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Edited by Ulrich Bindseil, Fernando González and Evangelos Tabakis

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Risk Management for Central Banks and Other Public Investors

Domestic and foreign financial assets of all central banks and public wealth funds worldwide are estimated to have reached more than USD 12 trillion in 2007. How do these institutions manage such unprecedented growth in their financial assets and how have they responded to the ‘revolution’ of risk management techniques during the last fifteen years? This book surveys the fundamental issues and techniques associated with risk management and shows how central banks and other public investors can create better risk management frameworks. Each chapter looks at a specific area of risk management, first presenting general problems and then showing how these materialize in the special case of public institutions. Written by a team of risk management experts from the European Central Bank, this much-needed survey is an ideal resource for those concerned with the increasingly important task of managing risk in central banks and other public institutions.

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Foreword

The reader familiar with central bank parlance will have certainly noticed that our vocabulary is full of references to risks. It seems that no speech of ours can avoid raising awareness of risks to price stability or evade the subject of risks to the smooth functioning of the financial system. Indeed, one way to describe our core responsibility is to say that the central bank acts as a risk manager for the economy using monetary policy to hedge against inflationary risks. However, we tend to be less willing to share information on the ways we manage financial risks in our own institutions. It is thus not surprising that a book that sheds light on risk management in the world of central banks and other public investors in a systematic and comprehensive way has not been published so far. And I am very happy that the initiative to prepare such a book has been taken by staff of the European Central Bank.

Central banks' own appetite for financial risks is not always easy to understand. Our institutions have historically been conservative investors, placing their foreign reserves mostly in government securities and taking very little, if any, credit risk. Progressively, the accumulation of reserves in some countries, either as a result of their abundant natural resources or of foreign exchange policies, has led their central banks to expand their investment universe and, with it, the financial risks they face. More recently, the landscape of public investors has been enriched by sovereign wealth funds, state-backed investors from emerging economies that made their presence more than noticeable in international capital markets and have occasionally created controversy with their investment strategies.

While managing investment portfolios is one area where risk management expertise is needed, central banks have other core concerns. They are in charge of monetary policy in their jurisdiction. They are also expected to intervene when the stability of the financial system is at stake. In order to steer the system out of a crisis, they are prepared, if needed, to take those

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risks which other market participants rush to shed. They are prepared to provide additional liquidity to the system as a whole or lend to specific banks on special conditions. Such behaviour, which may seem to put risk management considerations on hold, at least temporarily, further complicates the effort of an outsider to understand the role of risk management in the central bank.

Being responsible for risk management in a public institution, like a central bank, does not simply rely on technical risk management expertise. Although the requirement for a high degree of fluency in quantitative techniques is not less important than in private financial institutions, it must be combined with a deep understanding of the role of the public institution and its core functions. In our institutions, financial decisions are not taken based only on risk and return considerations but also take into account broader social welfare aspects.

Central bank risk managers provide decision makers with assessments of financial risks in the whole range of central banks' operations, whether these are linked to policy objectives or are related to the management of investment portfolios. They should be able to deliver such assessments not only under normal market conditions but, even more so, under conditions of market stress. Decision makers also seek their advice to understand and draw the right conclusions from the use of the latest instruments of risk transfer in the markets and the implementation of risk management strategies by financial institutions in our jurisdictions.

The European Central Bank placed, from the very beginning, particular attention to risk management. As a new member of the central bank community, it had the ambition of fulfilling the highest governance standards in organizing its risk management function within the institution and applying state-of-the-art tools. No less than that would be expected from a new central bank that would determine monetary policy and oversee financial stability for an ever-increasing number of European citizens, playing the lead role in a system of cooperating central banks.

Central banks and other public investors have been entrusted with the management of public funds and are expected to do so in a transparent way that is well understood by the public. This book systematically explains how central banks have addressed financial risks in their operations. It discusses issues of principle but also provides concrete practical information. It explains how risk management techniques, developed in the private sector, apply to central banks and where idiosyncrasies of our institutions merit special approaches. The blend of analysis and information provided in the

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next pages makes me confident that this book will find an eager readership among both risk managers and central bankers.

José Manuel González-Páramo
*Member of the Executive Board of
the European Central Bank*

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Introduction

Ulrich Bindseil, Fernando González and Evangelos Tabakis

Domestic and foreign financial assets of central banks and public wealth funds worldwide are estimated to have reached in 2007 more than USD 12 trillion, which is more than 15 per cent of world GDP, and more than 10 per cent of the global market capitalization of equity and fixed-income securities markets. Reflecting unprecedented growth of their financial assets, and the revolution of risk management techniques and best practices during the last fifteen years, the investment and risk management policies and procedures of central banks and other public investors have undergone a profound transformation. The purpose of this book is to provide a comprehensive and structured overview of issues and techniques in the area of public institutions' risk management. On each of the main areas of risk management, the book aims at first presenting the general problems as they also would occur in private financial institutions, then to discuss how these materialize in the special case of public institutions, and finally to illustrate this general discussion by describing the European Central Bank's (ECB) specific approach. Due consideration is given to the specificities of public institutions in general and central banks in particular. On the one side, their public character relates to certain policy tasks, which will also impact on their investment policies, in particular with regard to assets which are directly considered policy assets (e.g. monetary policy assets, foreign reserves to stand ready for intervention purposes). Secondly, the public character of these institutions has certain implications regardless of policy tasks, such as particular duties of transparency and accountability, less flexibility in terms of human resource policies and contracting, being outside the radar of regulators, etc. These characteristics will also influence optimal investment policies and risk management techniques of public institution.

The book targets portfolio managers, risk managers, monetary policy implementation experts of central banks and public wealth funds, and staff in supranational financial institutions working on similar issues. Moreover, staff from the financial industry who provide services to central banks would also have an interest in this book. Similarly, treasury and liquidity managers of banks will find the risk management perspective of central banks' liquidity

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providing operations useful in understanding central bank policies. Around a half of the chapters also provide methodological discussions which are not really specific to central banks or other public investors, but which are equally relevant for any other institutional investors. Finally, students in both finance and central banking will find the book important as bridging theory and practice and as providing insights in a key area of central banking other than monetary policy on which very little has traditionally been made public.

The authors of this book all work or worked in the ECB's Risk Management Division (except two, who work in the ECB's Directorate General Market Operations), and the topics covered reflect the area of expertise of the respective authors. Thus, the book obviously reflects the experience of the ECB and the specific challenges it has had to address. Nevertheless, the book aims at working out the generic specificities and issues relating to all public institutions' risk management functions.

There are two types of books with which the present one can be compared. First, there are a number of books on central bank investment policies and risk management, like Bernadell *et al.* (2004), Danmarks Nationalbank (2004), Pringle and Carver (2007, but also previous editions), Johnson-Calari and Rietveld (2007) or Bakker and van Herpt (2007). These books however do not aim at being comprehensive and conceptually structured, nor do they go really into depth. In contrast, the present book is intended to be a comprehensive reference book, structured along the main areas of central bank investment and risk management, reviewing systematically the existing literature, going into depth, and using state-of-the art methods. Second, there are at least two recent books by teams from the institutional investor/asset allocation area of major investment banks, namely Litterman (2003) and Dynkin *et al.* (2006). These books are similar in authorship as they are produced by a team of experts from one institution and cover topics in the broader area of financial management, including risk management. However the two books have a different perspective, namely that of investment management, and do not cover the risk control and risk mitigation aspects of risk management.

Structure of the book: Investment vs. policy operations; different risk types

The book is structured into three main parts: the first deals with the risk management for *investment operations* of public institutions. Investment

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operations are defined broadly as financial operations of public institutions which are not or only limitedly constrained by the policy mandates of the public institution. Still, the public character of the institution should influence its investment and risk management policies, relative to a non-public institutional investor. The second part deals with *policy operations* of central banks, whereby the focus is on collateralized lending operations, as such monetary policy operations are standard today for central banks to control short-term interest rates. Most issues arising in this context are, however, also relevant for collateralized lending programmes that a financial institution would establish, and techniques discussed are therefore relevant for the financial industry. Finally, a short third part deals with organizational issues and operational risk management in public financial institutions.

While the segregation of risk management approaches into those relating to investment and those relating to policy operations may seem straightforward for central bankers, its compatibility with the idea of integrated financial risk management may be questioned. Why wouldn't all risks be mapped eventually into one risk framework? It appears a standard problem of any bank that risks from different business lines seem at a first look difficult to aggregate, but that these problems need to be overcome because segregated risk management is inferior. In contradiction to this, in many central banks, the organizational units for risk management are segregated: one would be responsible for investment operations, and the other for policy operations. In the case of the ECB, both risk management functions are assigned to one division, not to aggregate risk across the two 'business lines', but for achieving intellectual economies of scale and scope. A probably valid explanation in the case of the ECB for not integrating the two business lines in terms of risk management is that monetary policy operations are in the books of the national central banks (NCBs) of the Euro-system, and not in the books of the ECB. Therefore, also, losses would arise with NCBs. The responsibility of the ECB's risk management for defining the risk framework for policy operations is based on the fact that losses relating to monetary policy operations are *shared* across NCBs. In contrast, the ECB's investment operations are genuinely in the books of the ECB, and directly affect its P&L. Therefore, integrating the two types of operations would mean ignoring that the associated P&Ls are not for the same institutions, and thus should be part of different risk budgets, etc. While the ECB has thus a valid excuse for keeping the two issues separated, which affects the structure of the current book, other central banks should

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probably not follow this avenue, as all types of operations end up affecting their P&L.

The structure of this book from the risk *type* perspective may appear less clear than for a typical risk management textbook. While Chapter 3 is purely on the credit risk side, Chapters 2, 5 and 6 are about market risk management. Chapters 7–10 are mainly on the credit risk side; however, potential losses in reverse repo operations are also driven by liquidity and market risk when it comes to liquidating collateral in the case of a counterparty default. Chapter 4 addresses risk control tasks aiming at both credit and market risk. Operational risk management as discussed in Chapter 13 is a rather different animal, but as operational risk contributes in Basel II a third component to capital requirements, it is thought that a book on public institutions' risk management would be incomplete if not also discussing, at least in one chapter, issues relating to operational risk in public institutions. In the ECB, the more limited interaction between operational and financial risk management is reflected by having separate entities being responsible for each.

Part I: Investment operations

Part I of the book, on investment operations, begins with a chapter (**Central banks and other public institutions as financial investors**) discussing the 'nature' of central banks and other public institutions as investors. The chapter aims at providing tentative answers to questions like: What are the special characteristics of such investors implied by their policy mandates? What are the basic risk–return properties of their balance sheets? What capital do they need and what are their long-run financial perspectives? In which sense should they be 'active' investors and how diversified should they be? Are they unique in terms of aversion against reputation risk? The chapter suggests that while on one side, many financial industry risk management techniques (like VaR, limit setting, reporting, performance attribution) are directly applicable to public institutions, the foundations of integrated risk management (e.g. risk budgeting, economic capital calculation, desired credit rating) are very special for public institutions, and in fact are more difficult to derive than in the case of a private financial institution.

Chapter 2 (**Strategic asset allocation for central banks and public investors**) contains a general introduction to strategic asset allocation and a

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review of the key issues relating to it. It also provides a review of central bank practice in this area (also on the basis of available surveys), and a detailed technical presentation of the ECB's approach to strategic asset allocation. The importance of strategic asset allocation in public institutions can hardly be overestimated, since it typically drives more than 90 per cent of the risks and returns of public institution's investments. This also reflects the need for transparency of public investments, which can be fulfilled in principle by a strategic asset allocation approach, but less by 'active management' investment strategies.

Chapter 3 discusses **Credit risk modelling for public institutions' investment portfolios**. Portfolio credit risk modelling in general has emerged in practice only over the last ten years, and in public institutions only very recently. Its relevance for central banks, for example, is on the one hand obvious in view of the size of the portfolios in questions, and their increasing share of non-government bonds. On the other hand, public investors tend to hold credit portfolios of very high average credit quality, still concentrated in a limited number of issuers, which poses specific challenges for estimating sensible credit risk measures.

Chapter 4 on **Risk control, compliance monitoring and reporting** turns to the core regular risk control tasks that any institutional financial investor should undertake. There is typically little systematic literature on these topics which are so relevant and also often challenging in practice.

Chapter 5 on **Performance measurement** again deals in more depth with one core risk control subject of interest to all institutional investors. While in principle being a very practical issue, it often raises numerous technical implementation issues. Chapter 6, on **Performance attribution** complements Chapter 5. While performance attribution is a topic which can fill a book in its own right, this chapter includes a discussion of the most fundamental principles and considerations when applying performance attribution in the typical central bank setting. In addition, the fixed-income attribution framework currently applied by the European Central Bank is introduced.

Part II: Policy operations

Chapters 7 to 11 cover central bank **policy operations** conducted as reverse repo operations. Chapter 7 on **Risk management and market impact of central bank credit** reviews the role and effects of the collateral framework

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which central banks, for example, use in conducting temporary monetary policy operations. First, the chapter explains the design of such a framework from the perspective of risk mitigation. It is argued that by means of appropriate risk mitigation measures, the residual risk on any potentially eligible asset can be equalized and brought down to the level consistent with the risk tolerance of the central bank. Once this result has been achieved, eligibility decisions should be based on an economic cost–benefit analysis. The chapter looks at the effects of the collateral framework on financial markets, and in particular on spreads between eligible and ineligible assets.

Chapter 8 goes in more depth with regard to methodological issues of **risk mitigation measures and credit risk assessments in central bank policy operations**. It motivates in more detail the different risk mitigation measures, and how they are applied in the Eurosystem. In particular, valuation issues and haircut setting are explained. To ensure that accepted collateral fulfils sufficient credit quality standards, central banks tend to rely on external or internal credit quality assessments. While many central banks today rely exclusively on ratings by rating agencies, others still rely on internal credit quality assessment systems.

Chapter 9 provides a **comparison of risk mitigation measures and credit risk assessment in central bank policy operations** across in particular three major central banks, namely the Federal Reserve, the Bank of Japan and the Eurosystem.

Chapter 10 (**Risk measurement for a repo portfolio**) presents a state-of-the-art approach to estimating tail risk measures for a portfolio of collateralized lending operations, as it is relevant for any investor with a large repo portfolio, and as it has been implemented for the first time by a central bank in 2006 by the ECB.

Chapter 11 turns to **central bank financial crisis management from a risk management perspective**. Financial crisis management is a key central bank policy task and unsurprisingly financial transactions in such an environment will imply particular risk taking, which needs to be well justified and well controlled. The second half of 2007 provided multiple illustrations for this chapter.

Part III: Organizational issues and operational risk

Part three of the book consists of Chapters 12 and 13. Chapter 12 is on **Organizational issues in the risk management function of central banks**,

and covers organizational issues of relevance for any institutional investor, such as segregation of duties; Chinese walls; policy *vs.* investment operations, optimal boundaries of responsibilities vis-à-vis other business areas etc. The final Chapter 13 treats **Operational risk management in central banks** and presents in some detail the ECB’s approach to this.