from these data is that as a result of the division of the income in accordance with the legal requirements and the current accounting methodology, the ordering of the expected returns from the different asset classes for the foreign reserves as a whole (FXR) is different from the orderings for the BNB (BNB) and the MF (MF). In practice, it affects to a much greater extent the expected return for the BNB than for the MF. As a consequence, it is highly probable that maximizing the expected return from the foreign reserves we deteriorate the expected return on BNB's net worth. Certainly, the example in question holds for a particular quarter with certain market expectations and is not a purely theoretical result. Regardless, it does illustrate the potential problems analyzed in the main body of text.

In figure 21, the empirical distributions¹¹⁰ of the three types of return (i.e. R_{FXR} , R_{BNB} , and R_{MF}) that we would have realized if we had invested the foreign reserves in European government bonds in the sectors 1-2 years and 0-1 years. It is apparent from the data that the risk for R_{MF} is lowest whereas the risk for R_{BNB} is highest. For example, VaR_{BNB} ¹¹¹ is twice as large as VaR_{FXR} for the sector 1-3 years, and in the sector 0-1 years VaR_{FXR} is not negative (loss) even when VaR_{BNB} is.

¹⁰⁹ The example given is only one of the solutions using real data from different periods.

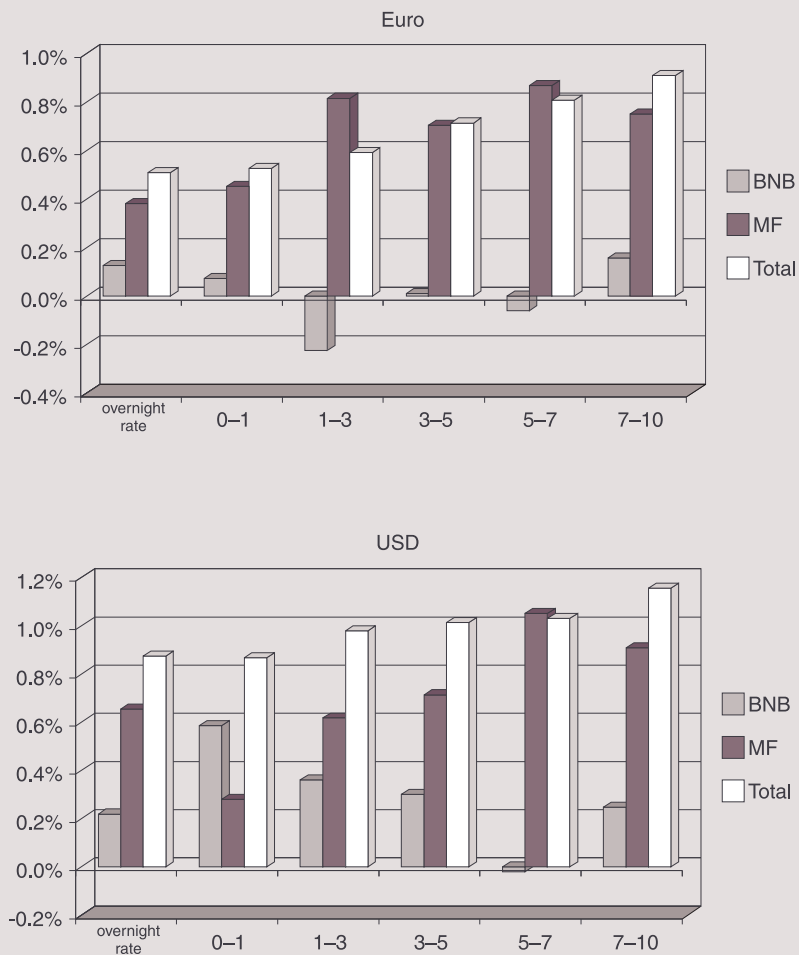
¹¹⁰ The distributions are constructed based on monthly data from the period January 2001 till December 2005.

¹¹¹ VaR is a measure of market risk and its definition can be found in Chapter 3, Section 3.

(continued)

(continued)

Figure 20 Expected quarterly return on the bonds in EUR and USD of different maturity sectors

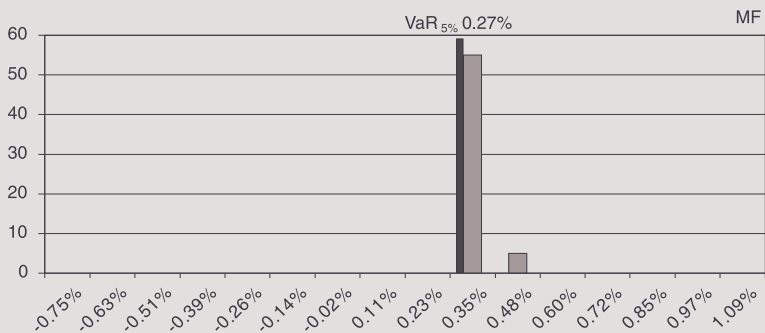
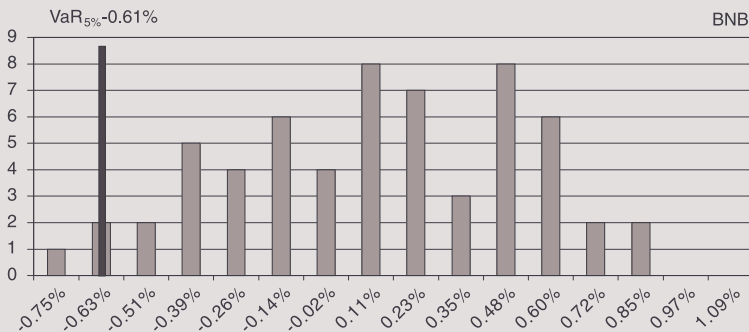
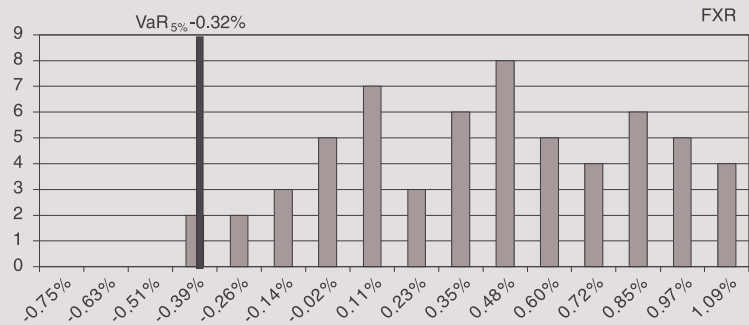


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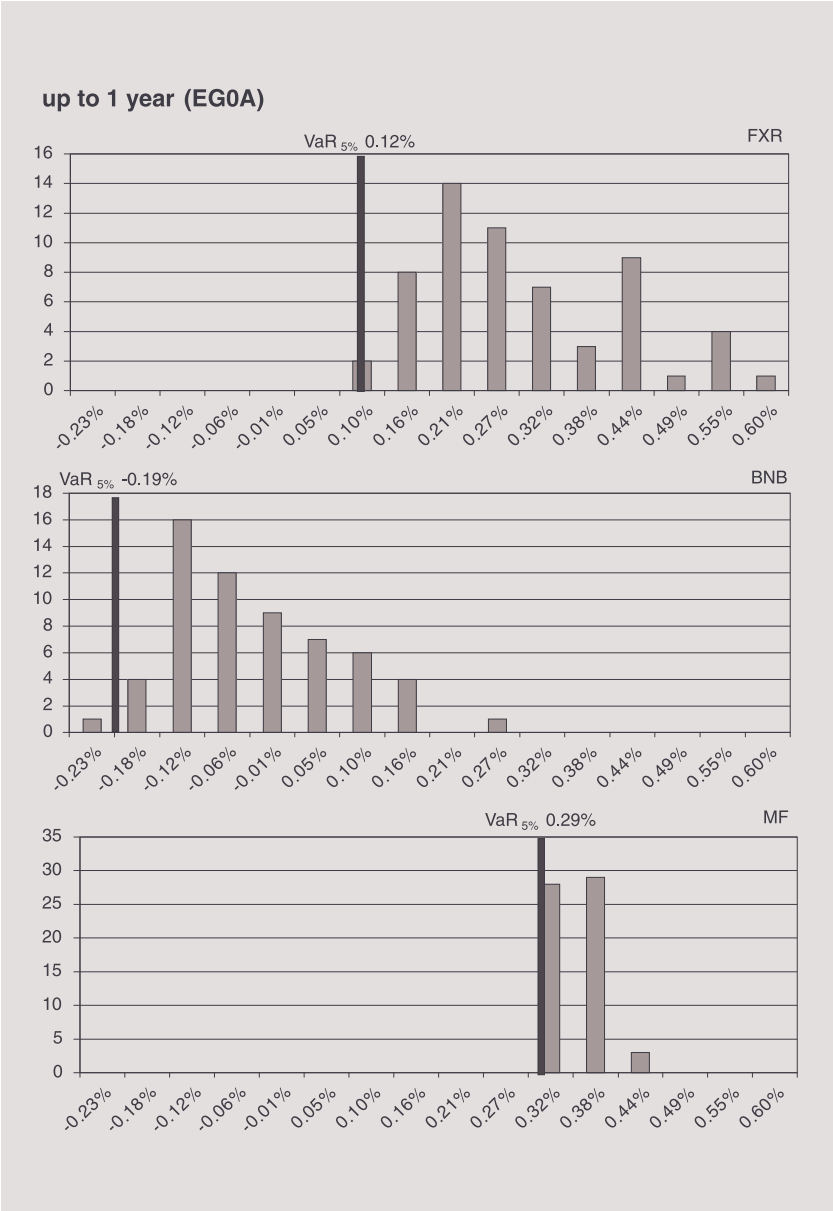
Figure 21 Empirical distributions of the three types of return on the foreign reserves if invested in European government bonds in the respective maturity sectors

1–3 years (EG01)



(continued)

(continued)



2. Risk Management Limits and Investment Guidelines of the BNB

The investment limits for the portfolio managers' team of the BNB, who manage the foreign reserves, are formed on three levels:

- Law on the BNB
- Board of Governors and Deputy Governor managing Issue Department
- Risk Analysis and Control Directorate (risk management operatives)

A leading principle informing the whole arsenal of investment limits is that the limits given at a lower level should not contradict or repeal the limits given at a higher level. Certainly, the limits written in the Law on the BNB hold the highest priority. They are followed by the limits determined by the Governing Council or the Deputy Governor managing Issue Department when formulating the investment objectives or the structural asset allocation.

Since 1999, the investment limits are systematized in a document with limited internal circulation named "Investment Limits and Benchmarks for the management of the Gross Foreign Reserve of the BNB." The document is updated after any change in the Law on the BNB, the investment objectives of the bank, changes in the structural asset allocation or after an intervention of the Risk Analysis and Control Directorate. It is endorsed by the Deputy Governor managing Issue Department. Mandatory appendices to the document are the full lists of permissible issuers of debt securities, commercial paper, and covered European bonds, as well as the lists of BNB's counterparties.

The imposition of investment limits aims to restrict the impact of the different types of risk (risk factors) to a level acceptable both for the legislator and the management of the bank before the actual investment of the foreign reserves. Some limits refer to the joint impact of two or more risk factors. The risk factors are identified in the description of the business processes systematized in the aforementioned "Business Procedures Manual for Managing Foreign Reserves" of the BNB. It depicts methods for identification of all types of risk, and it is also the main tool for the management and containment of operational risk within the BNB.

The compliance with the limits and procedures is constantly monitored, analyzed, and reported by the Risk Analysis and Control Directorate. The directorate is also responsible for the continual updating of the document. The existence of this document is the basis for the development of lucid criteria for the valuation of the risk management process within the BNB by the internal and external audit of the Bank and by the Court of Auditors of the Republic of Bulgaria.

The investment limits and procedures predominantly elaborate on the legally defined limits for the market (interest rate and foreign exchange) and credit risk. In the Law on the BNB there is no explicit legal limit for the interest rate risk, so this risk is controlled for by the means of a limit architecture at the lower level. By With a decision of the Investment Committee, the foreign reserves are divided into several portfolios by currency, with each portfolio serving a specific investment goal. For each portfolio a benchmark is defined and a limit of the maximum deviation of the modified duration of the portfolio from that of the benchmark is set, which is one of the main limits for interest rate risk by portfolio. Moreover, as a restriction on maturity risk,¹¹² limits for the maximum remaining time to maturity are set for the different asset classes. The latter jointly contains the interaction of the interest rate and credit risk. Thirdly, as part of the restriction on interest rate (incl. spread) risk, a limit for the maximum permissible relative loss is set for each of the portfolios. It is reported cumulatively since the beginning of each year and is valid within a given year. If reached, the portfolio managers revert to passive replication of the benchmark, i.e. they automatically lose their right to take active management positions with respect to the benchmark.¹¹³

For each financial institution, as is the case with the BNB, the main source of foreign exchange risk is the difference between the currency structures of the assets and the liabilities. The legislature has reduced to minimum the foreign exchange risk for the Bank. According to the amended Article 31, paragraph 3 of the Law on the BNB from the year 2005 *“the market value of the gross foreign currency reserves, excluding those under Article 28, paragraph 3, Section 3*

¹¹² A type of market risk and a subdivision of the interest rate risk. For more details see Chapter 2.

¹¹³ See Chapter 6 of Part 2.

(SDR) and Section 6 (gold bullion reserve), which are denominated in currencies different from Euro cannot be larger in absolute term than 2% of all monetary liabilities of the BNB denominated in these respective currencies. The compliance with this rule is monitored intraday and, in case of larger than the legally stipulated deviations, corrective measures are undertaken – i.e. immediate purchase or sale of the necessary amount of the given currency in order to bring the deviation within the limits postulated by law.

The freely convertible currencies in which BNB can invest its reserves are determined with a decision of the Governing Council. As explained in the Part 1 of this publication and Chapter 4, at present except for the reserve currency (Euro) open positions are allowed in a few other freely convertible currencies (US dollar, British pound, Swiss frank, and Japanese yen) of countries with the highest credit rating, in gold bullion, and in special drawing rights.

If necessary, the risk managers additionally restrict the foreign exchange risk resulting from the operational activities of the bank by imposing stricter limits for open currency positions intraday. At the end of the working day, every open currency position is closed. Another restriction on this level is given by the so-called *stop loss*¹¹⁴ limit, which, if reached, requires that the position be closed by the portfolio manager.

The credit risk is limited by Article 28 of the Law on the BNB, which states that the foreign reserves can be invested in instruments¹¹⁵ holding one of the two highest ratings given by at least two internationally recognized credit rating agencies. There, the possible issuers, for which the aforementioned minimum credit rating restriction holds as well, are also enumerated. The legal requirement is specified in three leading limits set by the Deputy Governor managing Issue Department:¹¹⁶

¹¹⁴ The maximum loss threshold for a given open position.

¹¹⁵ Cash in freely convertible currency, debt securities, and forward contracts.

¹¹⁶ In accordance with Article 28, paragraph 3 of the Law on the BNB, the Bank uses the ratings of the following three international agencies when assessing the credit rating – *Standard & Poor's*, *Moody's*, and *Fitch Ratings*. These agencies provide the international investors with the maximally independent and objective rating both for the debt issuer and the debt issued itself. Moreover, they offer ratings for the broadest spectrum of financial institutions with which the Bank could have business interaction.

1. The **issuers** of debt securities should hold a long-term credit rating which is given by at least two of the three rating agencies and is not lower than AA- by *Standard & Poor's* and *Fitch Ratings* or the respective rating by *Moody's*.
2. The **counterparties** of the BNB for deposits in currency or gold and for foreign exchange trades should hold a long-term credit rating which is given by at least two of the three rating agencies and is not lower than AA- by *Standard & Poor's* and *Fitch Ratings* or the respective rating by *Moody's*.
3. The **issues** of the debt securities should hold a long-term credit rating which is given by at least two of the three rating agencies and is not lower than AA- by *Standard & Poor's* and *Fitch Ratings* or the respective rating by *Moody's*.

The types of financial instruments in which the BNB currently trades are bonds denominated in currency or gold with fixed or floating coupon without an embedded call option; short term deposits in currency or gold; currency denominated commercial paper; and demand deposits in currency or gold. In accordance with the policy for constant gradual improvement of the spectrum of financial instruments for the management of the foreign reserves, in 2005 bond and interest rate futures contracts were allowed. Furthermore, in the last two years, the BNB became part of three securities lending programs. These are relatively new products developed by BNB's custodian bank or the bank operating the securities lending. The aforementioned credit rating limits also hold for the new products.

Foreign exchange (Forex) operations are rarely used for risk management purposes, which to a great extent follows from the legal restrictions on foreign exchange risk elaborated above. According to the requirements of the Law on the BNB, the Bank is not allowed to invest in corporate debt securities issued by non-financial institutions, irrespective of the credit rating of the issuer or the issue. The law does not allow investment on company equity or shares, which is a rule for most central banks. Table 9 below gives the differentiation by asset class and instrument, for each of which minimum credit rating requirement must hold.

From all issuers mentioned above, the credit risk of a country's government is deemed lowest as all the assets in this class hold the guarantee of the respective state. In pursuit of maximal restriction of the liquidity risk and, subsequently, ensuring the liquidity and security of the foreign reserves, the Deputy Governor of the BNB managing Issue Department sets a limit for minimum exposure in government debt securities as the most riskless asset class. Thus the BNB constantly invests a sizeable part of the foreign reserves in assets with the highest credit quality (AAA by *Standard & Poor's* or the respective rating by the other two agencies). As an additional restriction on the government risk (now as part of the credit risk) by recommendation of the Risk Analysis and Control Directorate a list of countries, central banks and government guaranteed financial institutions in whose debt securities the portfolio managers are allowed to invest has been endorsed and constantly updated. All of them comply with the legal requirement for minimum permissible long-term credit rating.

The supranational institutions in which the BNB invests the foreign reserves are international public financial organizations like the Bank for International Settlements in Basel, the World Bank, the European Investment Bank, *etc.* All of them hold at least the minimum credit rating required by law.

The European covered bonds and the agency bonds are relatively new instruments for the debt securities market on which the BNB operates. They are issued in a number of European countries and are regulated by respective special legislative acts. These instruments feature either prime mortgages or claims on the government (public) sector receipts as collateral. This collateral provides not only additional security for the investors but also high credit rating for the issuers, which renders them legally permissible for the BNB investment universe. The government guarantees of the issuers and the prime dealers, as well as the considerable amount outstanding of the issues provide both for market depth and high liquidity of the financial instruments. Usually covered bonds trade with some spread to the government bonds of a given country, which, given the aforementioned guarantees for security and liquidity of the issues, allows the portfolio investors to earn extra return. As an additional limit for the credit

Table 9

Investment limits by asset class

Asset class	Instruments	Amount of the total volume
<i>Governments</i>	<ul style="list-style-type: none"> - currency or gold deposits and investment programs within central banks - debt securities and commercial paper issued by the state, central banks, or financial institutions with an explicit government guarantee 	Min 50%
<i>Banks</i>	<ul style="list-style-type: none"> - currency or gold deposits with foreign banks - foreign exchange operations - commercial paper issued by banks. 	Max 30%
<i>Supranational institutions</i>	<ul style="list-style-type: none"> - currency or gold deposits, - commercial paper and debt securities. 	Max 20%
<i>European covered bonds</i>	<ul style="list-style-type: none"> - bonds of the type <i>Jumbo Pfandbriefe (Germany)</i> - bonds of the type <i>Obligations Foncières (France)</i> - bonds of the type <i>Irish Asset Covered Securities (Ireland)</i> 	Max 30%
<i>Agencies</i>	<ul style="list-style-type: none"> - bonds issued by financial agencies without a government guarantee – <i>Freddie Mac, Fannie Mae</i>, etc. 	Max 20%

risk, BNB has adopted the practice to consider the long-term credit rating of the issuer and not of the issue. The latter, due to the prime quality of the collateral usually has a higher credit rating than the issuer.

The trades with all debt securities in which the BNB invests are done only at the delivery versus payment condition, which is also an international standard, in order to limit the credit and liquidity risk. This is a relatively conservative trading approach imposed by the Risk Analysis and Control Directorate and endorsed by the Deputy Governor managing Issue Department. With this limit, the credit risk with respect to the counterparty is eliminated, i.e. the probability of the BNB meeting its part of a contracted deal and not receiving the contracted asset from the counterparty is practically nil. The counterparties for securities trading must hold a short-term credit

rating given by at least two of the three rating agencies which is no less than *A-1* by *Standard & Poor's* or the respective ratings by *Moody's* and *Fitch Ratings*. This requirement is introduced chiefly for the containment of settlement risk of securities trades as part of the procedures for the management of liquidity and operational risk.

In order to further reduce the credit, liquidity and operational risk, the Deputy Governor managing Issue Department, after a deliberation in the Investment Committee, endorsed the document "Policy on the BNB's Counterparties in the Management of the Foreign Currency Reserve." The document, developed by the Risk Analysis and Control Directorate, aims to set clear and transparent criteria and to reduce subjectivity in the process of reviewing, changing, or selecting new members of the counterparty list. Based on the criteria set, the present and future business partners of the Bank for the management of the foreign reserves are contacted on a regular basis. All partners are promptly informed for the leading principles in BNB's policy regarding its counterparties and for the changes that have occurred.

The foreign financial institutions which are counterparties of the BNB in operations with the gross foreign currency reserve can be divided into two groups. The first group comprises all the foreign financial institutions to which the Bank can have credit exposure. A leading criterion for inclusion in this group is a credit rating that meets the requirements of the Law on the BNB, i.e. rating higher than or equal to *AA-* by *Standard and Poor's* and/or *Fitch Ratings* and *Aa3* by *Moody's* given by at least two of the three agencies. For the sake of a more precise delineation of the credit limits for maximum individual exposure to the financial institutions of this group, the Risk Control Unit has developed and maintains a detailed methodology for internal ratings in numerical value, which elaborate the long-term credit ratings by the aforementioned agencies and are calculated based on the information on the financial institutions which is available on the market. The individual credit limit is determined as percent of the core capital of the respective institution depending on the internal rating awarded to it – i.e. the higher the capital of a given financial institution and its internal rating, the larger its limit for credit exposure enjoyed by the portfolio managers. The methodology also stipulates

criteria for optimizing the number of counterparties in Group One. The counterparties in Group One can also be listed in Group Two.

Group Two consists of the financial institution with which the BNB in securities under the delivery versus payment condition. A leading criterion for inclusion in this group is short-term rating higher than or equal to *A-1* by *Standard & Poor's*, *F-1* by *Fitch Ratings* or *P-1* by *Moody's*. This rating must be given by at least two of the three agencies. Within the methodology governing this group there also exist criteria ensuring optimal balance between necessary and the possible number of counterparties.

In accordance with the endorsed "Policy on the BNB's Counterparties in the Management of the Foreign Reserves", the counterparties are assessed and ranked for a given unit of time based on a set of objective criteria – chiefly but not limited to the realized turnover, the number of trades with the given counterparty, and the incidence of settlement problems and operational risk. The ones scoring lowest in each group are replaced: based on some additional criteria at least two of the lowest scoring institutions are selected for exclusion from each group. They can be superseded, if necessary, by other financial institutions that have shown interest in becoming BNB's counterparties for a given type of operations.

The assessment and subsequent updating of the counterparty list are done at least once per year at a meeting of the Investment Committee and are subject to endorsement by the Deputy Governor managing Issue Department. After the completion of the annual review, each counterparty is informed of the result and state of the bilateral business relations and its rank in the respective group. The counterparties that have been excluded at a given annual review can apply again for inclusion but cannot be included prior to the next annual review. The financial institutions which no longer comply with the requirements of the Law on the BNB due to credit rating downgrades are immediately notified and automatically excluded from the counterparty list.

For the foreign financial institutions that have never been BNB's counterparties and wish to do business with the Bank, a set of formal criteria has been compiled. An integral part of it is their giving BNB

access to their market quotes, analyses, and forecasts. Based on that, the most appropriate institutions are sifted. It has been organized internally that the list of these institutions is maintained and updates constantly, which facilitates its supplementing with counterparties from the groups looked into detail above. If necessary, a procedure for on-the-run inclusion of new counterparties has been provided for, prior to the annual regular update.

In order to limit the credit and liquidity risk, the Risk Analysis and Control Directorate, after endorsement by the Deputy Governor managing Issue Department, can impose further restrictions. Firstly, apart from the aforementioned requirement for minimum exposure to government or government guaranteed securities or securities issued or guaranteed by central banks, as well as deposits with central banks¹¹⁷, before the tactical asset allocation, the directorate sets for the portfolio managers the maximum permissible exposure to each of the other asset classes as outlined in Table 9. These limits are set on the balance sheet level, i.e. for the foreign reserve portfolio as a whole, and are subsequently translated into particular limits for each individual portfolio. Secondly, at this stage of the management of the foreign reserves a maximum permissible maturity of the currency and gold deposits is set for each counterparty. Thirdly, again at this stage of the management of the foreign reserves, a limit for maximum permissible exposure as a percentage of the market value of the total assets of the BNB in any given moment is set for each counterparty. Fourthly, again at this stage of the foreign reserve management, a minimum amount outstanding of each issue of a security that complies with all the aforementioned limits is set, since the issues with a larger amount outstanding are less affected by adverse market moves. This ensures good liquidity and ensures the securities are representative of the market in any given time. Thus the BNB also limits its reputational risk.

The compliance with the limits is monitored and controlled daily by the Risk Analysis and Control Directorate. A control mechanism has been set up to ensure that the sum total exposure to each particular instrument/asset class in the individual portfolios does not exceed the

¹¹⁷ For more information see Table 9, page 116, row 2 "Governments".

limits set for the foreign reserve portfolio as a whole.

Particular attention on the part of the BNB is required when managing the liquidity risk given the chosen monetary regime (see Chapter 4) and the commitment of the central bank to constantly bolster the trust invested in it as set in the Management and Development Strategy till 2009. Firstly, in order to guarantee liquidity limits for minimum daily availability of highly liquid assets by currency are set. They are determined through a methodology based on the historical trends. However, in order to be on the safe side, the values for the limits are adjusted upward with a factor reflecting the volatility given shocks on the domestic currency market.

The predominant part of the instruments in which the foreign reserves are invested, as pointed out in this chapter, traditionally enjoy high liquidity, i.e. in the need of cash, they can be easily sold and/or used as collateral at any time with virtually no additional cost. The short term deposits in currency or gold with banks as well as the gold bullion reserve held in the Bank's vaults enjoy lower liquidity. The short term deposits can and should be converted to cash before their maturity only given extraordinary circumstances – urgent need of cash. In ordinary times such a usage leads to opportunity cost as well as additional costs incurred. The gold bullion reserve in the BNB's vaults, as clarified in the analysis above, is the least liquid component of the foreign reserves. It can be sold on the market in the course of a few days to a few weeks. For reputational reasons, however, the BNB has not forfeited its policy to physically keep part of its foreign reserves in gold bullion.

Secondly, in order to ensure liquidity, as well as to limit the operational risk, limits for the maximum amount of a single transaction pertaining to the management of the foreign reserves have been set. These limits are a function of the type of transaction, the post of the Bank employee who contracts the transaction, and the currency of denomination of the transaction. These limits are set by the Risk Analysis and Control Directorate and are endorsed by the Deputy Governor managing Issue Department. They are monitored and reported on a daily basis.

Chapter Eight

Strategic Asset Allocation

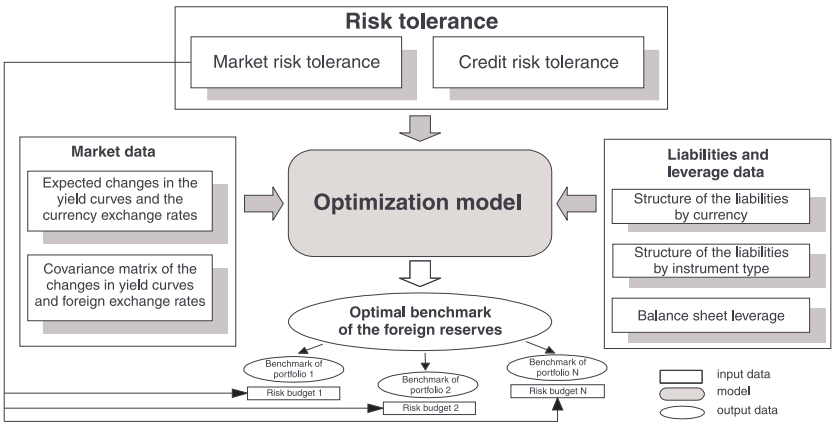
Strategic asset allocation or SAA is the next stage in the hierarchy of investment decisions which follows investment policy definition (see Chapter 3 and Figure 16). Its primary point is to select a benchmark for foreign reserves. The benchmark is a model portfolio which expresses the chosen investment policy as articulated through investment objectives and risk tolerance. The benchmark is of paramount importance: a number of studies¹¹⁸ show that over 90 per cent of a portfolio's return is down to its benchmark. The benchmark has a similar contribution to the risk characteristics of a portfolio.

For SAA purposes the BNB has developed an optimisation model which maximises expected return on net capital value (i.e., the deposit of the Banking Department) subject to a set risk constraint. The model is Type 2 according to the optimisation models classification in Chapter 3, Section 3.

The SAA process and its relationship to the Law on the BNB are shown diagrammatically in Figure 22. In general, the process comprises input data, optimisation model, and output data. All three constituents of the process shall be clarified in this sequence below.

¹¹⁸ See for instance Ibbotson, Roger G., Paul D. Kaplan, "Does Asset Allocation Policy Explain 40, 90, or 100 Percent of Performance?", *Financial Analysts Journal*, January/February 2000.

Figure 22 The Strategic Asset Allocation Process



1. Input Data

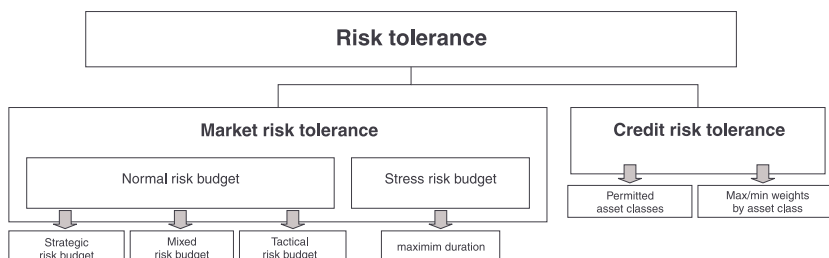
Input data in the optimisation model are: the specified risk tolerance, the expected leverage of the Issue Department, and expected returns of different asset classes.

1.1. Risk Tolerance

The most important element from the input data for the optimisation model is the permissible level of risk. It follows directly from the risk tolerance set by the Board of Governors and represents its “risk appetite.” This inclination of the Bank’s leadership depends both on its members’ individual attitudes to risk and on the external priorities dictated by the Law on the BNB regarding investment goal attainment. As noted in Chapter 7, the Law on the BNB sets priorities by the objectives of liquidity and security. To guarantee their attainment, the Board of Governors has to reinterpret them in the form of specific quantitative risk limits for the different portfolios. This is accomplished through explicit risk tolerances for market and credit risk (Figure 23).

Figure 23

Risk Tolerance, Risk Budgets, and Investment Limits



Credit risk tolerance is set by reference to two sources: the limits set out in Article 28, paragraph 3 of the Law on the BNB, and additional internally imposed constraints. Article 28 sets minimum credit rating requirements for the assets, and the types of credit risk-attended assets into which the foreign reserve may be invested. Internal limits further specify particular permitted asset classes and maximum credit exposure¹¹⁹ to each of them. Thus, the share of deposits with commercial banks is capped at 30 per cent of the market value of the foreign reserve, while the share of government or government guaranteed bonds has to be not less than 50 per cent, since they are considered to carry no credit risk. Similar internal limits are in place for all other asset classes attended by credit risk.

Market risk tolerance is set quantitatively by what are called risk budgets. By definition, the risk budget is the maximum permitted level of market risk. The BNB conditionally recognises two capital market scenarios: turbulent and normal. Two types of market risk budgets are thus defined for these two scenarios: stress and normal (see Figure 23).

When market is turbulent, with frequent slumps and considerable losses in the market values of securities, the stress risk budget is the maximum loss in euro which the net worth would incur given a worst case change in yield curves¹²⁰, spreads, and exchange rates. The

¹¹⁹ Credit exposure to a given asset class is measured by its share in the market value of foreign reserves.

¹²⁰ For a definition and details of yield curves and credit spreads, see Chapter 2, Section 3.2.

worst case scenario is constructed in such a way that the twin objectives of liquidity and security are attained, even given a market slump. Indeed, even if a worst case scenario were to obtain in market variables (yield curves and foreign exchange rates) alongside a liquidity crisis on the domestic interbank market, the BNB would still be statutorily mandated to convert levs against euro freely at the peg rate, and to be in a position to discharge its duties as lender of last resort. A limit on the maximum acceptable interest rate exposure of the foreign reserves (their maximum duration¹²¹) ensures compliance with the stress risk budget.

It should also be noted that it is very hard if not impossible to determine what the worst possible scenario for the market variables may be. Because of this, certain assumptions based on historical data need to be made. The methods for determining the maximum permissible duration of assets and the worst case scenario used by the BNB are described in Box 4 at the end of this Chapter.

A normal market is one where customary volatility levels obtain most of the time. *The normal risk budget* is the maximum percentage loss that the net worth of the Issue Department would incur at 95 per cent confidence level: what is called value at risk¹²².

Following the diagram in Figure 23, the normal risk budget can be decomposed into three distinct risk budgets: strategic, mixed, and tactical. The strategic risk budget is linked to the structure of the benchmark and represents the absolute risk: the outcome of the optimisation model. The mixed risk budget covers risk brought about from variance between the tactical portfolio (TAA¹²³) and benchmark (SAA) on the one hand, and from variance between the tactical portfolio (TAA) and balance sheet liabilities on the other. Since this risk cannot be fully accounted for, a conservative assumption is made of it. The tactical risk budget is explicitly stated and limits relative port-

¹²¹ At present this budget equals 2.8 years of duration of the foreign reserves.

¹²² For definition and more details regarding the value at risk market risk measure, see Chapter 3, Section 3. At present this risk budget equals zero total negative return on the net worth.

¹²³ TAA or tactical asset allocation is also called active management. TAA represents positioning by portfolio managers which is different to benchmark and aims to obtain higher returns than benchmark. TAA is addressed in detail in Chapter 9.

folio risk¹²⁴. Relative risk stems from TAA-induced deviations between the portfolio and benchmark. Given a certain assumption¹²⁵, it may be interpreted as foreign reserve yield in the interval of plus/minus one tactical risk budget of benchmark yield.

The motive for assuming risk and budgeting for it can be illustrated with the following example: were the elimination of all market risk desired, it would be possible to invest the whole foreign reserve into commercial bank current accounts. This solution would, however, be undesirable for two reasons. First, such an investment, though immune from market risk, would involve great credit risk, which a central bank would be unwilling to assume. Second, the absence of market risk would be costly since in the long term deposits carry lower return than government bonds. Investing in government bonds, on the other hand, carries market risk but no credit risk. For this very reason most central banks tend to invest over half of their foreign reserves into government debt and are willing to assume a measure of market risk. For the sake of comparison it is useful to note that other institutional investors such as mutual or pension funds assume much greater market risk than central banks. This also explains why in the long run they receive higher returns than central banks. A mere comparison of returns for these two types of institutional investors would be spurious, however, since it does not account for the different levels of market risk assumed.

1.2. Liabilities and Leverage

Balance sheet data are an input parameter in the optimisation model and comprise three components: liabilities by instrument, liabilities by currency, and leverage. These data are necessary since they influence both expected return and risk to the net worth (the Issue Department balance).

¹²⁴ Relative risk is the risk that the actual portfolio return may be lower than benchmark as a result of active management.

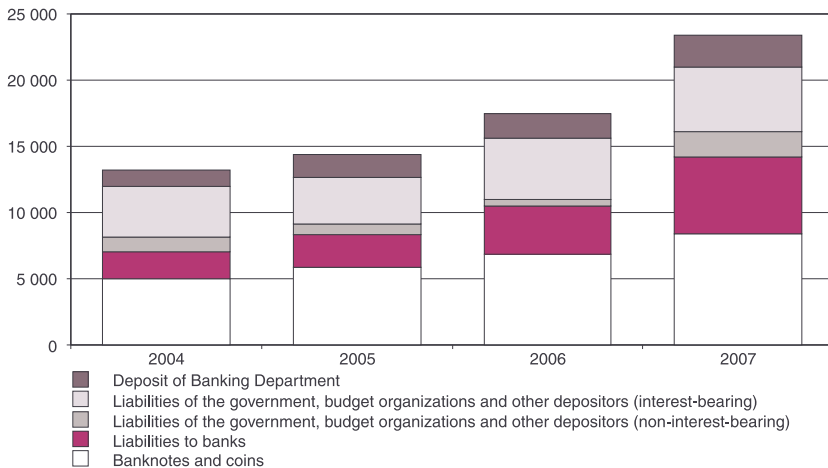
¹²⁵ The assumption is that differences between portfolio and benchmark yields (relative yield) are normally distributed at zero mathematical probability and standard deviation equal to the tactical risk budget. The accepted term for the tactical risk budget is tracking error.

The structure of liabilities by instrument is necessary to calculate expected interest costs on them (see Box 5)¹²⁶. The structure of liabilities by currency is necessary to calculate returns from currency mismatch: between the currency structures of assets and liabilities or, as it is termed, currency revaluation income. The structure of liabilities by these two parameters is necessary to estimate the covariance between assets and liabilities: itself part of the risk to the net worth.

Figure 24 Structure of the Liabilities by Currency



¹²⁶ By contract, the BNB pays market interest to the government and other budget organisations which have deposits on the balance sheet of the Issue Department. Under Article 5 of Ordinance No 21 and a Board of Governors' resolution, no interest accrues on banks' minimum required reserves.

Figure 25 **Structure of the Liabilities by Balance Sheet Entry**

The ratio of attracted to own funds (leverage) is the quotient between foreign reserves and the net worth of the Issue Department. It defines the relationship between net return¹²⁷ on foreign reserves and return on the net worth as expressed by the formula:

$$(1) \quad \text{Net return on foreign reserves} \times \text{Leverage} = \text{Return on net worth}$$

The three sets of balance sheet input data change dynamically. This calls for forecasting of their expected values for the horizon of benchmark optimisation.

1.3. Market Data

Market data comprises estimates of expected returns on different bond maturity sectors. Expected changes in yield curve and exchange rates directly influence expected returns on different bond maturity sectors, and hence expected return on the net worth. In turn, the covariance matrix of these changes affects risk to the foreign reserve and thus risk to the net worth.

¹²⁷ *Net return* on foreign reserves should be understood as return less the cost of balance sheet liabilities. For more on the influence of leverage on risk and return on the net worth, see Sherpe, W., L. Tint, "Liabilities: A New Approach," *Journal of Portfolio Management*, 1990.

Market data are the most critical input item, since the solution to the optimisation problem is highly sensitive to them. Small changes in these data lead to large changes in output data (the optimum benchmark). Moreover, sensitivity as regards yield curve changes and exchange rates is much higher than as regards the covariance matrix¹²⁸. Unlike risk tolerance, which reflects subjective inclination to assume risk, market data has to be forecast. Practitioners and academics have not agreed on any general principle for assessing yield curve changes, similar to those for assessing the covariance matrix. The BNB applies one of the possible approaches: that of no expected change in yield curves, which assumes that current yield is the best predictor of future yields. The arguments for this approach, and an overview of other possible approaches, are presented in Box 5.

2. The Optimisation Model

The optimisation model is at the core of strategic asset allocation. Each optimisation model comprises two parts: target function, and constraints. The target function shows what is being optimised, what variables are used, and how the function depends on them. The constraints determine the set of feasible solutions among which the optimum must be sought. The target which has to be maximised by using the foreign reserve benchmark selection model is expected total return on the net worth (Figure 26). It is a function of the expected returns on different bond and deposit maturity sectors scaled by balance sheet leverage and weighed according to their market weights in foreign reserves. Formula (1) on p. 127 shows that as total expected return on the net worth is maximised, so is total return on the foreign reserve.

¹²⁸See for example Chopra, V.K., W.T. Ziemba, "The Effects of Errors in Means, Variances, and Covariances on Optimal Portfolio Choice," *Journal of Portfolio Management*, 1993.

Figure 26 Optimisation Model for Foreign Reserve Benchmark Selection

Maximize	Expected return on the net worth
Given:	Normal risk budget Mixed risk budget Tactical risk budget
and constraints for:	1) maximum duration of the assets 2) max/min weights by asset class 3) prohibition for short positions in bonds and options

The constraints in the model control market and credit risk to assets. The risk budgets and maximum duration limits control market risk, whereas the limit for maxim/minimum weights for different assets attended by credit risk control foreign reserve credit risk.

The model seeks optimum allocation of the assets by maturity sector and by asset classes which maximise target return, but provided that the objectives of liquidity and security are attained. Thus the BNB priority of liquid and secure foreign reserves and the secondary priority of return on them are again emphasised.

3. Output Data

3.1. The Foreign Reserve Benchmark

The benchmark is the solution to the optimisation problem given the investment constraints. It is a combination of the market weights of the permitted asset classes and reflects the long term investment strategy as regards the combination of market and credit risk which management is willing to assume in attaining the Bank's investment objectives.

It must be noted that the benchmark is optimum at the time of its selection. As time passes, it ceases being optimum since the conditions at which the optimisation problem was solved change. The level

of risk may thus exceed the strategic risk budget and breach the risk tolerance set by the Board of Governors. Conversely, market risk may fall below permitted levels set by the strategic risk budget. This outcome is also undesirable, for lower risk translates into lower return in the long run. For these reasons, the benchmark has to be rebalanced periodically into line with set risk budgets. This is accomplished by solving the optimisation problem again using updated input data. At present the BNB does this quarterly.

Within a given quarter, however, the structure of the benchmark remains unchanged and it is possible for it to be sub-optimal with regard to fresh market data. During this period portfolio managers are allowed to deviate from the structure of the benchmark when investing foreign reserves, thus making use of this data. This is one of the leading roles of the tactical asset allocation, whose aim is to take advantage of any inefficiency in the benchmark in order for the foreign reserve to attain yet higher return. The extent to which foreign reserve investment deviates from benchmark is controlled for by means of the tactical risk budget. The latter limits the relative risk which portfolio managers may assume through deviating from benchmark and thus constrains the degree of possible underperformance of reserves *vis-à-vis* benchmark.

3.2. Benchmark Portfolios

Once chosen at balance sheet level, the benchmark is distributed into the different portfolios in which BNB assets are distributed for management by different teams and managers. This distribution is a function of the weights of individual portfolios in the market value of reserves. It is conducted so that the benchmark is weighed by portfolio, thus preserving its optimum structure as attained when solving the optimisation model.

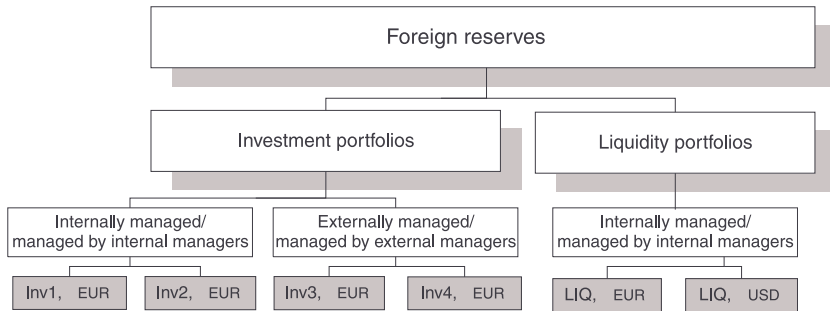
As benchmark is distribution by portfolio, so tactical risk also needs to be distributed¹²⁹. As in the prior step of benchmark distribution, portfolio weights are again applied to determine portfolios' risk budgets. Unlike benchmarks, however, risk budgets are not

¹²⁹ Since the tactical risk budget is initially defined in terms of the net worth, it has to be weighed by balance sheet leverage before being distributed.

subadditive. That is why a further assumption of zero correlation between the different portfolio managers' teams is necessary.

The foreign reserve is split into portfolios for operational reasons. Different portfolios serve different purposes, such as investment (INV) and liquidity (LIQ) (Figure 27).

Figure 27 Foreign Reserve Structure by Portfolio



Investment portfolios target relatively higher return and have benchmarks with higher risk assets. These portfolios comprise primarily securities and under normal circumstances are used neither to meet liquidity needs (payments) nor to receive frequent (daily, weekly, or monthly) receipts. Two investment portfolios are mandated to external managers, promoting greater diversification of management styles and the exchange of knowledge and experience in portfolio and risk management.

The liquidity portfolios are used primarily to meet BNB liquidity needs and to service Ministry of Finance and commercial bank payments. Day to day receipts and withdrawals, such as adjustments to banks' minimum required reserves or transfers on behalf of the Ministry of Finance or government bodies take place via these portfolios. They also service all foreign debt payments. Unlike investment portfolios, liquidity ones comprise mainly or entirely short term deposits. No active intervention is expected of their managers and their benchmarks have much simpler structures compared to investment portfolio

lios. In certain cases where funds in a given currency are less than EUR 100 million, they are invested in very short term deposits.

Since the foreign reserve varies continually with payments and receipts, the weights of investment and liquidity portfolios in that reserve also vary. This makes it necessary to determine the expected sizes of the portfolios at the beginning of each quarter, before benchmark distribution. In the process, the liquidity portfolio in euro takes the lead since liquidity is managed mainly in that currency. The extent of the liquidity portfolio has to be large enough to meet all necessary expected payments, obviating the need to transfer funds from investment portfolios over a quarterly horizon. The rest of the euro denominated foreign reserve funds are distributed among the four investment portfolios. A governing principle for the size of the USD liquidity portfolio is that it should be approximately equal to US dollar liabilities on the Issue Department balance sheet by time to maturity. The methodology for determining the size of the euro liquidity portfolio is shown in Box 6 below.

Box 4

Setting a Worst Case Scenario and Determining Maximum Asset Duration

When markets are in a turbulent regime it is necessary to define the worst case scenario for risk management purposes. Definition encompasses three types of market variables: exchange rates, spot interest rates from government bond yield curves, and credit spreads from spread bond yield curves. Since the Law on the BNB prohibits short positions¹³⁰, the most unfavourable changes in exchange rates are devaluations of the US dollar against the euro and of gold against the dollar, and increases in spot rates and credit spreads.

The most extreme deviations in these variables are calculated using monthly data from a historical time series of over 10 years. It is also attempted to reflect the fact that the correlation between changes in different market variables is not unity: conditional changes are sought. Under the methodology the first item found is the largest increase in spot rates, but only at yield curve levels close to the current ones. Only then are the

¹³⁰ See LBNB Article 28, paragraph 3.

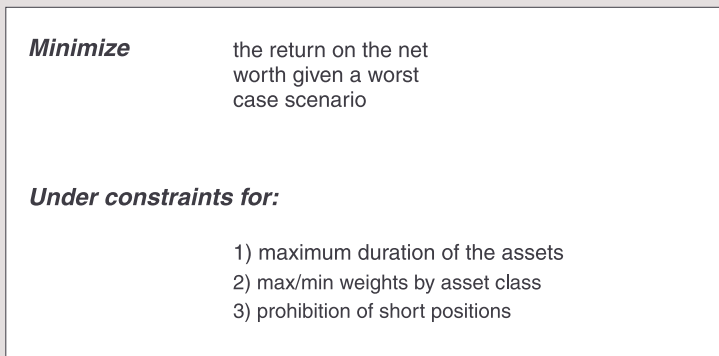
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largest increases in credit spreads determined, but only for spot rate yield curve changes close to the least favourable change determined at step one.

An optimisation model is used to determine the maximum permissible duration of foreign reserves.

Figure 28 **Optimisation Model for Determining the Maximum Permissible Duration of Foreign Reserves**



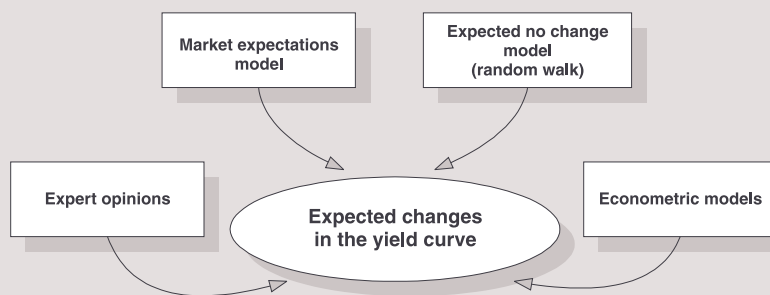
The credit exposure limit is set by max/min weights for each asset class, while the interest rate exposure limit is set by the maximum permissible duration of the foreign reserves. The restriction on short positions reflects the prohibition on bond borrowing or option issuing.

The optimisation model tests whether a given set of investment limits guarantees that losses do not exceed the stress risk budget in the worst case scenario alongside a foreign reserve structure which would incur the greatest loss. Of all values of the duration which satisfy this condition, the highest is defined as the maximum permissible duration.

Box 5 Methods for Forecasting Changes in the Yield Curve

Figure 29

Change Assessment Models



The *market expectations model*¹³¹ asserts that the current yield curve reflects market participants' expectations and can be extrapolated using forward rates. According to this model, expected spot rate changes are equal to the difference between forward rates and current spot rates. Though practitioners often refer to the model in forecasting changes, most empirical academic studies denounce it as unfit for forecasts with horizons of under a year¹³². This renders it inapplicable for SAA purposes at the BNB.

Econometric models for spot rates may broadly be divided into two groups. The first group are models representing spot rates or their change only as a function of the information obtained from the yield curve. Time series regressions of spot and/or forward rates are usually used to estimate parameters. For instance, expected change is often modelled as the linear function of the difference between long-term and short-term spot rates (yield curve slope), or as a function of the spread (difference) between forward and spot rates, or as a linear combination of forward and spot rates.

Diebold and Li (2006)¹³³ describe the above, plus other popular models of this kind, and test them empirically. The second group of models represents spot rates and changes in them as a linear function of macroeconomic variables such as, inter alia, inflation, the federal funds rate,

¹³¹ Also known as the *Pure (or Unbiased) Expectations Hypothesis*. For more on this model and empirical tests of it, see Chapter 2, Section 3.3.

¹³² See for instance Fama, Eugene F., "The Behavior of Interest Rates", *Review of Financial Studies*, 2006, 19(2) and works cited there.

¹³³ Diebold, F.X., C. Li, "Forecasting the Term Structure of Government Bond Yields," *Journal of Econometrics*, 130, 2006.

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economic indices, exchange rates. Mixed models also exist where expected spot rate changes are modelled as a function of themselves and some macroeconomic variables. For more information on them and further references, see *Diebold, Rudebusch and Aruoba* (2006)¹³⁴.

The expected no change model or random walk model is the simplest representative of the first group of econometric models. It is shown separately in Figure 29 since it is the model which the BNB currently uses to calculate expected spot rate changes.

According to this model, the best predictor of the future yield curve is the current one: expected change in spot rates is always zero¹³⁵. The reason for selecting this model as part of the SAA methodology is that it yields much better predictions. It is comparable with much more complex models, and is often better than them. Because of that it is used in most tests of new models, being rather hard to beat, especially for short-term forecasts, e.g. up to six months. *Diebold & Li* (2006) subject this claim to comparative analysis and uphold it. The simplicity and predictive power of this model make it widely used in practice and recommended for central bank foreign reserves management¹³⁶.

Expert opinions are an alternative to quantitative models for forecasting and usually represent the subjective opinion of experts with significant experience of debt market. This helps them offer informed predictions based on available macroeconomic, market, and other data. It turns out, however, that the subjective forecasts even of leading economists hardly beat the expected no change model. *Brooks and Gray* (2004)¹³⁷ are among the many confirming this. They look into the long history¹³⁸ of consensus (e. g., average) forecasts by eminent economists whose long term interest rate predictions on the American yield curve appear in the *Wall Street Journal* every six months. The authors conclude that the expected no change model performs better. Indeed, consensus forecasts have been in the wrong direction 65 per cent of the time. Another recent paper on the topic is by *Mitchell and Pearce* (2005)¹³⁹. On the whole, re-

¹³⁴ *Diebold, F.X., G.D. Rudebusch and B. Aruoba*, "The Macroeconomy and the Yield Curve: A Dynamic Latent Factor Approach," *Journal of Econometrics*, 131, 2006.

¹³⁵ The model does not assert that changes are nil, but that *expected* (in the sense of mathematical expectation, e. g., average) change is nil.

¹³⁶ See for example "Total Return Management of Central Bank Reserves," *Fixed Income Research*, Lehman Brothers, January 2005.

¹³⁷ *Brooks, R., J.B. Gray*, "History of the Forecasters," *Journal of Portfolio Management*, Fall 2004.

¹³⁸ More precisely 43 forecasts.

¹³⁹ *Mitchell, Karlyn, Douglas K. Pearce*, *Professional Forecasts of Interest Rates and Exchange Rates: Evidence from The Wall Street Journal's Panel of Economists*, Working Paper, Department of Economics, North Carolina State University.

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search shows that expert forecasts are best for the most short term rates which are almost entirely driven by the monetary policy of central banks and are thus predictable to some extent.

The analyses and works cited show that in the long run the capital markets for debt securities are highly efficient and thus to a large extent unpredictable. In other words, the current yield curve reflects the entirety of publicly available market information and the expected no change model is a success for this reason. The role of experts, however, is to know the assumptions behind the models used and to make decisions different from the models when these assumptions change or the markets are in a short-lived phase of inefficiency. In this sense, experts' judgment will always be necessary, as no model gives good predictions all the time, and it is the experts' who can determine when this obtains.

Box 6

Methodology for Determining the Size of the Liquidity Portfolio in Euro

Each quarter optimum, minimum, and maximum sizes of the liquidity portfolio in euro are determined as follows¹⁴⁰:

Minimum: this is determined from a net external cash flow time series beginning 1 January 2003 and is defined as the minimum of the cumulative net external cash flow within a calendar quarter. To avoid the regular fluctuations at the end of each calendar month caused by adjustments of minimum reserves by commercial banks (large external cash inflows at the close of one month followed by external cash outflows of a similar magnitude at the beginning of the next), the accumulation of net cash flows begins with a five day offset between the sixth business day of one quarter to the sixth business day of the next.

Maximum: this is determined as the minimum size plus 5 per cent of the expected amount of euro-denominated assets for the quarter.

Optimum: this is determined as the sum of:

The minimum size plus a third of the difference between maximum and minimum sizes.

¹⁴⁰ The practice that the sizes are multiples of 10 million has been adopted, which may result in rounding.

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The market value of the liquidity portfolio can exceed the maximum or be less than the minimum for not longer than five consecutive business days. When the forecast net cash flow is expected to exceed the limit size of the liquidity portfolio the Director of the Treasury head may rule for this cash to be:

- 1) Either fully or partially transferred into euro investment portfolios;
- 2) Or transferred to or from euro investment portfolios as appropriate to bring the euro liquidity portfolio back to its optimum size.

To cut transaction costs funds in the liquidity portfolio may currently be invested only into deposits ranging from overnight to one week and into interest rate or bond futures.

Chapter Nine

BNB Tactical Asset Allocation

This chapter focuses on the stage of the investment process which follows the choice of benchmark and the setting of investment guidelines and limits. As indicated in Part I, foreign reserves are actually invested at the tactical asset allocation stage. This boils down to daily buying and selling eligible classes of assets: fixed income securities, money market instruments, and futures on interest rates and bonds. At this stage, investment decisions rest mainly on current expectations of return on an asset class within the investment horizon or on finding and exploiting price anomalies. Tactical asset allocation (TAA) is said¹⁴¹ to contribute 5 to 10 per cent of returns. This can largely be explained by constraints on deviation from the benchmark imposed on portfolio managers.

As explained in Chapter 8, the benchmark has an optimum structure at the beginning of an investment horizon. Significant short term changes or deviations from market equilibrium may occur within that horizon, even if it were just one quarter. Thus, a major TAA goal is to change portfolio structure dynamically as market conditions and expectations evolve. The purpose is to attain optimum allocation and higher-than-benchmark returns within SAA limits.

Other objectives set at the TAA level are to maintain close contacts with the Bank's counterparties and gain market knowledge, experience, and skill; these can be critical at junctures when Bank assets may have to be sold rapidly as part of Law on the BNB Article 31 operations, or to assist adherence to investment objectives amid sharp market fluctuations.

¹⁴¹ Ibbotson, Roger G., Paul D. Kaplan, "Does Asset Allocation Policy explain 40, 90 or 100 Percent of Performance?," *Financial Analysts Journal*, CFA Institute, January/February 2000.

BNB portfolio managers follow the general TAA framework described in Part I. This combines investment decisions with horizons of a day to several weeks with ones from a month to a quarter. Top-down or bottom-up analyses may be applied when adopting investment decisions (the former starts at the macroeconomic level, descending through particular sectors to particular asset classes or securities; the latter focuses on specific assets or securities).

Different strategies may be implemented depending on market conditions and portfolio managers' expectations. Some address idiosyncratic risk¹⁴², others systemic risk, and yet others combinations of both.

Table 10 **BNB Investment Strategies**

Passive Strategy	Active Strategy with Deviations from Main Risk Factors (excluding Duration)	Active Strategy with Deviations from Main Risk Factors (including Duration)
Some securities in the benchmark are purchased to match major benchmark risk characteristics: duration, convexity, credit exposure	<ol style="list-style-type: none"> 1. Open positions in "rich" or "cheap" maturity sectors 2. Utilisation of temporary market anomalies 3. Credit diversification 	<ol style="list-style-type: none"> 1. Deviations from benchmark duration and/or convexity 2. Yield curve open positions 3. Open positions to credit
<i>Low Relative Risk</i>	<i>Moderately High Relative Risk</i>	<i>High Relative Risk</i>

1. BNB Active Portfolio Management Strategies

When managing BNB foreign reserves the active approach usually aims at higher relative returns at acceptable risk levels. It assumes that portfolio managers and financial analysts are able to pinpoint market anomalies, determine risk factors *vis-à-vis* which an exposure may to be opened, and pick the right time for such openings.

¹⁴² Risk stemming from factors other than interest rate changes and usually inherent to a particular issuer or security.

1.1. Active Positions as regards Duration, Convexity, Yield Curve, and Credit Spread

Since the greater part of foreign reserves is invested into fixed income securities, interest rate risk measured by modified duration is the leading risk factor monitored by portfolio managers. Depending on managers' expectations, portfolio duration may be:

- a) different from benchmark (shorter or longer)
- b) equal to benchmark (neutral).

For example, where a general interest rate drop is expected within the investment horizon, portfolio duration may be extended by comparison with the benchmark, or vice versa: if interest rate rises are expected, portfolio duration is drawn down on the benchmark. All changes in modified duration render portfolio market value more or less sensitive to interest rate changes. Depending on the quality of portfolio managers' forecasts, all relative duration positions contribute to higher or lower portfolio return relative to benchmark. When portfolio managers are uncertain of future interest rate movements, they usually adopt a neutral position, i. e., a duration position equal to that of the benchmark.

Another factor which can greatly impact relative performance is interest rate volatility, usually measured by convexity. When high volatility is expected, higher convexity is preferred, usually implemented through a barbell strategy. In this case, portfolio managers invest in the short sector (two years) and the long sector (ten years) of the yield curve and sell or avoid the medium sector (five to seven years). Where portfolio managers also wish to express a view on future interest rate movements, they may combine their convexity positions with the modified duration position.

Since the above risk factors have the greatest effect on return, the adoption of positions on them is deemed the mark of a strongly expressed active strategy. Important to such a strategy is not only the direction and magnitude of interest rate changes, but also their timing. The strategy is characterised by greater return volatility; it has higher standard deviation of relative performance (tracking error).

Relative positions to the benchmark may also be based on expectations of future maturity sector yields, changes in different asset

class spreads, or identified market anomalies (for example, due to asset evaluation model errors, supply-and-demand asymmetries, or irrational market participant behaviour).

When portfolio managers have a strong view on how particular sectors' yields will move, they usually take a long position in sectors where prices are expected to fall less or increase more, and vice versa. This strategy rests on expected yield curve slope or shape changes. Diverse factors drive such movements; here are two examples:

Box 7

Yield Curve Exposures

In early 2005 portfolio managers expected legislative changes in European pension investment, particularly in the Netherlands, and adopted a long position in the thirty year sector of the yield curve simultaneously with a short position in the ten year one. The main driver was a view that the longest end of the yield curve would flatten due to supply and demand changes.

Figure 30

30 Years – 10 Years Spread

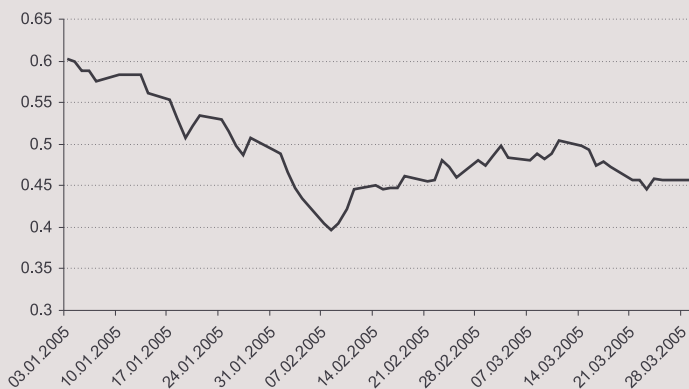


Figure 30 shows the change in the thirty and ten year sector spreads between January and March 2005. Until the ultimate legislative position clarified, the spread tightened and the position earned a positive relative return. In early February legislative delays and speculation on how radi-

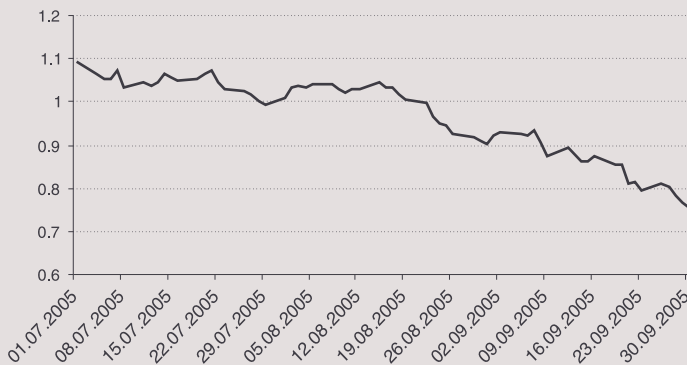
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cal the reform would be pushed the spread towards its normal level and even wider, turning the position to loss. However, the position stayed open because managers judged the trend to be short-lived, losses to be insignificant compared to the costs of closure, and because of their conviction that over a longer term the spread would continue tightening.

An example of curve positioning based on a different factor is from the summer of 2005. Amid rising interest rates, a short position in the two year sector was taken simultaneously with a long position in the ten year sector. Here managers' expected yield curve flattening, mainly due to the ECB's formal intention to fight inflation. Figure 31 shows the actual dynamics of the ten year and two year sectors between July and September 2005.

Figure 31 Figure 30 10 Years – 2 Years Spread



When seeking higher relative returns, taking positions to spread products¹⁴³ is a frequently used approach. Position opening decisions may rest on technical or fundamental factors. When the factors are technical, the investment horizon is usually short: the spread may be at a historic high or low and this may signal a forthcoming correction. When the factors are fundamental, the horizon is usually long: expectations are of coming changes in issuer creditworthiness or in the outlook for the issuer's sector.

Credit and spread analyses and evaluations of fair security values

¹⁴³Please refer to footnote 71.

are widely used in this strategy. Credit analysis usually assesses the risk of issuer default or the probability of credit rating downgrades. The Law on the BNB requires portfolio assets to be issued by entities with high credit ratings, which by definition implies low default risk. Where downgrades of issuers whose debt is included in the benchmark are expected, portfolio managers may take a short relative position to their debt, limiting loss due to asset depreciation. Conversely, if a credit rating upgrade is expected or portfolio managers' analyses point to an issuer's debt being underpriced, a long relative position may be taken. Information on issuers' credit standing comes from Reuters, Bloomberg, rating agencies, or BNB counterparties, and is assessed by the Analysis Division and portfolio managers at the Treasury Directorate. A case of an exposure to credit risk is presented in Box 8.

Box 8

Exposure to Credit Risk

In 2005 Italy's poor economic data, growing budget deficit, and lack of political will to tackle problems caused a short relative position to be held on Italian debt in BNB portfolios. The decision rested on portfolio managers' expectations of an Italian credit rating downgrade. The position ended in profit because, as shown in Figure 32, the spread between ten year Italian and ten year German debt widened from 13 b.p. to 20 b.p. in 2005.

Figure 32 Spread between Italian and German 10 years Bonds



1.2. Active Positions based on Quantitative Methods

An approach often applied in BNB reserve management in search of higher relative return is to open positions based on expected future movements of the spread between two securities. Here the assumption is that, other things being equal, the spread between two securities would tend to revert to its mean level. For this reason, if the spread was above its mean, it is seen as “cheap” and good for buying; if it was below its mean, it is considered “rich” and good for selling. If we have two securities with similar risk characteristics and their spread is above its historical mean it is good to buy the “cheap” paper (that with the higher yield) and sell the “rich” paper (that with the lower yield) expecting the spread to return to its mean level; the faster the move to the mean, the higher the return from the position. A very important factor to be considered when deciding to open a position is the reason behind the deviation of the spread from its mean. Is it due to purely technical reasons, or to fundamental ones? If the latter prevail, the probability of the deviation lasting longer is very high. This can turn the position to loss or to lower than expected earnings. An example of active positions based on quantitative methods is given in Box 9.

1.3. Active Positions utilising Peculiarities of the Fixed Income Market

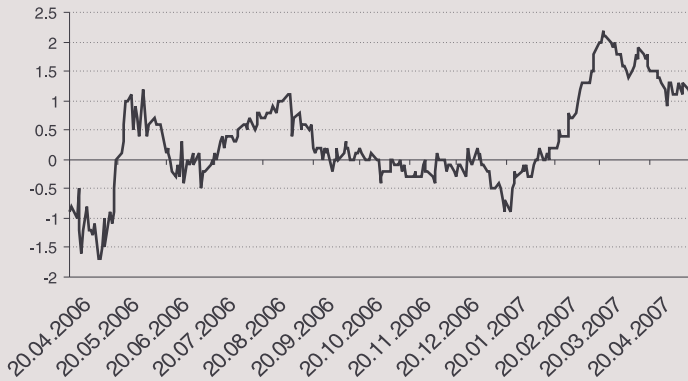
Positions may also be opened for reasons other than expected interest rate movements. Here, a higher relative return is sought by utilising the peculiarity of the fixed income market that yields fall with declining bond maturity (“riding the yield curve”). The steep part of the curve is used, or else funds from low yield sectors are used to finance purchases of higher yield sectors (“carry trade”). Some spread products may be added for a measure of credit diversification. The latter often involves products at the short end of the yield curve (up to two years) at the expense of government securities. Other things being equal, the spread risk in this part of the curve is low and relative return from is higher.

Box 9

A Position based on Future Movement
of Spread between two Securities

Analysing changes in the spread between a German and French security in the three year sector between April 2006 and May 2007 puts the mean for the period at (-0.004) b.p. When, on May 18th, 2006, the spread reached (-0.03) b.p., it was time to “buy the spread” (i. e., buy the German paper yielding 3.69 per cent, and sell the French paper with a yield to maturity of 3.66 per cent) and then close the position on June 16th, 2006 when the spread was 0.02 b.p.

Figure 33 Spread between 3-year French and German Bonds



Source: Bloomberg.

1.4. The Importance of Market Timing

Timing is a leading success factor in active strategies. Positioning earlier or later than interest rate or spread changes may impact overall relative return. Once a position is taken, it is most important to monitor market dynamics and effect corrections, or indeed close the position, if performance and/or risk are awry of portfolio managers' expectations within the investment horizon.

2. New Instruments Used in Active Strategies

Reserve management is a dynamic, continuously evolving process and the BNB constantly evaluates different approaches and methods to boost efficiency. In late 2004 the Bank began using interest rate and bond futures. Compared with securities, these instruments offered a rapid and more economical route to attaining desired exposure duration, yield and spread. This made them preferable in certain strategies. They are widely used in opening positions with horizons ranging from mere hours to a day or up to a week and resting on technical analyses or portfolio managers' expectations of data announcements. They may also be used in medium or long-term strategies such as ones resting on expectations of yield curve flattening in the two to ten year sectors. In the latter case, a short position in two year bond futures is taken simultaneously with ten year bond futures; the position may express some duration view or may be duration-neutral. Information systems are used intensively to determine the exact number of contracts to trade. Due to recent years' market depth in these instruments, liquidity risk is very close to that attending fixed income instruments.

3. Passive Strategies

If portfolio managers do not have a clear view on future market movements, or the risk budget is exhausted, a passive reserve management approach applies. No deviations from benchmark risk characteristics are made, the aim being to achieve a return very close to benchmark. There are different ways to proceed:

1. To buy the benchmark: all securities in the benchmark are bought, with the same weight as they have in it. Portfolio return is identical to benchmark and transaction costs are least due to low turnover. This is often hard to implement: the benchmark may contain many securities, some of which may be very illiquid.
2. Stratification: securities in the benchmark are grouped to certain criteria. Each group is presented in the portfolio by one or

more securities. Again the aim is to achieve the same risk characteristics as benchmark. Transaction costs are low again, but tracking error is greater due to the inherent presence of model error in grouping.

3. Buying some of the securities in the benchmark and attempting to emulate its major risk characteristics. This strategy is used more often at the BNB. The choice of securities is random, yet diverse methods of identifying “rich” or “cheap” securities are often applied. While transaction costs and tracking error are low, they are higher than in the above strategies. Moreover, there is the possibility of error in the quantitative methods used to evaluate securities. Valuation methods often applied at the BNB are based on swap curve or z-scores.

Box 10

Passive Strategy Implementation

New investment guidelines and a new benchmark for euro investment portfolios were introduced in late 2003 and early 2004. Starting to build the new portfolio, managers selected duration and convexity equal to those of the benchmark and low tracking error as their main objectives.

Due to huge transaction numbers and traded amounts, portfolio restructuring took three days. The instant to buy or sell securities often depended on portfolio managers' expectations of future market developments, mostly signalled by technical analysis. Different analyses were combined in choosing a particular security and determining if it was “rich” or “cheap”: spread against swap curve, fair value, and z-scores. Particular attention was paid to transaction costs to achieve an optimum result, with bigger or smaller purchases of different securities and careful investment and divestment timing.

When the new structure was complete, portfolio managers gradually turned to active strategies pursuing the objective of investment portfolios (achieving higher relative returns). This involved opening positions to duration, convexity and spread movements between different euro area sovereign debts or particular securities and spread products.

Systems developed by the Investment Division and the Risk Analysis and Control Directorate provide continuous monitoring and evaluation of investment results. These are compared to benchmark and

where they may fall short, or depending on market developments and managers' expectations, active positions may be closed or strategies changed. This may be with respect to assumed risks or absolute or relative exposure sizes. Control is examined in detail in Chapter 11.

Chapter 10

BNB Foreign Reserve Management Results

The results from the management of BNB's foreign exchange reserves are reported to the public in *Annual* and *Semiannual Reports*. Performance reviews over periods of more than a year provide an opportunity to reinforce comprehension of the specific terminology used, of all theoretical approaches, and of various relationships within the overall process of reserves management. It also allows better in-depth understanding of the economic purpose of foreign currency reserves and the significance of time in the overall process. This is why information on reserves here is structured differently to *Annual* and *Semiannual Reports*.

As explained in Chapter 7, the process of foreign exchange reserve management must be, and in the case of the BNB is, independent of the Bank's profit allocation policy. Therefore, the interpretation of the results of foreign reserve management does not include profit distribution and analyses of annual transfers to government. The latter is specified in Article 36 and Article 8 of the Law on the BNB and done as soon as the outcomes of reserve management are available.

Returns for the 2000 to 2007 period are presented below. The reasons why the entire period after currency board launch is not covered are:

- The ECB and the euro exist since 1999 and the former presence of a wide range of European currencies in the BNB's portfolio complicates analysis;
- BNB's awareness of best international practice in foreign reserves improved by degrees, with benchmarks being introduced in April 1999;
- Data on prior periods are restricted, due to the fact that the specialized foreign reserve management information system went live in early 2000.

1. Impact of the Market Environment on Reserve Management Returns

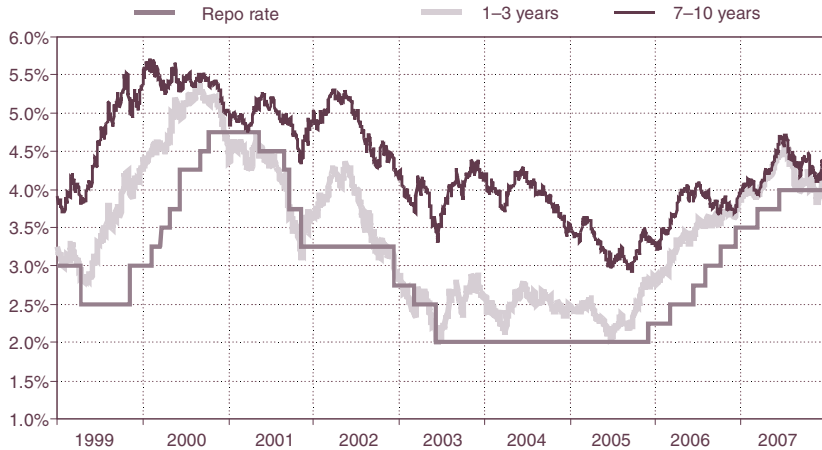
The BNB is not an institutional investor whose strategy centres on maximizing return; it is a central bank operating a currency board. Its primary goal is to maintain the stability of the national currency: foreign asset liquidity and security have priority. As explained in Chapter 7, the objective of optimum returns stems entirely from these priorities and is neither quantitatively nor legally set. This calls on the BNB to operate in money and fixed income markets with the lowest risk and highest liquidity, and in relatively short term and highly liquid sub-sectors of the government bond, state-guaranteed instrument, and covered bond markets. As a rule, conditions in these market segments depend very largely on changes in the monetary and interest rate policy of the two major central banks: the ECB and the Federal Reserve. Thus, monetary policy awareness is essential in managing foreign reserves as it has a direct effect on the portfolio performance.

As evident from the figures below, the nine years since the euro launch comprise two tightening (rising repo rate) and one easing cycles (falling repo rate). For two and a half years, between mid-2003 and late 2005, the ECB conducted expansionary monetary policy by maintaining the key rate at historical lows. Thereafter, a discrepancy arose between ECB announcements and decisions. Official and unofficial ECB statements in October and November 2005 did not indicate explicit intentions to change monetary policy stance. However, in December the Bank surprised market participants by raising the repo rate without signalling a new interest rate cycle. In advance in a similar manner, the Bank halted monetary policy easing in mid-2007 to alleviate the growing liquidity crisis on financial markets, without signalling the change beforehand.

At the outset of the same period the Federal Reserve Bank cut the fed funds rate more aggressively, keeping their target rate at the lowest possible level until mid-2004. Thereafter the Federal Open Market Committee raised interest in several consecutive steps by 25 basis points at each monetary policy meeting. To avoid potential yield curve

Figure 34

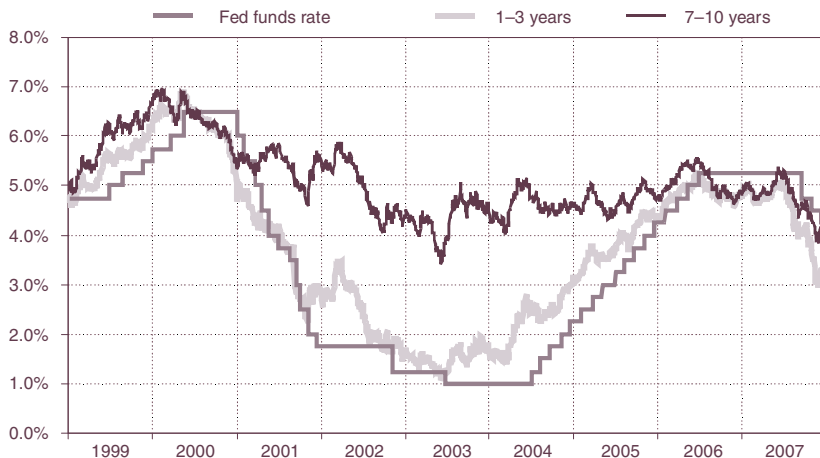
ECB Interest Rate Policy (Repo Rate) and Market Yield to Maturity of 1–3 Year and 7–10 Year European Government Bonds *



* The market yield of instruments maturing in under a year is very close to the repo rate and is not shown here.

Figure 35

Federal Reserve Bank Interest Rate Policy (Federal Funds' Target Rate) and Market Yield to Maturity of 1–3 Years and 7–10 Year Treasury Securities



volatility (see Figure 35), these steps were announced in advance. The cycle of interest rises ended in June 2006 when the key rate reached 5.25 per cent. At the very beginning of the financial crisis in August 2007, the Federal Reserve took decisive steps towards lowering the key rate in line with stated intentions and market expectations.

Short-term target rate levels determined by the ECB and the Fed directly influence interest on short-term interbank deposits, for example ones with maturities of up to a month. Historically low interest on the interbank market between mid-2003 and mid-2006 caused relatively low returns in this market segment. On the other hand, the financial crisis after summer 2007 inflated credit risk in this segment to unprecedented levels. This immediately hit major multinational banks where high degrees of risk were concentrated, primarily due to their securitising of US sub-prime lending. This caused the BNB to restrict its exposure to such banks' credit risk further, and to limit deposit durations. This cut risk, yet lowered return.

Since public debt restructuring in 2002 and 2003 in line with Law on the BNB Article 31, the BNB's portfolio has comprised almost exclusively euro assets. For this reason, the analysis of the market environment and its influence on returns from foreign reserve management is deliberately limited to euro denominated instruments.

As stated Part I, the other key factor determining return on the BNB reserve portfolio is how the low risk fixed income market for short-term government and state-guaranteed instruments interprets the two leading central banks' signals on monetary policy stance.¹⁴⁴ Other than expected short-term interest rates, yields on government bonds depend on evolving investor risk appetite: preferences for the relative safety of fixed income instruments or for alternative investment segments featuring higher risk but promising higher returns. The actual dynamics of coupon and market yield to maturity on fixed income instruments maturing in under a year and of ones maturing in one to three years are shown below.

¹⁴⁴ Based on daily figures on the European government bond market, compiled by *Merrill Lynch and Bloomberg*. The indices, composed of various government bond issues with specified maturity, are representative for risk (credit and interest rate risk) and market return in that segment over specific period of time.

Coupon Yield and Market Yield to Maturity

Figure 36 Government Bonds maturing in under a Year

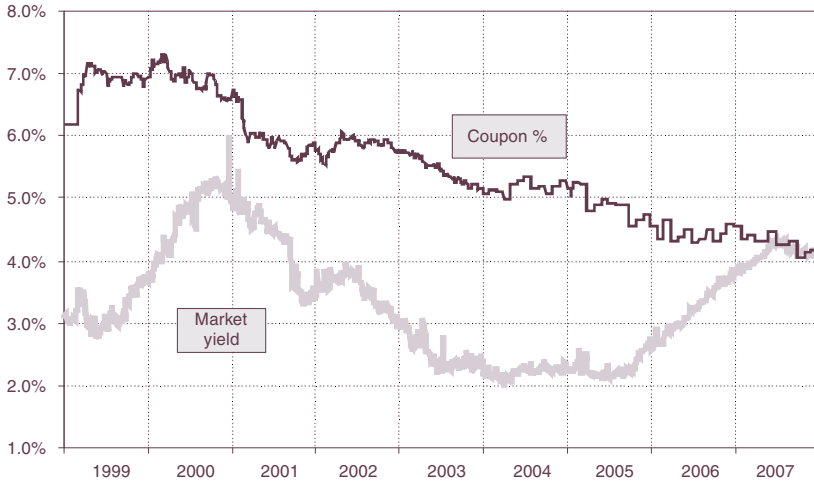
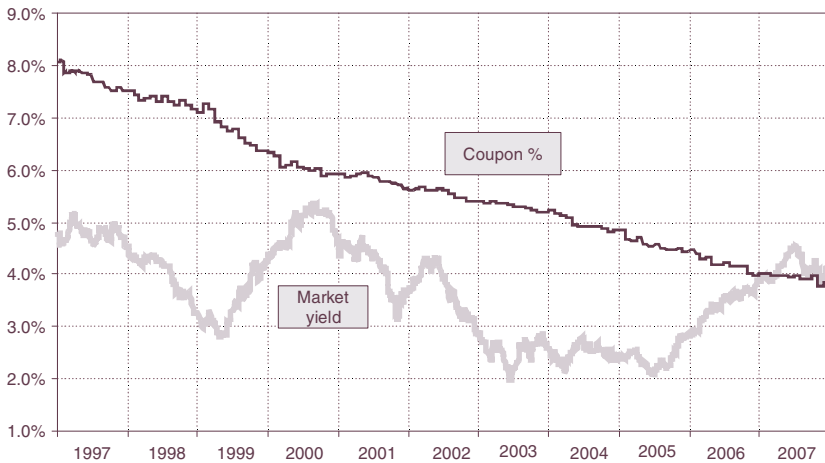


Figure 37 Government Bonds maturing in between one and three Years



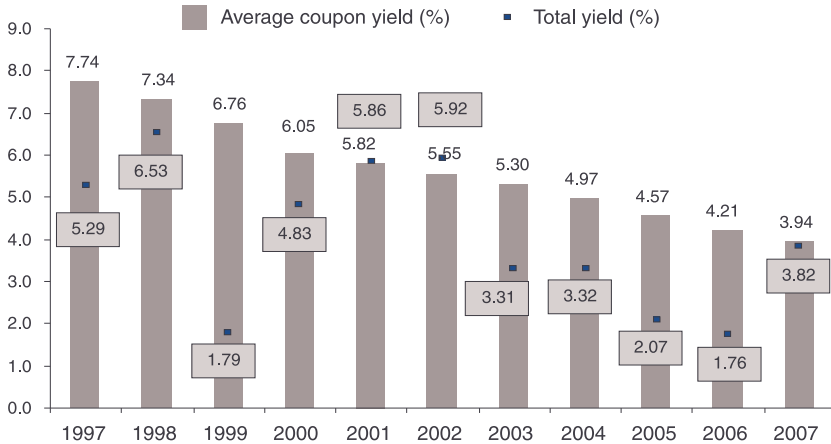
The graph above show a clear fall in coupon return during the review period. This is a segment in which the BNB operates actively. The trend is not substantially influenced by short-term interest changes (market yield to maturity), rather marking a transition from a period of high short-term interest rates to one of lower rates. Newly issued bonds, a much used instrument in the segment, pay a coupon close to their market yield to maturity and this is reflected in a decrease in average coupon yield. The decrease in coupon yield is observed across all maturity sectors (table 11) of fixed income instruments.

Table 11 **Average Coupon Rate for the Period in per cent**
(%)

GS maturing in:	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
up to 1 year	-	-	6.83	6.93	5.98	5.85	5.45	5.17	4.92	4.44	4.30
1-3 years	7.74	7.34	6.76	6.05	5.82	5.55	5.30	4.97	4.57	4.21	3.94
3-5 years	7.97	7.17	6.39	6.03	6.07	5.83	5.27	4.66	4.15	4.27	4.59
5-7 years	8.02	7.56	7.22	6.68	6.07	5.39	4.80	5.03	5.27	5.04	4.60
7-10 years	7.33	6.70	5.83	5.16	5.04	5.11	5.22	4.81	4.45	4.00	3.97

The one to three year sector has not returned negative total yield on an annual basis over the review period. Price yields in the sector have been low but still positive in two of the eleven years covered (2001 and 2002) (Table 12). Some market participants in the one to three year sector predicted the ECB's monetary policy evolution correctly (refer to figure 38). Thus, in late 1999 they foresaw the cycle tightening of early 2000, a year later foreseeing the easing of 2001. Other participants were not as successful in forecasting monetary policy evolution from late 2001 until mid-2002 or between the second half of 2003 and the first half of 2005.

Figure 38 Average Coupon Rate and Aggregate Returns on Bonds maturing in 1-3 Years



The aggregate annual yield on bonds maturing in more than three years was negative in at least one calendar year.

Table 12 Aggregate Yield over the Period (%)

Maturity sector	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	average
Deposits up to 1 month	4.26	4.21	2.82	4.21	4.41	3.31	2.35	1.93	2.08	2.84	4.05	3.11
up to 1 year (discount bills)	-	-	2.77	4.14	4.57	3.50	2.43	2.12	2.06	2.80	3.99	3.15
up to 1 year	-	-	2.93	4.18	5.03	4.15	2.59	2.17	2.06	2.75	4.03	3.32
1-3 years	5.29	6.53	1.79	4.83	5.86	5.92	3.31	3.32	2.07	1.76	3.82	3.62
3-5 years	6.63	9.75	-0.50	6.13	5.94	8.70	3.87	5.64	2.83	0.51	3.45	4.03
5-7 years	8.89	12.39	-2.31	7.31	5.81	10.67	4.22	7.60	4.11	-0.36	2.98	4.38
7-10 years	11.12	15.23	-4.69	8.51	5.23	11.85	4.54	9.40	6.01	-1.13	1.87	4.50

Notes: Average values for the period are derived by computing the geometric mean of the particular data set. Due to data shortages, average values for individual sectors combining maturities of up to a year are based on figures for the 1999 to 2007 period.

A more thorough overview of historical data suggests that the sector combining maturities of up to a year has never delivered negative aggregate returns, not even on a quarterly basis, unlike other sectors such as the one to three years (in two of 44 quarters), three to five years (in 11 of 44 quarters), five to seven years (in 12 of 44 quarters), and seven to ten years (in 13 of 44 quarters). However, due to the higher coupon rate *vis-a-vis* prevailing market yield to maturity in the sector, negative price yields obtained in 102 of the 108 months reviewed.

Historical market data on European investment grade bonds thus reinforces the theoretical assertion that in the long term relative to risk assets (here with shorter maturities) deliver lower returns against higher risk assets (here with longer maturities). The emphasis on the investment horizon is not accidental: it is obvious that there are certain periods in which yields on instruments carrying longer maturities have been significantly higher, and this is certainly no exception. The greater market risk (modified duration) in longer maturity term structures explains the greater dispersion (or risk) of investor-realised yield. The latter justifies the BNB's additional strategic positioning conservatism where greater price volatility is expected.

When ECB's and Fed's key rates reached historical lows in 2002 and 2003, analysts' uncertainty of future interest policy and of the length of new interest rate cycles increased considerably. At such junctures, re-evaluating investor risk tolerance is worthwhile. In early 2004 the BNB adopted a more conservative strategic asset allocation policy. The duration was also cut from a year to three months. The conservative practice was resumed in April 2006 when the ECB commenced a new cycle of interest rises signalled in advance to market participants. Amid financial market distress in August 2007 the Bank adopted additional safeguards against credit and interest rate risk.

2. Portfolio Risk and Return

Practice shows that among the various risk components¹⁴⁵ managed by the BNB, interest rate risk¹⁴⁶ and currency risk¹⁴⁷ have the most adverse impact on results. The impact of other types of risk (such as credit and operational) on overall financial performance is negligible because of adequate internal controls and procedures for timely identification and mitigation. The gold in the BNB's reserve portfolio exposes the Bank to currency risk (for details on this commodity, see Chapter 5). SDRs in US dollars and other currencies also expose the portfolio to currency risk, but to a lesser extent, especially after external debt restructuring and repayment of IMF loans¹⁴⁸.

Table 13 shows the targeted level of interest rate risk of sovereign euro-denominated bonds with different maturities¹⁴⁹ included in BNB benchmarks.

Table 13 Exposure by Sector and Average Interest Rate Risk of the Benchmark Portfolio of Euro Denominated Sovereign Bonds Issued by Euro Area Countries*

Investment horizon	Benchmark exposure in euro						Average modified duration of the sector								Average modified duration of the benchmark								EUR
	Sector						Sector								Sector contribution								
	Deposits	up to 1 y discount	up to 1 y	1-3 y	3-5 y	5-7 y	7-10 y	Deposits	up to 1 y discount	up to 1 y	1-3 y	3-5 y	5-7 y	7-10 y	Deposits	up to 1 y discount	up to 1 y	1-3 y	3-5 y	5-7 y	7-10 y		
1999	30%	20%	20%	20%	10%			0.00	0.38	0.50	1.77	3.38	4.75	6.51		0.08	0.10	0.35	0.34				0.87
2000		20%	50%		20%	10%		0.00	0.37	0.50	1.78	3.31	4.67	6.48		0.19		0.36	0.33				0.87
2001		20%	50%		20%	10%		0.00	0.37	0.49	1.74	3.40	4.86	6.55		0.18		0.35	0.34				0.87
2002		10%	7%	14%	24%	18%	19%	9%	0.00	0.36	0.51	1.72	3.36	4.87	6.54		0.03	0.07	0.41	0.59	0.91	0.61	2.61
2003		11%	8%	17%	23%	17%	18%	6%	0.00	0.36	0.48	1.80	3.51	5.03	6.67		0.03	0.08	0.42	0.59	0.89	0.40	2.41
2004		22%	31%	31%	10%	5%		1%	0.00	0.37	0.50	1.75	3.48	4.98	6.70		0.11	0.16	0.17	0.17		0.10	0.70
2005		14%	17%	18%	15%	25%	3%	9%	0.00	0.37	0.49	1.81	3.54	5.04	6.86		0.06	0.09	0.27	0.88	0.15	0.62	2.07
2006		28%	29%	23%	12%	3%		5%	0.00	0.37	0.50	1.74	3.47	5.01	6.90		0.10	0.11	0.22	0.10	0.00	0.33	0.87
2007		23%	36%	32%	9%	1%			0.00	0.37	0.48	1.74	3.46	4.97	6.86		0.13	0.15	0.15	0.04	0.00	0.00	0.48

* The BNB investment horizon was a year until the close of 2004 and three months thereafter.

Notes: Values are rounded and their sum does not equal 100. Under existing methodology the duration on deposits is equal to zero.

¹⁴⁵ Refer to Chapter 8.

¹⁴⁶ The possibility that the total value of assets might fall below the value of liabilities following unanticipated changes in interest rates.

¹⁴⁷ The possibility that the total value of assets might fall below that of liabilities as a result of exchange rate fluctuations.

¹⁴⁸ Bulgaria used accumulated fiscal reserves to repay its 357.9 million euro-worth of obligations to the IMF between early 2006 and mid-2007.

¹⁴⁹ For procedural reasons sector weights in Table 13 do not always form correct matches with given quarters. Thus the benchmark for Q1 of 2006 was enforced between 16 January and 6 April. Between 1 and 15 January the benchmark for Q4 2005 was still valid.

Active positions (see Chapter 9) taken by portfolio managers against the benchmark, explain differences between actual exposures of euro-denominated assets and the benchmark portfolio.

Figure 39 **Average Modified Duration (Interest Rate Risk) of Foreign Reserves**

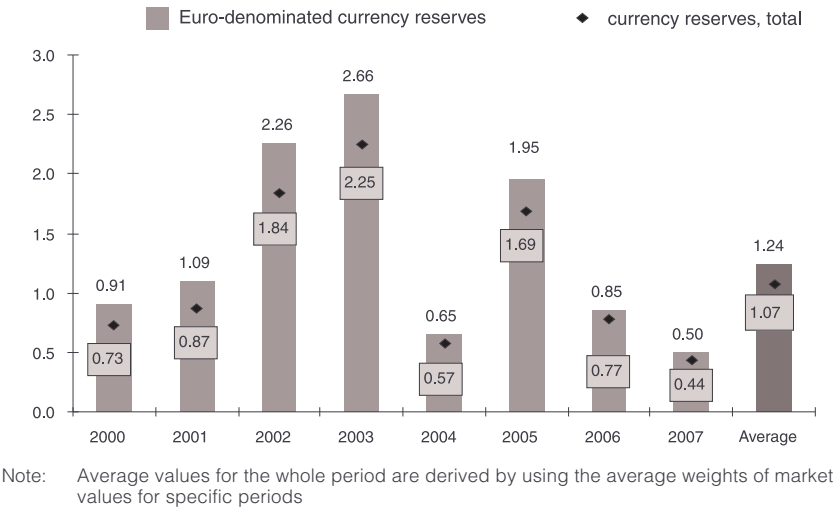
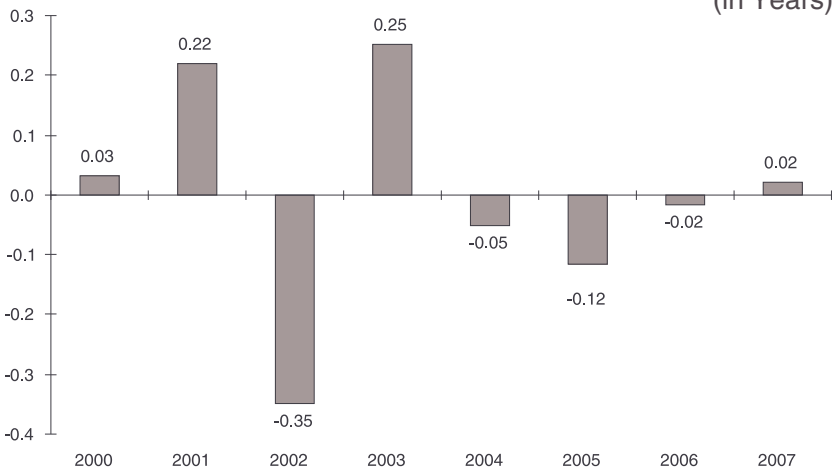
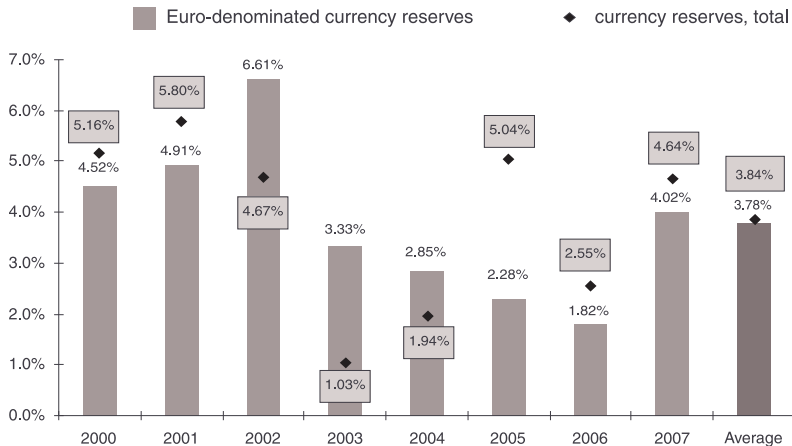


Figure 40 **Average Deviation of Modified Duration (Interest Rate Risk) of Euro Denominated Assets Relative to Benchmark (in Years)**



Return¹⁵⁰ on foreign reserves in the context of the risk characteristics discussed above is presented in Figure 41. Figure 42 presents average risk and return on BNB euro-denominated assets against average values for different market segments. Over the period the average duration of the BNB's investment portfolio was 1.24 years: below average for the market portfolio in the one to three year segment (1.76 years). At the same time, against the risk assumed, the income of 3.78 per cent generated by the reserve portfolio is very close to that generated by the market portfolio (3.85 per cent). Hence, returns on the reserve asset portfolio are entirely commensurate with those realised by the market against a comparable level of risk.

Figure 41 Realized Aggregate Returns on Foreign Reserves over the Period



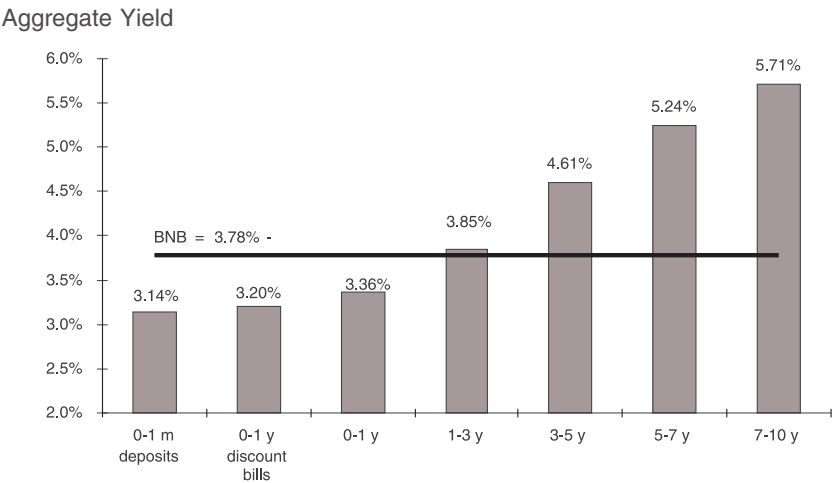
Note: Average values are geometric and unweighted.

Overall, the market rewarded investors for assuming greater interest rate risk during the review period. However, increases in interest rate risk and in returns were not proportional. If the BNB had invested only in term deposits (*i. e.*, had assumed only credit risk), annual yield would have been 0.6 per cent lower than achieved. If it had assumed

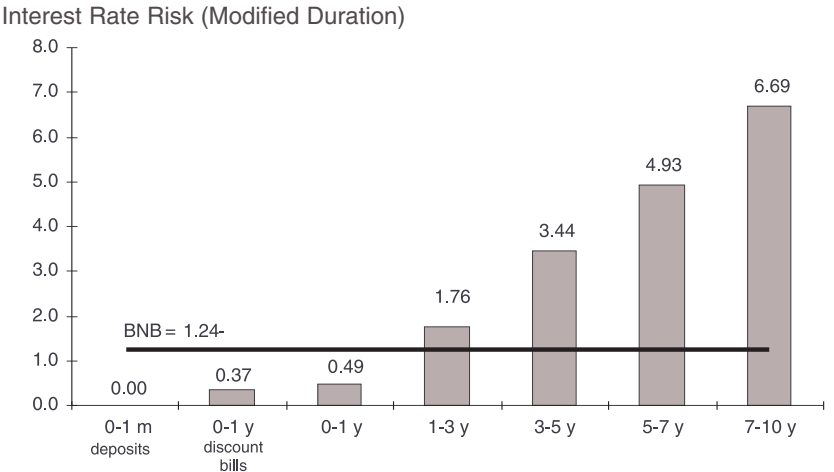
¹⁵⁰ Before operating expenses and not taking into account the net effect (paid/received) of taxes and commissions, punitive interest, lending securities, exchange rate differences and other factors.

more interest rate risk, though the average yield would have been higher, there could have been negative or zero return periods. This could have resulted in uneven income flows to the Ministry of Finance and invoked political consequences.

Figure 42 **Average Aggregate Yield and Interest Rate Risk**
of European Bonds and Euro-Denominated Assets
between 2000 and 2007



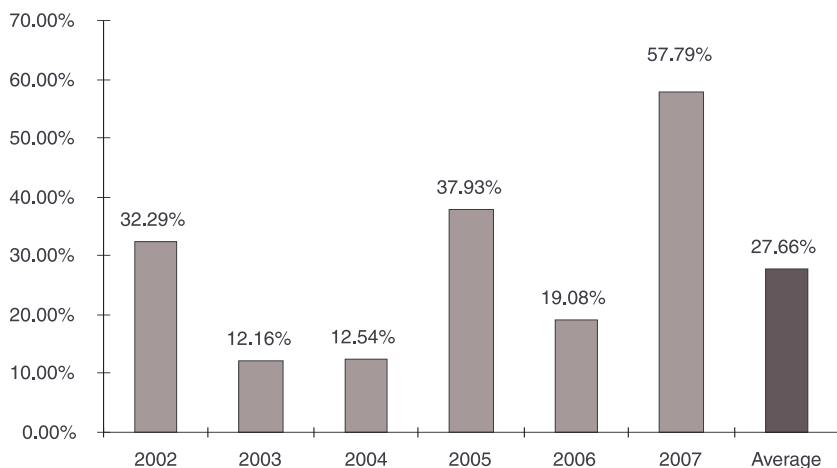
Note: Average values are geometric and unweighted.



Note: The average for the BNB is market value weighted.

Foreign reserve management effectiveness may be assessed through other indicators. Figure 43 shows income earned on the Banking Department¹⁵¹ deposit. From an economics' standpoint, this is the currency board's "return on capital" (Chapters 4 and 7). It is also influenced by expenses (interest paid) on Issue Department liabilities, currency mismatch and leverage on the Issue Department balance. Calculated this way, the average return on the foreign reserve portfolio over the past six years is 27.7 per cent: comparable to returns achieved by commercial banks (profit making institutions) in Bulgaria and the EU.

Figure 43 Returns on the Banking Department's Deposit



Note: The average values are geometric and unweighted.

The absolute return generated on foreign reserves over the period under review was 3366 million leva (1782 million euro), as shown in Figure 44.

¹⁵¹ Return on Banking Department capital deposited with the Issue Department (net official foreign exchange reserves) cannot be computed prior to 2002 due to insufficient data.

Figure 44 **Absolute Yield on Foreign Reserves**
(million BGN)

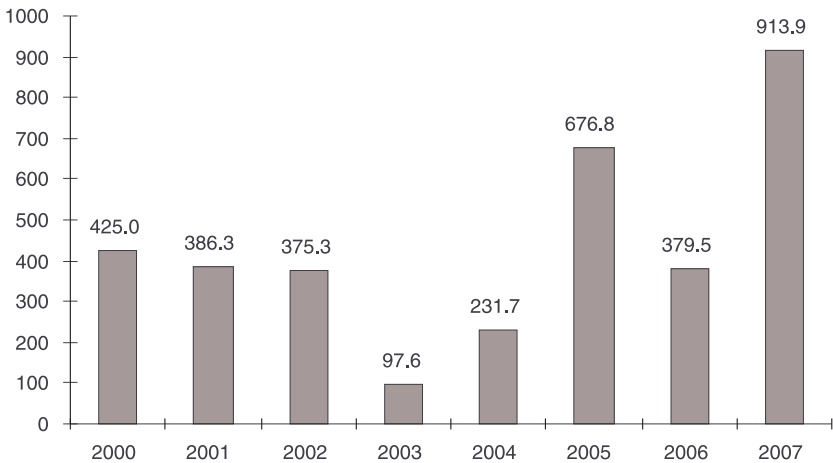
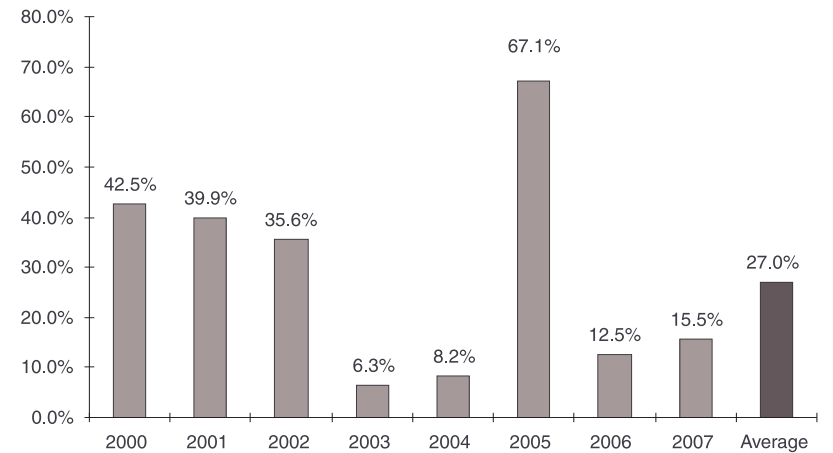


Figure 45 **Contribution of Returns to Foreign Reserve Growth**



Analysis of the liability structure shows that the key factors behind sustainable growth in the BNB's foreign reserve (Figures 45 and 46) are net purchases of reserve currency by the banking system and stable government finances. During the period under review the average contribution of yield to foreign reserves was 27 per cent. As may be expected, this is lower than the average achieved in periods of sharp increases of foreign reserves or during financial market fluctuations.

Because of LBNB's constraints on open foreign exchange positions, the currency composition of reserves is externally imposed and depends mainly on:

1. Government decisions on the currency structure of its deposits with the BNB.
2. The market value of gold.
3. The SDR-denominated exposure of the BNB to the IMF. Commercial banks' preferences as to currencies in which they preferred their minimum required reserves¹⁵² denominated, were also taken into account until mid-2005.

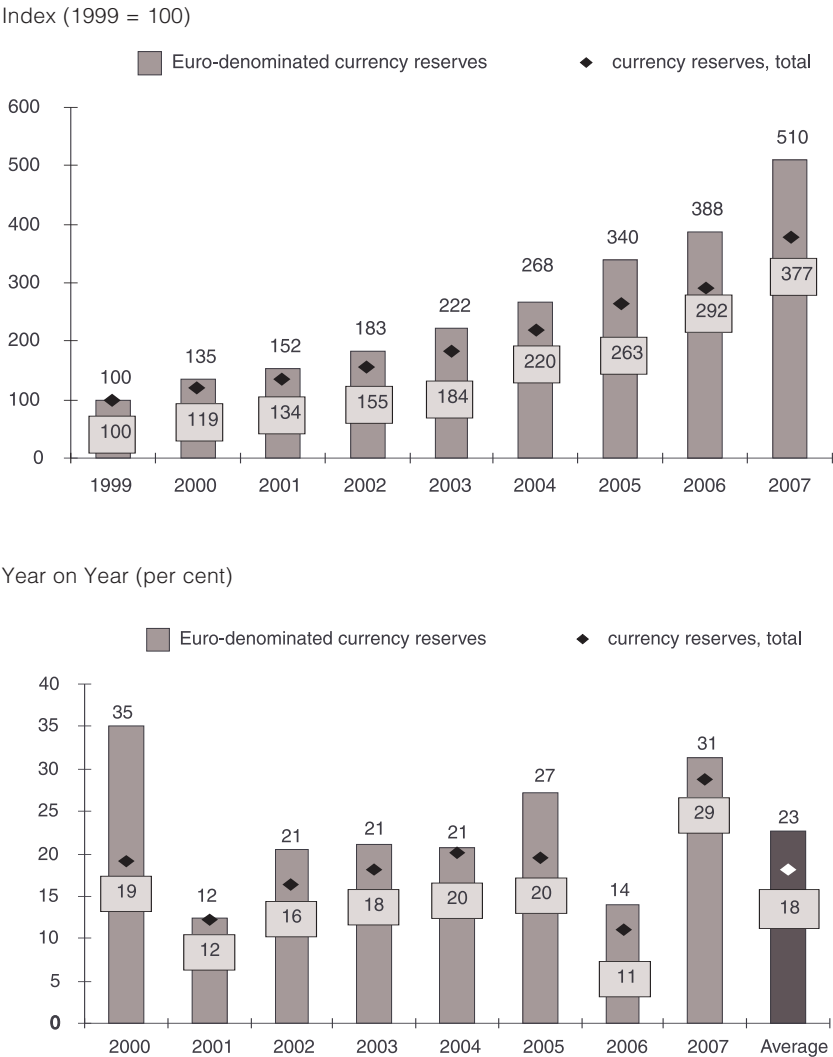
Table 14 **Average Market Value of Foreign Reserves over the Review Period**

Investment horizon	Average market value of foreign exchange reserves								
	million BGN					percentage share of total			
	EUR	USD	gold	other	total	EUR	USD	gold	other
1999	3 564	705	631	301	5 201	69	14	12	6
2000	4 814	489	759	137	6 199	78	8	12	2
2001	5 413	516	760	264	6 954	78	7	11	4
2002	6 527	572	823	165	8 086	81	7	10	2
2003	7 905	590	807	246	9 548	83	6	8	3
2004	9 541	613	827	482	11 463	83	5	7	4
2005	12 127	469	899	208	13 703	88	3	7	2
2006	13 835	81	1 203	92	15 211	91	1	8	1
2007	18 174	51	1 269	100	19 595	93	0	6	1

Note: Values are rounded and do not add to 100.

¹⁵²Until the close of 2004 Ordinance 21 on minimum required reserves allowed banks to hold reserves in US dollars, Swiss francs, euro, and leva. BNB Governing Council Resolution 135 of November 18th, 2004 ruled that banks may hold only leva and euro reserves.

Figure 46 Growth of the Average Market Value of Reserves



Chapter Eleven

Accountability

Reporting, control, and communication are important aspects of investing. Reporting is part of each stage. It enables operational analysis and inspection and keeps the Deputy Governor in Charge of the Issue Department abreast of developments. Reports about risk assumed and results obtained go to the National Assembly and the public semiannually. As shown in Figure 8, reporting and control close the loop of foreign reserve management. They are a basic means of limiting operational risk in foreign reserve management and an important means of retaining and boosting public confidence in the BNB and the monetary and foreign exchange regime.

1. Reporting

Reports of diverse scope and frequency, intended for different readerships, emerge at each stage of the investment process shown in Figure 8. Figure 47 below represents them diagrammatically. By frequency, they are immediate, daily, weekly, quarterly, semiannual, and annual. Except immediate reports, each covers a set level of detail, yet contains not less than: 1. currency, maturity structure by instruments in the reserve overall or in individual portfolios; 2. counterparty exposure; 3. portfolio and benchmark risk exposure and return; 4. analyses of markets, constraints and management effectiveness.

Immediate reports occupy the lowest, or operational, level and comprise technical data on each transaction's risk and return, plus changes to portfolio characteristics. These reports allow ongoing analysis of legal and operational constraints as regards currencies, instruments and counterparties, and of the current market environment, and thus offer the basis of continuous control over constraints by the head of the Investment Department and the Treasury and Risk Control and Analysis directors.

Daily reports are also at the operational level. Their purpose is to enable control by the BNB's senior operational executives. They cover both statutory and operational constraints and tactical investment decisions.

These two report types cover limited scopes of information and are mainly for the Bank's operational management. Under internal BNB rules, Governing Council and Investment Committee Members also have access to them.

Unlike immediate and daily reports, weekly and quarterly reports carry information on each of the four areas listed above. They are more general, however, and daily information or details of individual deals needs to amplify them for analysis purposes.

The BNB Semiannual and Annual Reports contain special analyses of foreign reserve management processes and outcomes. The Governing Council adopts them before formal tabling for deliberation by the National Assembly. The public has access to them and they are a statutory channel of communication between Bank, National Assembly, and public, offering public control over the BNB and promoting public confidence in the Bank and the monetary and foreign exchange regime.

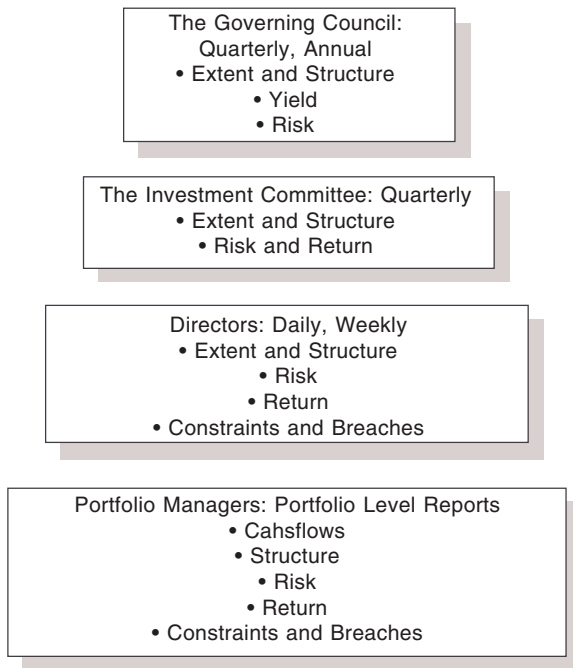
The above makes it clear that different reports have different readerships. Portfolio managers use mostly immediate and daily reports because they provide technical detail on portfolio risk characteristics, yield, and incipient changes on a deal-by-deal basis. Risk managers also generate and use immediate and daily reports on: 1. individual asset class exposures; 2. credit risk limits; and 3. individual counterparties. This, along with Analysis Division studies and assessments on the state and trends of international financial markets, helps the decision process at portfolio manager teams.

Senior and middle operational executives (the Governor, the Deputy Governor in Charge of the Issue Department, the Treasury Director and the Director of Risk Analysis and Control) use weekly reports. They comprise details of, *inter alia*, portfolio risk and yield, important accounting information, information on larger cashflows over the past day, data on operational errors, omissions, and excursions beyond limits, and document processing and settlement issues.

Other Governing Council Members and the Investment Committee use quarterly reports. They comprise detailed analyses of portfolio return and risk. Annual and Semiannual Reports include details of foreign reserve management and are ultimately intended for the public. Public accounts also appear on the Bank website and are available to all.

Figure 47

Summary of Periodical Reports



2. Control

Control over foreign reserve management at the BNB addresses several matters: investment constraints, documentation and settlement, and internal rules and procedures. The National Audit Office and the National Assembly Budgetary and Finance Committee exercise their own control over legal matters.

As the reporting pattern described above suggests, continuous control over investment constraints set by law or during strategic asset allocation is a basic part of the process of investing the BNB's foreign reserves. Investment constraints shape the frame of tactical asset allocation and portfolio management within which operational management acts. The avoidance of investment limit breaches in tactical asset allocation ensures the greatest degree of attainment of investment objectives within set risk tolerance and investment horizons.

Control over investment limits is the direct duty of the Risk Control Division, the Director of Risk Analysis and Control and the Deputy Governor in Charge of the Issue Department. Upon each transaction, officers check statutory credit and interest exposures and exposures determined at strategic asset allocation, in addition to monitoring them for each portfolio and for the Bank's general foreign reserve portfolio. A dedicated information module monitors Bank exposure to each counterparty. There is also a mechanism for direct control over constraints which affect BNB securities investment.

The internal document *Investment Guidelines and Benchmarks in Gross International Foreign Exchange Reserve Management* is a detailed and systematic description of investment constraints. Issued since 1999, it is updated after each amendment to the LBNB or to Bank investment objectives, changes in strategic asset allocation, and inputs from the Risk Control and Analysis Directorate. The document contains comprehensive schedules of issuers of licensed securities, commercial securities, Eurobonds, and schedules of BNB counterparties in securities and deposits. Chapter 7 has a summary of the major investment constraints in BNB foreign reserve management and the types of risk to which they relate.

As regards documentation and settlement, long established Bank practice entails the checking of foreign reserve transactions at several levels, with a balance struck between security, time, and operational spending. First level checks take place immediately after completion of each transaction and are by the Investment Department Manager or his/her Deputies. The basic parameters of all primary transaction documents are checked immediately afterwards by employees of the Liquidity and Risk Control Divisions. The former tally documents against relevant standards and settlement regulations, while the latter check them against legal and internal risk limits. This is prior to SWIFT settlement notices. The final check (payment authorisation) is at the Risk Control Division. Bearing in mind the hierarchical structure of these offices, the process guarantees complete separation between entering into transactions and settling the bill.

To limit legal risk in document processing and settlement, the BNB adheres strictly to accepted international standards and conventions on transaction conduct. In individual cases the Bank may agree with counterparties in advance on whether deals will be under Bulgarian, US or EU/Swiss financial law. The BNB works largely with US and European issuers who have credit ratings which meet or exceed statutory minima. If new instruments are introduced or new issues are launched, the BNB may facilitate document processing and settlement by instructing reputable international law practices who service world markets to represent it under framework representation contracts.¹⁵³

It is important for control to be sequenced properly and conducted continuously across all stages of the investment process, with clear divisions of responsibility. The BNB manual described above guarantees this. It has detailed descriptions of each stage of investing, the responsibilities of individual employees, the constraints imposed, and control forms and organisation, all with a view to managing the diverse types of risk. The exceptional degree of liquidity which the law requires of the BNB foreign reserve is best attained by following pro-

¹⁵³ A legal consultant is also employed at the office of the Deputy Governor in Charge of the Issue Department. In addition, since 2004 the Investment Committee has co-opted BNB executives with senior qualifications in international law.

cedures¹⁵⁴. They provide rule-based foreign reserve management which is accountable to the Governing Council, internal and external BNB auditors, the Republic of Bulgaria Audit Office, international financial institutions, and the public.

A basic tenet in the manual is to ensure thorough compatibility between procedures at different levels. Procedures stemming directly from the LBNB have the greatest precedence. Next come procedures set by the Governing Council or the Deputy Governor in Charge of the Issue Department in formulating investment objectives and strategic asset allocation. Thus, procedures are hierarchical and each Bank employee who deals with the foreign reserve is assured of working in an environment free of ambiguities.

3. Communication

As stated above, BNB Annual and Semiannual Reports are the basic means of communicating the process of investing the foreign reserve to the public. Publishing them is a statutory duty of the BNB, and their contents match or improve the financial understanding of the public. This means that ordinary people receive regular advice on foreign reserve management coached in accessible language which enables them to exercise their sovereign right of controlling Bank performance subject to currency board rules.

The Governing Council has set the structure, form, and contents of those parts of Annual and Semiannual Reports which deal with foreign reserve management by reference to recommended international practice for similar documents. Most generally, these parts describe the current extent of the foreign reserve, changes in it, risk and yield characteristics of individual portfolios, results of the investment process, and analyses of its efficiency to internationally adopted criteria and indicators. BNB Reports state the Governing Council's standpoints on the issues above and are tabled before the National

¹⁵⁴ The *Investment Constraints and Benchmarks in Gross International Foreign Exchange Reserve Management* manual cannot be published for security reasons lest potential international financial market developments lead to procedures in it being subverted in speculative attacks on the lev, on national monetary policy, or on the foreign exchange regime. This is entirely in line with recommended international investment practice and does not indicate any lack of transparency.

Assembly for deliberation and adoption. They are published on the BNB website within the statutory time span of 120 days from the end of each accounting period. This enables public debate on BNB policy, while international comparability of results helps BNB integration into international financial bodies and the ESCB.

Another statutory form of external communication is the weekly publication of the Issue Department balance sheet which contains specific information on foreign reserve liquidity and the structure of monetary obligations covered by it. To support and boost confidence in the currency board, this weekly balance is posted on the BNB website and national newspapers each Monday.

The third form of external communication involves exchanging information with BNB counterparties. BNB policy on the matter is set out in an internal document which details the types of information the Bank discloses and requires to and from counterparties, and at what frequencies. Daily communication with counterparties is via the Risk Control Division.

Formal internal communication on foreign reserve management is through immediate, daily, weekly, monthly, and quarterly reports, and through Investment Committee opinions. That Committee sets the form and contents of these opinions subject to approval by the Deputy Governor in Charge of the Issue Department.

Weekly, monthly, and quarterly reports circulate to Governing Council and Investment Committee Members. Further to these reports, over recent years the Deputy Governor in Charge of the Issue Department has presented personal quarterly analyses of foreign reserve management to the Council for advice and deliberation. These analyses usually publish in the month following calendar quarter months.

Since 2004 the Deputy Governor in Charge of the Issue Department has, prior to each calendar quarter, presented to the Governing Council for deliberation a personal report on expected international financial market developments, and Investment Committee recommendations as to benchmarks and portfolio horizons. This aims to improve Governing Council awareness of the Deputy's operational

decision making under LBNB Article 12, paragraph 2 and Article 20, paragraph 1.

Investment Committee deliberations of quarterly reports on foreign reserve management and Committee recommendations on benchmarks and portfolio horizons are important stages in internal communications. The Risk Control and Analysis Directorate develops and tables opinions, with the Committee seeking consensus in forwarding recommendations to the Deputy Governor. Discussion is also an important part of the training of BNB employees whose duties are not directly linked with reserve management.

Since information on the foreign reserve is publicly and market sensitive, the Bank considers that it ought not to be aired at irregular and informal fora such as press conferences, media interviews or articles to avoid unconscientious, hostile, or incompetent interpretations. Only the Governor or the Deputy Governor in Charge of the Issue Department may release such information. Where third parties may handle it, they are expected to cite precise sources. For the purposes of communication, the BNB manual specified degrees of information classification and access rules by individual employee. Matters not covered there are subject to the general ethics of BNB staff.

Chapter 12

IT Aspects of BNB Foreign Reserve Management

Effective foreign reserve management to recommended international theory and practice is impossible in today's international financial markets without modern information systems. In 2005 the Bulgarian National Bank had the opportunity of choosing from three information system alternatives: one developed in-house, one off-the-shelf from a reputable supplier, or one combining elements of both. Each option had pros and cons.

A system developed in-house would best match the Bank's specific needs. Development would, however, be prolonged since software writing is not a Bank core strength and there could be a paucity of human resources for such a complex task. An off-the-shelf system would save time and perform professionally, yet could fail to address the Bank's specific requirements. In addition, it would be expensive and its future development might not match the needs of any particular bank. An external main system combined with custom modules and subsystems developed in-house could be the most functional compromise, yet it carried the risk of diluted integrity. The BNB traversed a long road in search of an optimum IT platform solution for its foreign reserve.

1. An In-House Developed Information System

After careful study of the pros and cons of different approaches, in 1999 the BNB decided in principle to buy an off-the-shelf information system for its reserve management from a supplier of good international standing. Shortages of trained personnel and developed investment routines soon after currency board launch presented difficulties, however, especially in drawing up precise specifications. This stayed the Bank from proceeding quickly with the purchase. Instead, in 1999 a small team of three software specialists and risk managers

came together to design an in-house system.

The team's immediate goal was to describe the structure of processes and information flows and design a system capable of basic risk and performance measuring and reporting. Another important objective was to analyse and define the information needs of different BNB units involved in managing foreign reserves. The ultimate objective was to ensure effective risk management in line with the 1997 Law on the BNB.

Development of the in-house system continued until late 2005. By then, its functionality covered practically all basic information needs of units involved in managing foreign reserves. Meanwhile, through participating in the World Bank Treasury's RAMP training programme, the BNB accumulated considerable knowledge of foreign reserve management theory and practice, as well as of relevant IT systems and their capacity for managing risk in real time. In 2005 the BNB obtained European System of Central Banks observer status, gaining opportunities to increase knowledge and experience of reserve management IT platforms used by EU central banks, including access to qualified expert opinions on such platforms.

2. The Trema Information System

Once it was satisfied that the Bank has sufficient reserve management knowledge, a developed investment policy and procedures, and experienced staff capable of briefing potential suppliers, in 2005 the Governing Council decided to proceed with the selection of an off-the-shelf IT system. The motives for the decision highlighted the expected benefits of the external *versus* the in-house system:

- Ability to measure risk exposures and control compliance with risk limits in real time;
- Ability to offer Straight-Through Processing (STP);
- Ability to use a wide range of new financial instruments whose inclusion into the existing system would be prolonged;
- Speed and reliability;
- Elimination of reputation and operational risks which may arise

if the developers of the in-house system left the Bank.

Selection of the system involved two stages involving a public tender announcement in 2005 and detailed selection. First, the BNB studied information systems used by other EU central banks, identifying three systems suited to the needs of foreign reserve management under a currency board and to Eurosystem requirements. Second, vendors were invited to tender with details on functionality, technical features, user support, and price. Responses were evaluated on the basis of pre-announced criteria by an expert committee representing all BNB units involved in foreign reserves management. The final evaluation was presented with an opinion to the BNB Governing Council for decision.

The Finance KIT system by Trema (Europe) of Sweden¹⁵⁵ was deemed best suited to the BNB's functional and technical requirements, both as regards the currency board and future Eurosystem participation. The system was most widely used by Eurosystem central banks, including the European Central Bank. It took ten months from early 2006 for the system to go live. The preparatory period involved parallel use with the existing system from early 2007.

The selection of an information system used by many European System of Central Banks (ESCB) members offers opportunities for further cooperation and synergy. By joining forces these banks can attain a better relationship with the vendor, improving financial and other conditions for future versions of the system.

Finance KIT is an integrated system for financial institutions. It includes various portfolio management modules and supports a wide range of financial instruments with processing and settlement, risk management, and accounting modules. Individual modules may be purchased and incorporated separately to specific user requirements. The solution purchased by the BNB has a user configuration specific to the Bank. It reflects experience gained by a number of central banks and is consistent with the principles of foreign reserve management.

¹⁵⁵ When the US company Wall Street Systems took over Trema in July 2006, all elements of the Support and Service Agreements were transferred without any consequences for the Bank.

Figure 48 Main Functionalities of the IT System

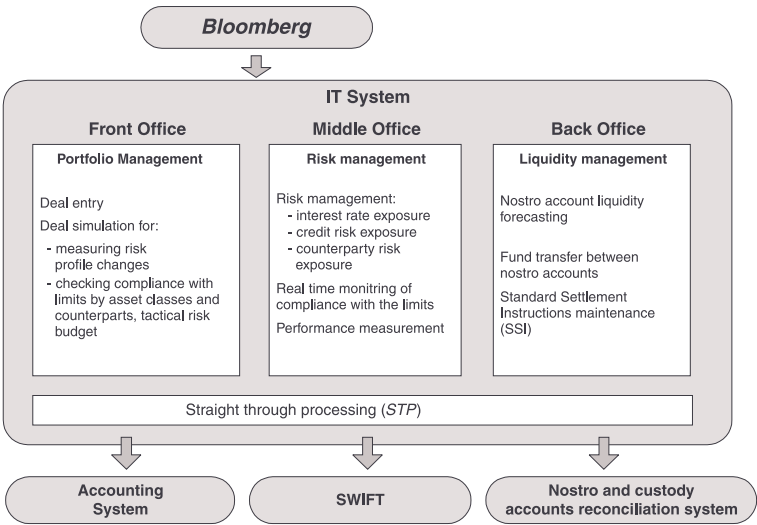


Figure 48 shows some key features of the system grouped by individual units and interfaces to other systems. The diagram shows how the system covers foreign reserve portfolio management (front office), risk management (middle office), and liquidity management (back office).

Though Finance KIT integrates foreign reserve management to the utmost, many other information systems still work alongside it:

- The Bloomberg system supplies, *inter alia*, news and market data on financial instrument prices, yield curves, and exchange rates. This information allows Trema to perform market valuations of portfolios and measure risk exposures in real time, allowing portfolio managers to simulate securities transactions before entering into deals, and to forecast risk profiles after transactions. Moreover, the system automatically checks whether and to what extent proposed deals may breach limits or tactical risk budgets. The Bloomberg system also contains a database allowing monitoring and analysis of historical risk and return levels;
- The SWIFT system has an interface for confirming deals and issuing payment orders;

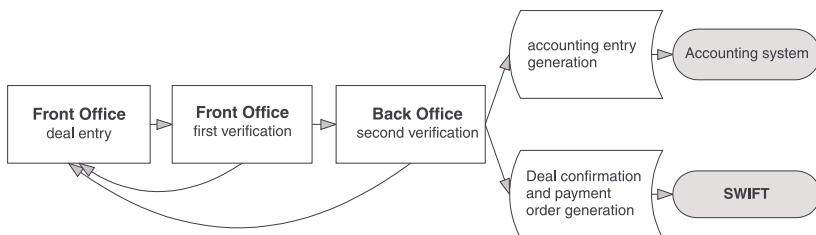
- The BNB accounting system for transferring data on reserve operations to the general ledger and the balance sheet. An important advantage of the new system is that it has a dedicated European Central Bank accounting module enabling accounting entries for all processes in ECB format. This will facilitate BNB entry into the Eurosystem;
- The system for reconciling nostro and custody accounts compares reserve management data with data from correspondent banks in which the BNB keeps nostro accounts and accounts for the custody of securities, ensuring information integrity.

An important risk management functionality provided by the system is automatic real time monitoring of limit compliance and tactical risk budget. In addition, the system calculates *ex-ante* risk: portfolio risk attending current positions.

The system offers straight through processing (STP; Figure 49) in liquidity management and transaction settlement. This features a single transaction input point at the front office; all further settlement details are generated without manual intervention and cash flows are updated in real time for efficient liquidity management. STP limits operational risk in transaction processing. As transactions are processed after entry in the front office, they are checked for errors but cannot be modified in error. The BNB has adopted the “four eyes” principle which means that the integrity of each transaction is verified by two employees besides its initiator. This minimizes errors, with the system generating confirmations, payment orders, and attendant

Figure 49

Straight Through Processing (STP)



accounting entries automatically. Where an error may be found by the two controllers, the system returns the transaction to its initial phase for correction.

Chapter 13

Foreign Reserve Management under a Currency Board amid Integration into the European System of Central Banks

This chapter aims to present the process of managing foreign reserves in the Eurosystem¹⁵⁶. We elaborate on the tasks of central banks in that system and on the integration objectives of the Bulgarian National Bank. The starting point for the analysis is the requirement for the BNB to work consistently towards full membership in the Eurosystem: one of the main duties set out in Maastricht Treaty Chapter 122 on the single European currency.

1. Foreign Reserve Management in the Eurosystem

The foreign reserves of the Eurosystem comprise those of the ECB and of the central banks in that system. At the close of 2007 they came to 347.4 billion euro, including 138.2 billion in foreign reserves and 209.2 billion euro in gold, Special Drawing Rights and reserve positions at the IMF.

ECB portfolio managers manage three portfolios with strictly defined (and different) investment objectives and risk tolerances. At the end of 2007 the foreign reserve portfolio had a market value of around 42.8 billion euro of which 32.1 billion euro were in USD and JPY and 10.7 billion euro were in gold, Special Drawing Rights and reserve positions at the IMF. The portfolio of the ECB's own funds had a market value of some 9.3 billion euro, and the pension fund portfolio was worth 161.2 million euro¹⁵⁷.

¹⁵⁶ The Eurosystem comprises the European Central Bank and the national central banks of euro area member states.

¹⁵⁷ The ECB pension fund portfolio comprises pension payments by ECB employees. The investment goal of that portfolio is to maximize the market value of assets and minimize the risk of liabilities on the balance sheet exceeding assets. The portfolio is managed by external managers selected by the ECB through procurement procedures.

Figure 50 Structure of the foreign reserves of the Eurosystem

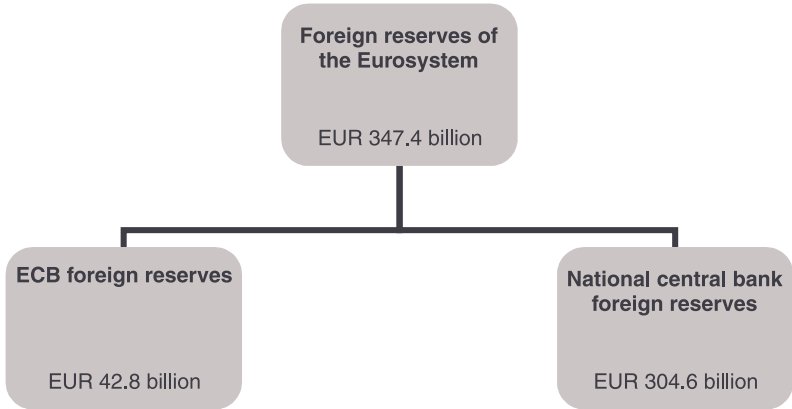
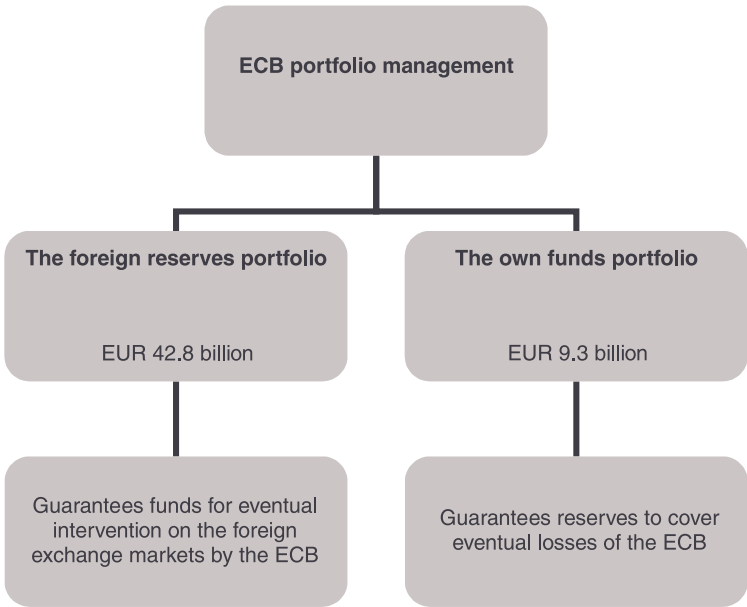


Figure 51 ECB portfolio management



The three portfolios of ECB reserves are managed in different ways and by different portfolio management teams, subject to several common objectives:

- The primary objective is to achieve the highest possible return on managed assets, taking into account the specific objectives and functions of the separate portfolios.
- Strictly defined rules have the object of avoiding the exercise of influence on financial markets. ECB portfolio managers are allowed to trade only highly liquid fixed income instruments whose prices cannot be affected by single transactions.
- A strict code of professional ethics defined by an ECB code of conduct and professional rules of confidentiality have the object of preventing trading based on inside information.
- A meticulous division or “Great Wall” separates portfolio managers from other Bank personnel, halting access by portfolio managers to information from other Bank divisions to prevent conflicts of interest.

Risk management and accounting processing of ECB transactions are centralized. The object is to monitor precisely what market risks are assumed by ECB portfolio managers and by national central bank managers acting on behalf of the ECB. Risk management rules include strict fulfilment of predefined risk limits, applying the mark-to-market approach of profit and loss measurement, and assessing performance against a model-based strategic benchmark. To exclude conflicts of interest, critical risk management items such as strategic benchmark approval and profitability or loss indicators are reported directly to the ECB Governing Council.

The ECB has developed distinct approaches to managing the different portfolios. The foreign reserve portfolio was created by the transfer of foreign reserve assets by national central banks to the ECB. Its market value reflects the market values of its constituent assets and the outcomes of gold and foreign exchange operations. The primary goal of the portfolio is to make available sufficient liquid assets in currencies other than the euro for rapid interventions on foreign exchange markets. To date the ECB has not intervened on

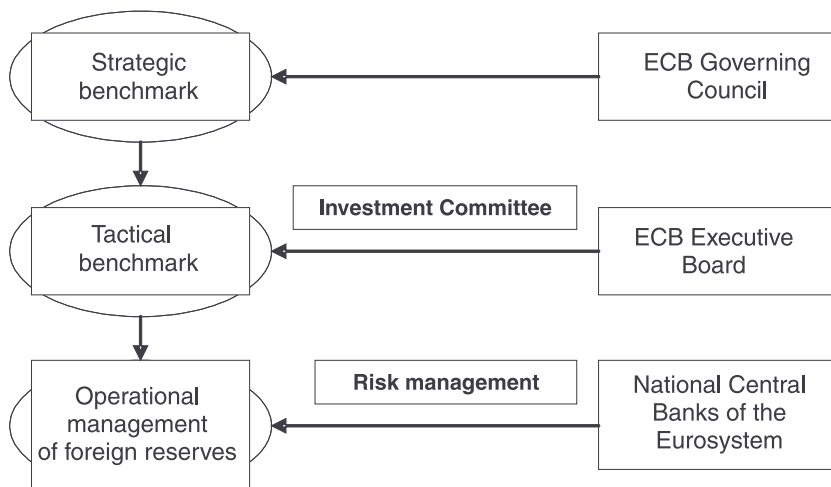
these markets which fluctuate in line with market forces of supply and demand. Foreign reserve portfolio managers follow three objectives ranked by importance: liquidity; security; high return. They follow a decentralized approach involving setting a strategic and a tactical benchmark, and also involving licensing portfolio managers at national central banks to achieve higher returns than these benchmarks.

The goal of ECB reserve portfolio managers is to attain higher returns than the strategic benchmark. This benchmark is structured to a proposal from ECB Risk Management Department and approved by the ECB Governing Council. The strategic benchmark reflects ECB long term risk tolerance and the Bank's view on the expected return on the foreign assets in the portfolio. Portfolio managers propose the assumption of tactical trading positions within predefined risk limits, the goal being higher returns than the strategic benchmark. It is these trading positions which comprise the aforementioned tactical benchmark, defined in its turn by the ECB Investment Committee and approved by the Executive Board. This tactical benchmark represents ECB risk tolerance and short-to-medium term return expectations.

The mandate of portfolio managers at national central banks, who are responsible for the operational management of foreign reserves, is to pursue higher return than the tactical benchmark. It is these managers who are the actual participants on financial markets on behalf of the ECB and the settlement of all transactions is executed at Eurosystem national central banks. The ECB foreign reserve management information system accumulates and analyses data from all transactions at the Bank's head office in Frankfurt.

A "specialization model" implemented in 2006 has increased ECB foreign reserve management effectiveness. This allows each national central bank to specialise in managing a single portfolio denominated in USD or JPY. In January 2007 the Slovenian and Luxembourgish central banks combined efforts by pooling their foreign reserve portfolios. They were followed by the Maltese and Cypriot central banks which joined the Eurosystem on 1 January 2008.

Figure 52 Investment Process Scheme of the ECB Foreign Reserve Management



Source: ECB.

The goal of the ECB's own funds portfolio management is to maximize expected return subject to no loss constraints at set discretionary intervals. The portfolio comprises euro-denominated assets. At the close of 2005 its market value was around 6.4 billion euro, increasing to 9.3 billion euro two years later. The portfolio is intended to cover potential losses and to cover ECB operating expenditure. The own funds portfolio comprises ECB equity payments by national central banks and ECB reserve funds intended to cushion potential losses from fluctuations of exchange rates, interest rates, or the gold price.

Paid up ECB equity stands at euro 4,014.961,580.45 of the Bank's overall equity of euro 5,760,652,402.58, with the following national bank shares:

Table 15

ECB equity subscriptions
by euro area national central banks

National banks	% of capital	Paid-in capital (euro)
<i>Nationale Bank van Belgie / Banque Nationale de Belgique</i>	2.4708	142 334 199.56
<i>Deutsche Bundesbank</i>	20.5211	1 182 149 240.19
<i>Bank of Greece</i>	1.8168	104 659 532.85
<i>Banco de Espana</i>	7.5498	434 917 735.09
<i>Banque de France</i>	14.3875	828 813 864.42
<i>Central Bank and Financial Services Authority of Ireland</i>	0.8885	51 183 396.60
<i>Banca d'Italia</i>	12.5297	721 792 464.09
<i>Central Bank of Cyprus</i>	0.1249	7 195 054.85
<i>Banque centrale du Luxembourg</i>	0.1575	9 073 027.53
<i>Central Bank of Malta</i>	0.0622	3 583 125.79
<i>De Nederlandsche Bank</i>	3.8937	224 302 522.60
<i>Oesterreichische Nationalbank</i>	2.0159	116 128 991.78
<i>Banco de Portugal</i>	1.7137	98 720 300.22
<i>Banka Slovenije</i>	0.3194	18 399 523.77
<i>Suomen Pankki – Finlands Bank</i>	1.2448	71 708 601.11
Total	69.6963	4 014 961 580.45

Source: ECB.

The eleven national central banks not yet in the Eurosystem but in the European System of Central Banks (ESCB), have also paid a percentage of their ECB equity shares. They do not receive dividends and are not liable to cover potential losses. Since January 2008 their share of paid-up capital is 7 per cent or euro 122,198,357.54 split as follows:

Table 16 **ECB equity subscriptions by national central banks
outside the euro area**

National banks	% of capital	Paid-in capital (euro)
<i>Danmarks Nationalbank</i>	1.5138	6 104 332.92
<i>Sveriges Riksbank</i>	2.3313	9 400 866.26
<i>Bank of England</i>	13.9337	56 187 041.67
Total	17.7788	71 692 240.85
Bulgarian National Bank	0.8833	3 561 868.99
<i>Ceska narodni banka</i>	1.3880	5 597 049.87
<i>Eesti Pank</i>	0.1703	686 727.37
<i>Latvijas Banka</i>	0.2813	1 134 330.06
<i>Lietuvos bankas</i>	0.4178	1 684 760.40
<i>Magyar Nemzeti Bank</i>	1.3141	5 299 051.33
<i>Narodowy Bank Polski</i>	4.8748	19 657 419.83
<i>Banca Nationala a Romaniei</i>	2.5188	10 156 951.89
<i>Narodna banka Slovenska</i>	0.6765	2 727 956.95
Total	12.5249	50 506 116.69
Total	30.3037	122 198 357.54

Source: ECB.

The balance of EU member states' foreign reserves (those not in ECB portfolios) are held and managed by national central banks. At the close of 2007 their market value was some euro 304.6 billion, of which 106.1b was denominated in foreign currencies and euro 198.5b was in gold and Special Drawing Rights. Since the ECB would use its own foreign reserves in interventions, the purpose of these reserves has changed. Nevertheless, national central banks' foreign reserves may also support the euro upon ECB request.

Before they intervene on foreign exchange markets in managing their foreign reserves, national central banks in the ESCB need ECB approval. This secures the conduct of a single European monetary and currency policy. It concerns all transactions which may affect the foreign exchange market and the liquidity of the Eurosystem money market. National central banks do not need ECB approval to invest foreign reserves and to transact obligations to the BIS and IMF.

2. Forthcoming Obligations of the BNB

The Bulgarian National Bank is part of the European System of Central Banks and owns equity in the ECB. In accordance with the Statute of the European System of Central Banks' Chapter 29, the algorithm for participation in ECB equity is the weighted average of the share of the particular country in EU population and GDP, both variables given equal weight. The capital key is recalculated quinquennially and at each EU enlargement, with last recalculation in January 2007 when Bulgaria and Romania joined. In accordance with Statute Chapter 49.3 ESCB enlargement also increased ECB capital from euro 5,565,000,000 to euro 5,760,652,402.58. The BNB equity is 0.8833 per cent or euro 50,883,842.67. With Bulgarian accession on 1 January 2007 the BNB paid down 7 per cent of this, or euro 3,561.868.99. Under Statute Chapter 49 the BNB has to pay the balance of ECB equity or euro 47,321.973.68 on joining the Eurosystem. The payment will be into the ECB own funds portfolio, managed by ECB portfolio managers.

In addition Statute Chapter 30 requires national central banks to transfer part of their foreign reserves to the ECB upon Eurosystem accession. These funds become part of the ECB foreign reserve portfolio and are calculated on the basis of banks' ECB capital keys and the value of national foreign reserves. The ECB foreign reserve portfolio continues to be managed by portfolio managers at national central banks and comprises USD and JPY denominated securities (depending on specialisation) and gold. The durations of securities transferred to the ECB foreign reserve portfolio ought not to deviate from the predefined limits of tactical benchmark durations. On the day of transfer national central banks need to advise their custodians of the securities' changed titles. Since 2006 national central banks have been able to cede foreign reserve portfolio management to the ECB or to seek joint management with other central banks.

Overall, Bulgarian accession to the Eurosystem would not call for profound change in the operational framework of BNB foreign reserve management. The Bulgarian National Bank has established a flexible infrastructure for this management, and one similar to that of the ECB.

Advanced foreign reserve management IT systems are in place and the Bank's portfolio managers are highly trained and experienced. The Bank invests constantly into increasing the knowledge and skills of employees involved in foreign reserve operational management. Upon Eurosystem accession BNB portfolio managers would exchange experience with colleagues in charge of managing ECB foreign reserves at other national central banks. Two BNB portfolio managers have already had the opportunity of working at the ECB for different periods.

The BNB would continue managing Bulgarian foreign reserves outside the ECB balance sheet, to rules identical to those prior to Eurosystem entry, and the Bank would continue to exercise discretion in determining the currency structure of its reserve. The selection of a benchmark for Bulgarian foreign reserve management would continue to be the prerogative of the BNB Investment Committee and Governing Council.

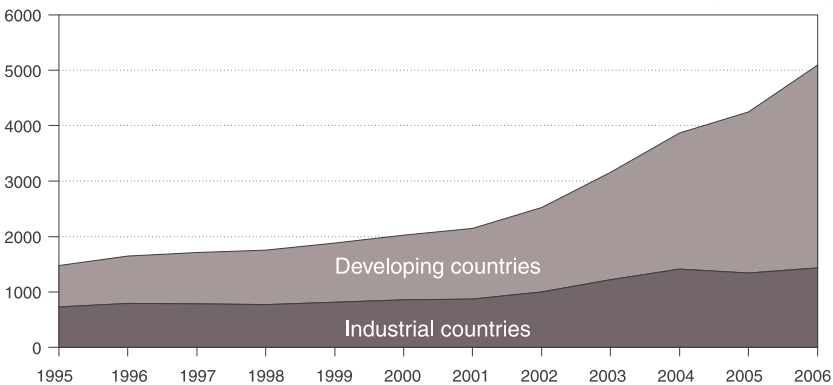
Chapter 14

From Managing Foreign Reserves to Managing National Wealth

The last decade has seen significant changes in many emerging markets. The main drivers of these changes have been moves to greater democracy, steady financial liberalisation, and integration into world money and capital markets. Confidence has accordingly risen and the volume and speed of capital movement have increased greatly. Emerging markets have made noteworthy changes to macroeconomic and financial policies, limiting budget deficits, conducting large scale privatisation, and implementing structural reforms to improve efficient public finance management. World manufacturing has relocated towards emerging markets.

As a result, by the close of 2007 the world economy experienced its most enduring period of rapid expansion. Historically low interest

Figure 53 International Foreign Exchange Reserves (except Gold) (USD billion)



Source: IMF (*IFS*).

rates accompanied this despite sharp fluctuations in commodity prices. Most emerging markets, especially those with significant natural resources, cut their debt considerably. Many transformed from net borrowers to holders of significant foreign reserves and gained substantial shares of global wealth (Figure 53).

Table 17 **Developing Countries' International Reserves:**
Annual Absolute Growth (except Gold; billion SDR)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Asia	52.86	40.35	29.23	69.38	64.59	83.91	86.23	122.72	199.08	265.22	205.31
China	23.73	31.37	0.15	8.96	14.24	42.41	42.58	60.53	121.01	179.10	135.47
Taiwan	0.47	0.66	2.27	13.22	4.55	15.32	21.66	20.15	16.60	21.56	-0.30
South Korea	1.69	-8.57	21.82	16.99	19.87	7.98	7.49	15.24	23.64	19.01	11.64
India	1.97	4.27	1.12	4.38	5.29	7.41	13.27	16.81	14.93	10.79	21.19
Singapore	7.23	-0.61	0.41	2.82	5.40	-1.31	0.26	4.29	7.72	8.79	9.29
Hong Kong	7.11	24.41	-5.11	6.45	12.42	5.91	-6.14	-2.65	-0.10	7.38	1.59
Malaysia	2.79	-3.38	2.75	4.13	-0.54	1.75	1.05	4.95	12.93	6.45	5.72
Thailand	2.03	-6.84	1.07	4.35	-0.25	1.17	2.24	-0.34	3.69	4.13	7.93
Indonesia	3.47	-0.40	3.84	3.14	2.61	-0.20	1.10	0.75	-1.02	0.68	4.14
Philippines	2.69	-1.59	1.18	3.08	0.38	0.68	-0.92	-0.62	-0.74	2.70	2.17
Africa	4.42	10.15	-2.88	1.40	11.36	9.70	1.71	8.07	20.35	30.84	34.76
Algeria	1.60	3.02	-1.10	-1.56	5.93	5.16	2.70	5.50	5.55	11.55	12.40
Nigeria	1.86	2.78	-0.58	-1.07	3.64	0.71	-2.93	-0.60	6.12	8.87	8.33
South Africa	-1.24	2.90	-0.46	1.53	0.04	0.14	-0.47	0.03	4.09	4.54	2.33
Morocco	0.22	0.32	0.19	1.00	-0.44	3.04	0.71	1.87	1.20	0.81	2.20
Near East	10.49	12.75	-0.86	5.99	13.67	6.17	-0.84	3.19	7.31	30.41	25.90
Libya	Data n/a	Data n/a	Data n/a	0.14	4.26	2.21	-1.25	2.66	3.36	11.10	11.77
Israel	2.48	7.13	1.03	0.37	1.40	0.73	-0.89	-0.01	-0.26	2.19	-0.25
UAE	0.58	0.60	0.24	1.33	2.60	0.88	-0.06	-1.04	1.78	2.77	3.66
Saudi Arabia	4.16	1.07	-0.93	2.28	2.65	-1.03	1.16	0.06	2.35	0.99	-0.27
Egypt	1.21	1.73	-0.96	-2.32	-0.49	0.22	-0.54	-0.60	0.05	5.23	1.84
Europe	3.65	9.40	0.68	6.49	18.43	13.59	26.09	31.20	44.69	84.86	107.45
Russia	-1.83	1.71	-4.02	0.62	12.46	7.27	6.51	16.84	28.55	45.27	73.41
Turkey	3.06	2.40	0.01	3.17	0.25	-2.24	4.89	2.96	0.09	12.42	5.21
Poland	2.47	2.72	4.28	-0.20	1.18	0.02	0.66	0.85	0.82	5.85	2.23
Czech Republic	-0.72	-1.38	1.69	0.42	0.66	1.42	5.91	0.69	0.18	2.32	0.21
Romania	0.40	1.36	-0.78	-0.92	0.78	1.23	1.38	0.91	4.00	4.49	4.75
Ukraine	0.66	0.37	-1.19	0.22	0.28	1.31	0.74	1.40	1.61	7.17	1.24
Hungary	-1.30	-0.53	0.39	1.36	0.61	-0.05	-0.92	0.97	1.67	2.73	1.33
Latin America	21.47	17.37	-11.43	-2.43	8.17	6.23	-8.02	13.29	10.49	36.68	27.77
Brazil	7.12	-2.89	-7.43	-4.89	-0.42	3.50	-0.72	5.33	0.91	3.52	19.39
Mexico	2.18	7.83	1.24	0.57	4.10	8.35	1.61	2.46	1.63	10.51	-1.11
Argentina	2.98	3.95	1.04	1.55	0.17	-7.72	-3.86	1.81	2.64	6.86	1.53
Venezuela	3.97	2.46	-2.19	0.48	1.10	-2.69	-1.11	4.55	1.04	4.90	2.82

Source: IMF (IFS).

These developments in the world economy have legitimately posed the question of how to manage newly accumulated assets more effectively. Growing attention to foreign reserve management by researchers and the public has brought about evolution in social and political discourse. Advances in research and changes in investment objectives have gradually overturned the broad consensus at international financial institutions and elsewhere that foreign reserves ought to be invested only in highly liquid short term low risk assets issued by industrialised countries. Today most agree (though some do not) that portions of foreign reserves which are not needed for monetary policy purposes by national central banks ought to be invested with the objective to increase wealth.

Under pressure from the international financial community and local public opinion a number of countries have also redirected “excess” foreign reserves (those not needed for monetary policy purposes or to maintain exchange rates) to public projects or deposits in private banks. Governments have started to demand higher income from central bank foreign reserve management and to monitor whether national wealth is invested rationally and effectively, according to the law, and in response to changes in markets.

A number of countries have channelled portions of foreign reserves investment funds intended to manage national wealth: sovereign wealth funds (Table 18). Their assets may also comprise revenue from the sale of natural resources, privatisation, or budget surpluses. Generated income offsets the economic impact of fluctuations in international commodity prices and hence budget revenues, or is saved for future balancing of the pension burden among the generations. There are two types of funds according to their use of resources: stabilisation and savings.

The emergence of sovereign wealth funds posed new challenges to government and central bank macroeconomic and reserve management policy. As described in Chapter 1, the traditional role of central banks is to maintain banking, financial system, and financial market stability and thus attain price stability. This implies that central banks continue to focus mainly on monetary policy and foreign reserve management. Each additional risk assumed by them in

search of higher income is at odds with the objective of monetary policy, regardless of the choice of monetary and exchange rate regime. This exposes central banks to political pressure and can undermine confidence in them. To avoid such conflict, legislators can channel some resource into separate sovereign wealth funds with investment objectives and strategic asset allocations distinct from those of central banks. Government or a body mandated by it can manage sovereign funds even where central or private banks marshal their resources tactically.

On the other hand, finance ministries or government bodies mandated with managing sovereign wealth funds – most often government debt management agencies – may lack the required knowhow. Incentives to seek additional income and control return on investment are absent from the traditional duties of government and from civil servants' motivation packages. This impinge on the development of investment management skills by them. Financial market development, financial innovation, and the emergence of sovereign wealth funds require people who are continually abreast of the latest in strategic asset allocation and portfolio risk management.

These challenges have engendered different expert opinions of sovereign wealth funds and a large group of forthright critics of them. For instance, *Davis, Owsowski, and Barnett (2001)* conclude that such funds (especially stabilisation ones) are not a panacea for structural fiscal problems in countries dependent on oil exports: they influence only budget revenue and not expenditure, and hence have no bearing on the consolidated budget deficit. Following this logic, marshalling part of oil importing countries' budget revenues into sovereign wealth funds pursuing public objectives through savings is inefficient if government continues to generate deficit and accumulate debt. The authors observe that in two cases examined by them there are changes to the absolute amount of the consolidated government budget, but that the budget balance is maintained in the end.

The proposed example illustrates the thesis that debate on sovereign wealth funds should develop as part of debate on national economic policy and long term national balance sheet management: it goes far beyond the mandate of any cabinet or central bank gover-

nor. Everything thus far presumes and requires great political responsibility when taking a putative decision to establish a Bulgarian sovereign wealth fund. Fraught with long term effects, this political decision ought to be deeply considered and embodied in special legislation.

The objective of what follows is to offer support for the process of taking such a strategic decision. The study addresses three important questions: what is an adequate level of foreign reserves for Bulgaria in the long run; how to define the objectives and principles of a sovereign wealth fund (provided the answer to the first question licences one); how to manage a sovereign wealth fund properly.

1. Determining an Adequate Level of Foreign Reserves for Bulgaria

As stressed in Chapter 4, existing currency board legislation in Bulgaria renders foreign reserve adequacy largely an endogenous variable. This stems from the full liberalisation of capital movements. Hence, it is more reasonable for Bulgaria to apply the Greenspan-Guidotti rule for assessing foreign reserve adequacy.

Even if one applied the indicators in Chapter 4, as traditionally used for quantitative assessments of foreign reserve adequacy (buffer-stock models), one would see that in the ten year existence of the currency board, Bulgaria has traditionally maintained more foreign reserves than the theoretical recommendation, irrespective of the academic concept applied. Hence, the current amount of foreign reserves does not expose Bulgaria to the risk of their becoming insufficient to maintain the currency board and the pegged lev euro rate.

Bulgaria lacks economically significant natural resources and does not produce commodities with a significant effect on the balance of trade or current account. Hence, macroeconomic policy is particularly important for the future level and dynamics of foreign reserves. In the currency board as described in Chapter 5, the mix of fiscal policy, government debt management, and structural reform are particularly important. The analysis shows convincingly that for the past ten years those three factors have formed the basis of the

Figure 54

Foreign Reserves/Monetary Aggregate M2 (%)

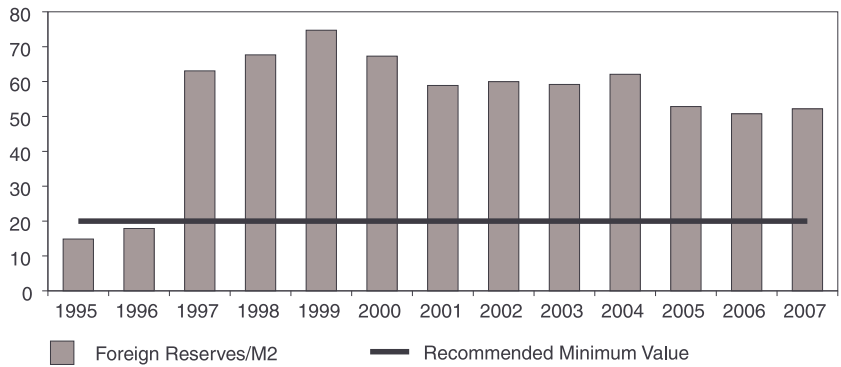
Source: IMF (*IFS*).

Figure 55

Reserves in Months of Goods and Service Imports

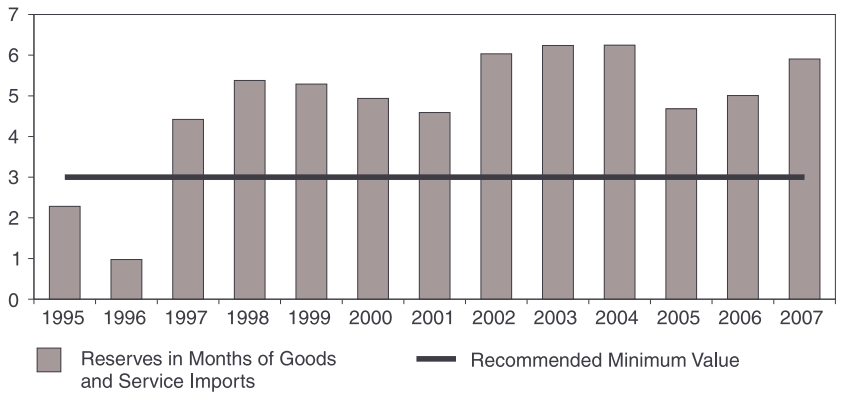
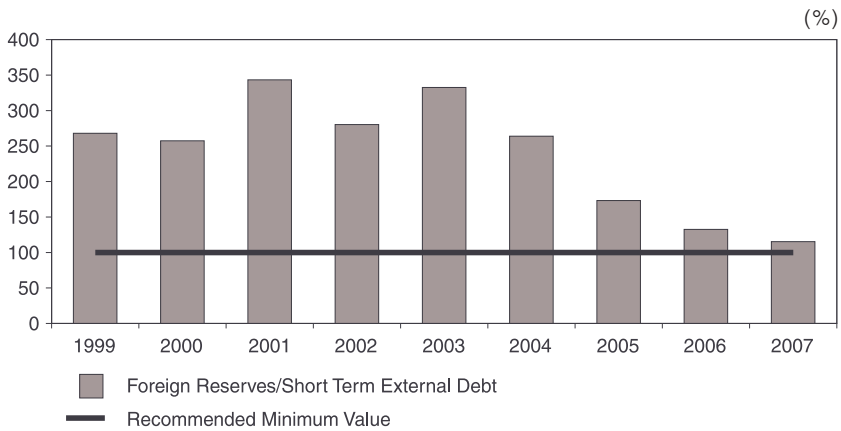
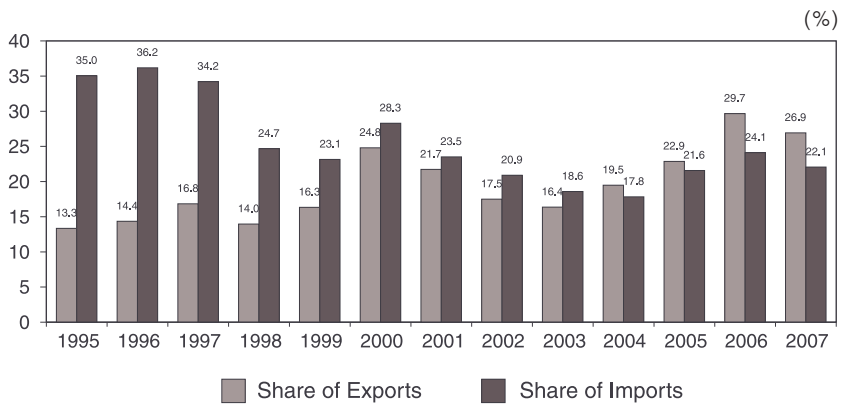
Source: IMF (*IFS*).

Figure 56 Foreign Reserves/Short Term External Debt



Source: BNB.

Figure 57 Share of Energy Commodities and Strategic Raw Materials in Bulgarian Foreign Trade Turnover

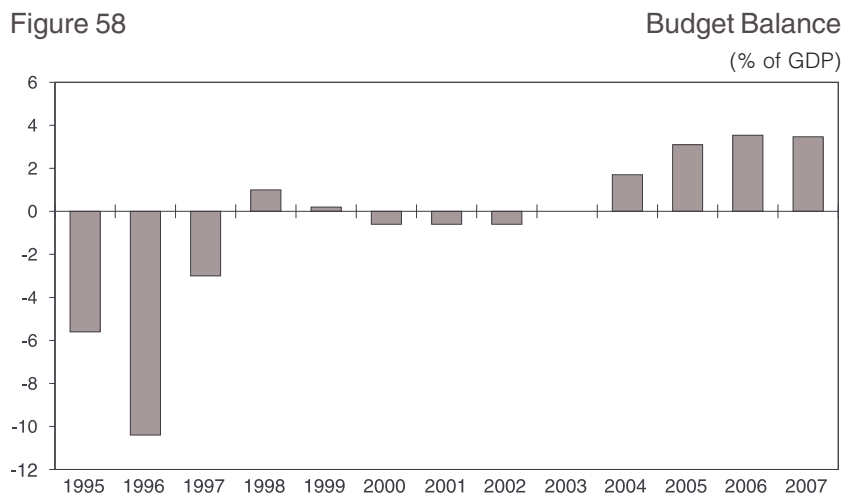


Source: BNB.

accumulation of foreign reserves (see figures below). Therefore, from the vantage of the future level and dynamics of foreign reserves, it is important to preserve a restrictive fiscal policy by maintaining a budget surplus adequate to the phase of the economic cycle, and to limit government debt consistently. These may be the most important conditions for maintaining foreign reserves at the level necessary for the normal function of the currency board. These policies should continue in support of ECB monetary policy once the BNB joins the euro area.

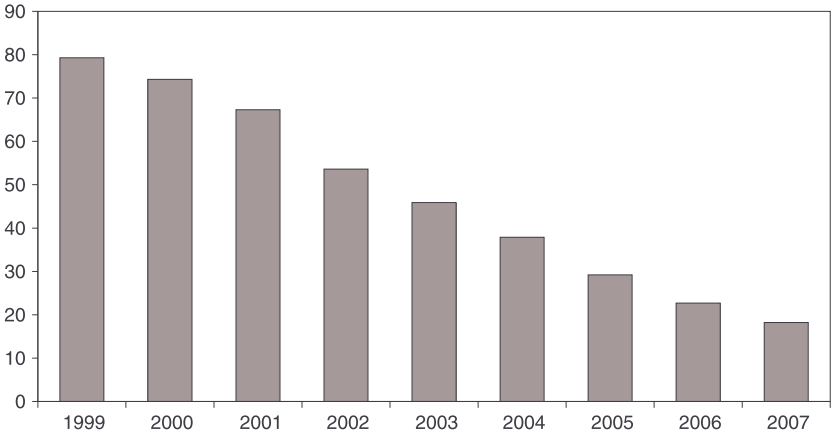
Besides its impact on the current level of foreign reserves Bulgarian membership in the European Union has turned out to be another very important factor when assessing foreign reserve adequacy. Since the beginning of 2007, accession to the EU and obligatory participation in its multilateral surveillance mechanism has greatly reduced any uncertainty regarding future macroeconomic policy. The convergence programme requires annual publication of medium term macroeconomic policy intentions. There are public annual assessments of this policy by the European Commission, the ECB, and Member States. Thus a new early warning mechanism, known to all economic agents, has emerged as a serious and proven guarantee

Figure 58



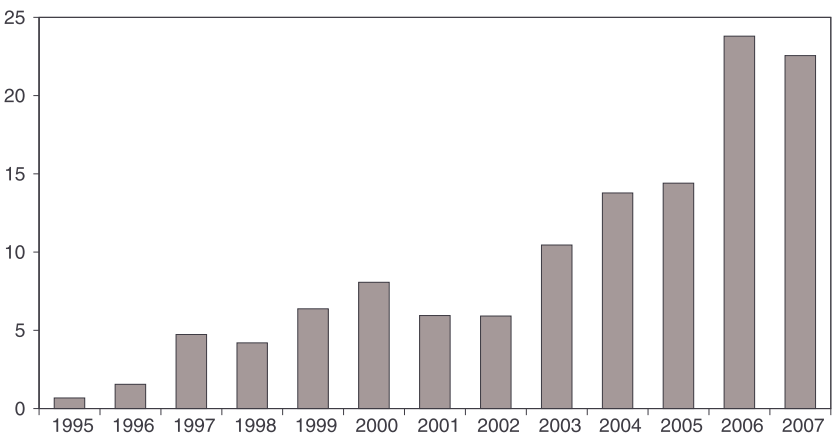
Sources: MF, NSI.

Figure 59 **Government Debt/GDP**
(% of GDP)



Sources: MF, NSI.

Figure 60 **Foreign Direct Investment/GDP**
(%)

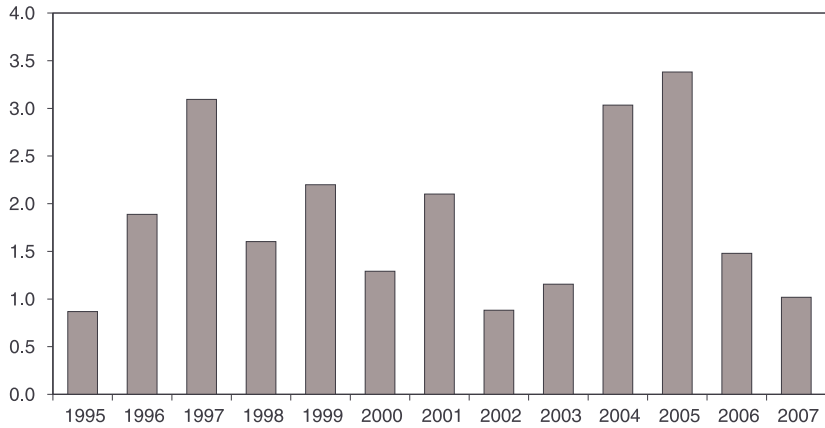


Sources: BNB, NSI.

Figure 61

Privatisation Revenue/GDP

(%)

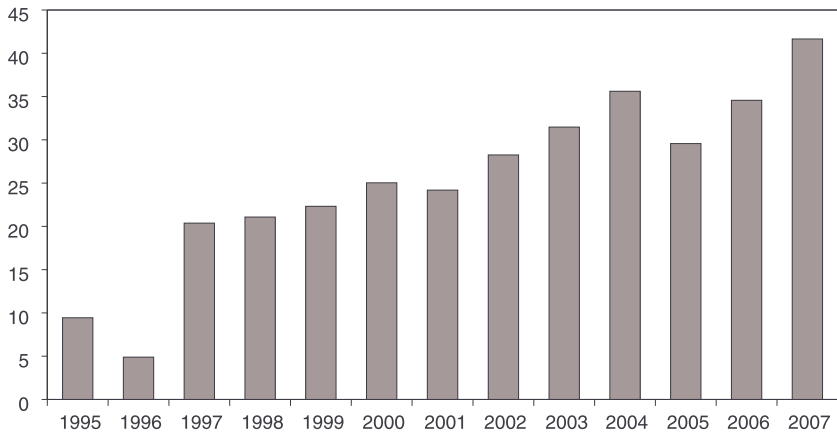


Sources: AP, MF, NSI.

Figure 62

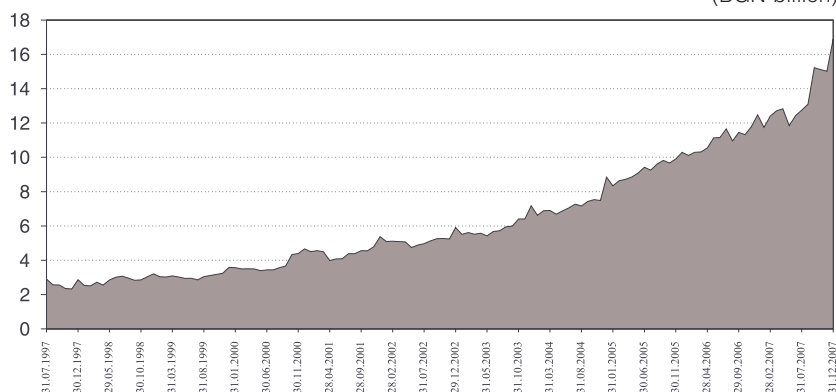
Foreign Reserves/GDP

(%)



Source: IMF (*IFS*).

Figure 63 Balance of Issue Department excluding the Government Deposit
(BGN billion)



Source: BNB.

of sustainability and predictability for Bulgaria's future economic course. The European Council has resolved that from 2008 ERM II countries' progress to Maastricht criteria for euro adoption are published and assessed as part of this multilateral surveillance mechanism.

A third very important factor when assessing the adequacy of foreign reserves is the possibility of economic diversification and flexibility to ensure future competitiveness. Taking into consideration the lack of economically significant natural resources, Bulgaria appears immune to what is termed Dutch Disease in literature¹⁵⁸. However, the Bulgarian economy has – and will retain over the medium-term – relatively low energy efficiency, and is at risk from volatile energy commodity prices. Thus, constraining exchange rates overvaluations through fiscal and structural policy and stimulating the competitive manufacturing of tradable goods are very important for the long term

¹⁵⁸ For more details, see **Corden, W.M.**, Boom Sector and Dutch Disease Economics, *Oxford Economic Papers*, Vol 36:362, 1984; **Krugman, P.**, "The Narrow Moving Band, the Dutch Disease, and the Competitive Consequences of Mrs Thatcher," *Journal of Development Economics*, Vol 27 (2) 50, 1987; **Ebrahim-Zadeh, C.**, "Back to Basics – Dutch Disease: Too Much Wealth Managed Unwisely," *Finance & Development*, Vol. 40 (1): 50, 2003.

adequacy of foreign reserves. Given the political choice of a currency board (to be replaced by ECB monetary policy), plus the free movement of capital, and relatively low flat rate taxation, labour market policy¹⁵⁹ remains the paramount and theoretically sole instrument of economic policy. Though imperceptibly, this is becoming an important long term factor in foreign reserve adequacy and the choice of objectives of any putative Bulgarian sovereign wealth fund.

The adequacy of foreign reserves to date offers grounds for assuming that government funds at the BNB (the government deposit with the Issue Department: the fiscal reserve) could be channelled into a sovereign wealth fund without leaving the BNB short of monetary policy means in the medium term, assuming that the currency board and countercyclical macroeconomic policy endure.

2. Determining the Objectives of a Sovereign Wealth Fund

Channelling some foreign reserves into a sovereign wealth fund would not change the objectives of managing public wealth: liquidity, security, and profitability. Assets in the sovereign wealth fund would continue to be part of public wealth. However, their management would pursue the objective of an expected return at a certain level of security: the sole change would be in priorities. The purposes of such a fund and the occasions on which it would be dispensed would define its required degree of liquidity. Therefore, it would be very important for the objectives of profitability and/or security to be defined precisely in law.

Sovereign wealth funds are generally supposed to have only one objective. Having a single objective from the very beginning would avoid conflicts between purposes and guarantee maximum transparency and accountability, as well as assisting an adequate and effective institutional setup. For instance, an objective for a future Bulgar-

¹⁵⁹ For an analysis of the transmission mechanism of economic policy in Bulgaria under the currency board, see for instance **Nenovsky, N., K. Hristov**, "Financial Repression and Credit Rationing under a Currency Board Arrangement for Bulgaria," *BNB Discussion Papers*, No 2, 1998.

ian sovereign wealth fund may be to generate an annual income of X , e.g. over a horizon of up to 2016 to support future annual pension spending of Z as dictated by population aging. In this particular case, it would be possible and necessary to determine the year from which the fund would commence disbursing money into the social insurance system: e.g. year $Y+1$.

Legal resolutions to both issues would give the opportunity of using optimisation models in fund management and of structuring the investment process as described in Part I. They would also provide a clear and precise definition of the priority of extracting income from the fund. Such an approach would cost the government some flexibility when using public money, yet would establish long term confidence and guarantee the sustainability of certain public disbursements: pensions in this case.

Another way to settle the issue of objectives is to take a course similar to that taken by the Law on the BNB and firmly delineate issuers, financial instruments, and currencies into which the fund may invest assets. This would assist investment process structuring and stress the importance of safety as a priority. Such an approach would simplify fund management and accountability and provide flexibility to government as regards using money, yet in this case, government and fund managers would bear greater and constant political responsibility to demonstrate fund profitability and efficiency to the public and the Parliament.

In the one-purpose-one-fund approach it is particularly important to balance the marginal benefits and marginal costs of sovereign wealth funds by assigning definite purposes to them. The limited extent of national reserves against the total amount of financial assets on the market is an objective constraint which restrains governments from establishing more than one sovereign wealth fund in practice.

3. The Institutional Setup of a Sovereign Wealth Fund

The relationship between factors influencing the adequacy of Bulgaria's foreign reserves and challenges faced by bodies implementing macroeconomic policy as indicated above in this Chapter, shows that the institutional setup of a sovereign wealth fund is of considerable import. Long term cross-party consensus on the institutional aspects of such a fund is necessary in parliament from the outset.

World practice shows that there is no uniform institutional organisation for sovereign wealth funds. The table below shows the general practice of creating structures through set legislation. Central banks of advanced industrialised countries are totally focused on managing foreign reserves and most of these countries have no sovereign wealth funds. Only some of them – for instance Norway and Switzerland – set aside portions of foreign reserves in funds or manage them separately to different (long term) benchmarks seeking higher profitability as a primary objective. Their central banks and governments set investment targets individually or jointly. This shows confidence in the institutional durability of these central banks and stems from the relatively high risk tolerance afforded them by law. These central banks face no legal restrictions on issuers, currencies, or assets into which they may invest their foreign reserves.

The experience of countries with sovereign wealth funds¹⁶⁰ shows that a clear-cut legislative solution to the institutional issues discussed below and division of responsibility between governments, central banks, finance ministries and some specialized ministries¹⁶¹ and regulators¹⁶² is crucial to creating confidence, lowering operational risk, and attaining fund objectives.

First, when establishing such a fund, it is recommended and even required to eliminate any possibility of future transfers of resources between it and foreign reserves. In the Bulgarian case, only such elimination would assure both strict observance of the currency board

¹⁶⁰ See for instance Johnson-Calari, J., *Sovereign Wealth Management*, Central Banking Publications, 2007.

¹⁶¹ This is most valid for countries with economically significant natural resources.

¹⁶² For instance the Court of Auditors or the National Audit Office.

Table 18

Sovereign Wealth Funds

Country/Territory	Fund name	Year of Inception	Main source	Legislative basis	Management
Kuwait	<i>Kuwait Investment Authority</i>	1960	Oil	Government Resolution, 1982 Act	Board of Directors chaired by Minister of Finance
Singapore	<i>Temasek Holdings</i>	1974	External Surplus	Government Resolution	Board of Directors
State of Wyoming, the USA	<i>Mineral Trust Fund</i>	1974	Minerals	Amendment to the Wyoming Constitution	State Treasurer's Office
State of Alaska, the USA	<i>Permanent Reserve Fund</i>	1976	Oil	State legislator decision later enshrined into Constitutional amendment	The Alaska Permanent Fund Corporation; admissible assets determined by State legislator.
Province of Alberta, Canada	<i>Alberta Heritage Fund</i>	1976	Oil	The Alberta Heritage Savings Trust Fund Act	Minister of Finance controlled by the Standing Committee on the Alberta Heritage Savings Trust Fund (nine Legislative Assembly Members)
United Arab Emirates	<i>Abu Dhabi Investment Authority (ADIA)</i>	1978	Oil		
Oman	<i>State General Stabilisation Fund</i>	1980	Oil and Gas		
Singapore	<i>Government of Singapore Investment Corporation (GIC)</i>	1981	External Surplus	Government Resolution	Own experts and external managers.
Brunei	<i>Brunei Investment Authority</i>	1983	Oil		
Norway	<i>Government Pension Fund – Global</i>	1990	Oil	The Government Petroleum Fund Act	Ministry of Finance holds main responsibility; operational asset management by the Norges Bank; 80 external managers employed by late 2006
Malaysia	<i>Khazanah Nasional BHD</i>	1993	External Surplus	Incorporated September 1993 as Public Limited Company under the 1965 Companies' Act	
Botswana	<i>Pula Fund</i>	1993	Diamonds		
Iran	<i>Oil Reserve Fund</i>	1999	Oil		
Azerbaijan	<i>State Oil Fund</i>	1999	Oil		

(continued)

(continued)

Kazakhstan	<i>National Fund</i>	2000	Oil, gas and metals	Presidential Decree	Qazaqstan Ultt?q Banki (the central bank)
China	<i>Central Huijin Investment</i>	2003	External Surplus		Ministry of Finance and the People's Bank of China
Russia	<i>Stabilisation Fund</i>	2003	Oil		Ministry of Finance; some management delegated to Bank Rossii (the central bank)
South Korea	<i>Korea Investment Corporation</i>	2005	External Surplus	Act Petroleum Fund Act	Independent under Hanguk Eunhaeng (central bank) and government control
East Timor	<i>Timor-Leste Petroleum Fund</i>	2005	Oil and Gas		Central bank to Finance Ministry guidelines; external managers permitted
Chile	<i>Pension Fund</i>	2006	Budget Surplus (Copper)		
Mauritania	<i>National Fund for Hydrocarbon Revenues</i>	2006	Oil and Gas		Ministry of Finance and the Banque Centrale de Mauritanie to government contract
Chile	<i>Stabilisation Fund</i>	1985/2006	Budget Surplus (Copper)		
Qatar	<i>Qatar Investment Authority</i>		Oil and Gas		

Source: *Sovereign Wealth Management, Central Banking Publications, 2007.*

rules which have governed the BNB for a decade, and eliminate any restriction to BNB institutional and financial independence. It would correspond with the desire to achieve maximum transparency and accountability under the separate mandates for managing foreign reserves and sovereign wealth.

Second, and similar to the point above, the possibility of using the fund for any purposes other than those for which it was set up ought to be legally removed. This would remove the option of political tampering with the fickle balance of savings, benefits, and generations. Another important reason for such a prohibition is to ensure from the outset that the investment process and the control mechanism for achieving the fund's objectives over time are well structured.

Third, the fund ought to be legally denied the right to invest into assets issued by the Bulgarian government or Bulgarian business, even if those assets were denominated in permitted convertible currencies and were freely traded on international markets. Besides raising the possibility of bypassing currency board rules, such investment would create a connection (albeit indiscernible) with the Bulgarian economy, transgressing the division between foreign reserves and a sovereign wealth fund.

Fourth, the sovereign wealth fund's sources ought to be legally defined. In the Bulgarian case (taking into account monetary and exchange regimes and the lack of economically significant natural resources) yield on its own investment and transfers of budget surpluses may be appropriate sources of revenue. The latter would eliminate any speculation as to the purpose to which budget surpluses are put. Indeed, most critics of sovereign wealth funds stress the fact that their existence does not stop governments financing them for political reasons, or else financing chronic current deficits using them.

Fifth, the possibility of hiring private managers to manage fund assets and related procedures ought to be legally defined.

Sixth, the institutional structure of fund management ought to be legally settled, it being particularly important to define powers and duties with regard to investment objectives, propensity to risk, and strategic and tactical asset allocation at each hierarchical level. The

independence of risk management from operational management ought to be guaranteed categorically at this stage.

Seventh, a legal spending cap ought to be imposed on the sovereign wealth fund: it could be one linked with the attainment of objectives, including financial ones.

Eighth, the fund's profit distribution policy ought to be legally determined in a way corresponding to its objectives and guaranteeing clarity of relations with the government budget, should any such relations arise.

Ninth, it ought to be legally guaranteed that the sovereign wealth fund's executives are as institutionally, personally, and financially independent of any political pressure as are central bank executives.

Tenth, a mechanism of overseeing the fund which excludes any possibility of its use as a political tool ought to be legally constructed.

The attainment of the purpose of the fund would be guaranteed to the fullest degree solely through clear legislative settlement of these, and many other, issues. The framework should also set a mechanism for public control over the fund and its disbursement.

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