

# Transparency, Risk Management and International Financial Fragility

Mario Draghi, Francesco Giavazzi and Robert C Merton

---

# **Transparency, Risk Management and International Financial Fragility**

**Geneva Reports on the World Economy 4**

## **International Center for Monetary and Banking Studies (ICMB)**

International Center for Monetary and Banking Studies  
11 A Avenue de la Paix  
1202 Geneva  
Switzerland

Tel +41 22 734 9548  
Fax +41 22 733 3853  
Website: [www.icmb.ch](http://www.icmb.ch)

© International Center for Monetary and Banking Studies

## **Centre for Economic Policy Research (CEPR)**

Centre for Economic Policy Research  
90-98 Goswell Road  
London EC1V 7RR  
UK

Tel: +44 (0)20 7878 2900  
Fax: +44 (0)20 7878 2999  
Email: [cepr@cepr.org](mailto:cepr@cepr.org)  
Website: [www.cepr.org](http://www.cepr.org)

British Library Cataloguing in Publication Data  
A catalogue record for this book is available from the British Library

ISBN: 1 898128 68 5

# Transparency, Risk Management and International Financial Fragility

Geneva Reports on the World Economy 4

**Mario Draghi**  
*Goldman Sachs*

**Francesco Giavazzi**  
*IGIER, Università Bocconi and CEPR*

**Robert C Merton**  
*Harvard Business School and Integrated Finance Limited*

ICMB INTERNATIONAL CENTER  
FOR MONETARY  
AND BANKING STUDIES

CIMB CENTRE INTERNATIONAL  
D'ETUDES MONETAIRES  
ET BANCAIRES



## **International Center for Monetary and Banking Studies (ICMB)**

The International Center for Monetary and Banking Studies was created in 1973 as an independent, non-profit foundation. It is associated with Geneva's Graduate Institute of International Studies. Its aim is to foster exchange of views between the financial sector, central banks and academics on issues of common interest. It is financed through grants from banks, financial institutions and central banks.

The Center sponsors international conferences, public lectures, original research and publications. It has earned a solid reputation in the Swiss and international banking community where it is known for its contribution to bridging the gap between theory and practice in the field of international banking and finance.

In association with CEPR, the Center launched a new series of *Geneva Reports on the World Economy* in 1999. The first report, 'An Independent and Accountable IMF', was published last September. It has attracted considerable interest among practitioners, policy-makers and scholars working on the reform of international financial architecture.

The ICMB is non-partisan and does not take any view on policy. Its publications, including the present report, reflect the opinions of the authors, not of ICMB or of any of its sponsoring institutions.

President of the Foundation Board	Tommaso Padoa-Schioppa
Director	Charles Wyplosz

## **Centre for Economic Policy Research (CEPR)**

The Centre for Economic Policy Research is a network of over 600 Research Fellows and Affiliates, based primarily in European universities. The Centre coordinates the research activities of its Fellows and Affiliates and communicates the results to the public and private sectors. CEPR is an entrepreneur, developing research initiatives with the producers, consumers and sponsors of research. Established in 1983, CEPR is a European economics research organization with uniquely wide-ranging scope and activities.

CEPR is a registered educational charity. Institutional (core) finance for the Centre is provided by major grants from the Economic and Social Research Council, under which an ESRC Resource Centre operates within CEPR; the Esmée Fairbairn Charitable Trust and the Bank of England. The Centre is also supported by the European Central Bank, the Bank for International Settlements, 22 national central banks and 45 companies. None of these organizations gives prior review to the Centre's publications, nor do they necessarily endorse the views expressed therein.

The Centre is pluralist and non-partisan, bringing economic research to bear on the analysis of medium- and long-run policy questions. CEPR research may include views on policy, but the Executive Committee of the Centre does not give prior review to its publications, and the Centre takes no institutional policy positions. The opinions expressed in this report are those of the author and not those of the Centre for Economic Policy Research.

Chair of the Board	Guillermo de la Dehesa
President	Richard Portes
Chief Executive Officer	Hilary Beech
Research Director	Mathias Dewatripont

---

## About the Authors

Mario Draghi is Vice Chairman of Goldman Sachs International, based in London. From 1991 to 2001 Professor Draghi was the Director General of the Italian Treasury and served as Chairman of the EU's Economic and Financial Committee, and was also a member of the G7 Deputies and Chairman of the Working Party 3 (OECD). Professor Draghi chaired the committee that drafted the body of legislation governing financial markets in Italy today. He was a Professor of Economics at the University of Florence from 1981 to 1991. He graduated from the University of Rome and has a PhD in Economics from the Massachusetts Institute of Technology.

Francesco Giavazzi is Professor of Economics at Bocconi University in Milan, a Research Fellow of CEPR and a Research Associate of NBER. He is also a member of the Strategic Committee of the French Treasury. During 1999 he was a member of the External Evaluation Committee of the Research Activities of the IMF. From 1992 to 1994 he served as a Director General of the Italian Treasury, responsible for debt management and privatizations. He graduated in Electrical Engineering from the Politecnico of Milan in 1972 and obtained a PhD in Economics from MIT (1978).

Robert C Merton is currently the John and Natty McArthur University Professor at the Harvard Business School. He is a co-founder and Chief Science Officer of Integrated Finance Limited, a specialized investment bank. In 1997, Professor Merton received the Alfred Nobel Memorial Prize in Economic Sciences. He is past President of the American Finance Association and a member of the National Academy of Sciences. In 1993, he received the inaugural Financial Engineer of the Year Award from the International Association of Financial Engineers.



---

# Contents

<i>List of Conference Participants</i>	<i>ix</i>
<i>List of Tables</i>	<i>xxi</i>
<i>List of Figures</i>	<i>xiii</i>
<i>List of Boxes</i>	<i>xiv</i>
<i>Acknowledgements</i>	<i>xv</i>
<i>Foreword</i>	<i>xvii</i>
<i>Executive Summary</i>	<i>xix</i>
<b>1 Risk and Transparency</b>	
1.1 Risk and derivatives	1
1.2 Transparency and accounting principles	3
<b>2 Risk and (Lack of) Transparency in US Balance Sheets: the Economic Effects of the Accounting Treatment of Defined-Benefit Pension Plans</b>	<b>5</b>
2.1 GAAP Rules and companies' exposure to risk via the pension plans they sponsor	5
2.2 Pension plans, income statements and bonuses	6
2.3 The transfer of risks onto the government	10
<b>3 Balance Sheets and Financial Guarantees</b>	<b>13</b>
3.1 Loans and guarantees	13
3.2 Transferring risk onto the government	14
3.3 Using option theory to measure the exposure to risk	16
3.4 The non-linear transmission of risk from corporate balance sheets to the government	20
3.5 Financial guarantees and negative feedback loops	20
<b>4 Sovereign Spreads, Macroeconomic Volatility and Debt Maturity</b>	<b>21</b>
<b>5 Observations for the Correct Evaluation of a Country's Exposure to Risk and for the Design of Prudential Rules for Financial Institutions and their Shareholders</b>	<b>27</b>
5.1 Balance sheets and financial crises	27
5.2 Government exposure to the financial system: computing a country's value-at-risk	29
5.3 The valuation of banks' assets	31
5.4 Can equity and/or subordinated debt substitute for risk monitoring?	32
5.5 Hedging macro risks	32



viii *Transparency, Risk Management and International Financial Fragility*

5.6	Foreign ownership of an emerging country's banks	33
5.7	Guarantees and governments' financial policies	34
5.8	Observations on Basel II	35
5.9	Capital controls	35
<b>6</b>	<b>Managing Risk to Reduce Financial Fragility</b>	<b>37</b>
6.1	Equity swaps as an instrument to diversify risk internationally	38
<b>7</b>	<b>Conclusions</b>	<b>45</b>
	<b>Discussion</b>	<b>47</b>
1	Discussion of the Report	47
2	First Panel Discussion - What is the problem? What can be done about it?	53
3	Second Panel Discussion - Risk assessment in balance sheets: Basel and other approaches	60
	<i>Bibliography</i>	<i>69</i>

---

# List of Conference Participants

Ignazio Angeloni	Deputy Director General Research, European Central Bank – Frankfurt am Main
Jeanne Barras-Zwahlen	Senior Economist, Relationship Development, Crédit Suisse Private Banking – Geneva
Jean-Pierre Beguelin	Chief Economist, Pictet and Cie – Geneva
Jan Marc Berk	Deputy Director Monetary Policy, De Nederlandsche Bank – Amsterdam
Martin Bornhauser	Editor, Neue Zürcher Zeitung – Zürich
Benoît Coeuré	Economic Adviser to the Director, Treasury Department, Ministry of Finance – Paris
Pierre Darier	Partner, Darier, Hentsch and Cie – Geneva
Oldrich Dedek	Vice-Governor, Czech National Bank – Prague
Thierry de Loriol	Chief Executive Officer, Ferrier Lullin and Cie SA – Geneva
Mario Draghi	Vice Chairman, Goldman Sachs International – London
Robert Dugger	Managing Director, Tudor Investment Corporation – Washington DC
Walter Engert	Research Adviser, Monetary and Financial Analysis, Bank of Canada, Ottawa
Stephen Freedman	Associate Director, Policy & Research, UBS AG – Zürich
Olivier Garnier	Head of Strategy & Economic Research, Société Générale Asset Management – Paris
Vitor Gaspar	Director General Research, European Central Bank – Frankfurt am Main
Hans Genberg	Professor, Graduate Institute of International Studies – Geneva
Francesco Giavazzi	Professor, Università Bocconi – Milano
Alberto Giovannini	Chairman, Unifortune Asset Management SGR – Milano
Svein Gjedrem	Governor, Norges Bank – Oslo
Ilan Hayim	Member of the Executive Committee, HSBC Guyerzeller Bank SA – Geneva

Marc Hendriks	Chief Economist, Economics Société Générale – London
Philipp Hildebrand	Managing Director, Member of the Executive Committee, Union Bancaire Privée – Geneva
Hugo Frey Jensen	Head of Financial Markets, Danmarks Nationalbank – Copenhagen
Karen Johnson	Director, International Finance, Federal Reserve System – Washington DC
Giles Keating	Global Head, Fixed Income Research & Eco, Crédit Suisse First Boston – London
Pierre Keller	Former Managing Partner, Lombard, Odier and Cie – Geneva
Ulrich Kohli	Director, Head of the International Affairs Division, Swiss National Bank – Zürich
Dino Kos	Executive Vice-President, Markets Group, Federal Reserve Bank of New York – New York
Edwin Lambregts	Economist, Monetary and Economic Policy Department, De Nederlandsche Bank – Amsterdam
Jean-Pierre Landau	Director, European Bank for Reconstruction and Development – London
John Lipsky	Chief Economist, Economics and Policy Research, JP Morgan – New York
David Lipton	Managing Director, Moore Capital Strategy Group – Washington DC
Jean-Claude Manini	Member of the Senior Management, Darier Hentsch and Cie – Geneva
Nuno Martins	Economist, Research Department, Bank of Portugal – Lisboa
David Mayes	Adviser to the Board, Bank of Finland – Helsinki
Robert C Merton	John and Natty McArthur University Professor, Harvard Business School
David Miles	Professor, Imperial College Management School – London
Carlo Monticelli	Co-Head European Economics, Deutsche Bank – London
Michael Mussa	Institute for International Economics (IIE)
Avinash Persaud	Managing Director, Global Head of Markets Research, State Street Corporation – London
Michel Peytrignet	Director, Head of Economic Division, Swiss National Bank – Zürich
Christian Pfister	Director for Economic Analysis and Research, Banque de France – Paris

Jean Pisani-Ferry	Président Délégué, Conseil D'Analyse Économique – Paris
Richard Portes	President, CEPR – London
Jan Fredrik Qvistad	Chief Economist, Executive Director, Norges Bank – Oslo
Hermann Remsperger	Member of the Board, Deutsche Bundesbank – Frankfurt
José Ramon Martinez Resano	Senior Economist, Operations Department, Banco de España – Madrid
Jean-Jacques Rey	Honorary Executive Director, National Bank of Belgium – Belgium
Märten Ross	Deputy Governor, Bank of Estonia – Tallinn
Hans-Jörg Rudloff	Chairman, Barclays Capital – London
Eric Sarasin	Partner, Private Banking International, Banque Sarasin and Cie – Geneva
Claudio Segré	Chairman, Argus Fund – Geneva
Neal Soss	Chief US Economist, Economics Crédit Suisse First Boston – New York
Alexander Swoboda	Professor, Graduate Institute of International Studies – Geneva
Angel Ubide	Director, European Analysis, Tudor Investment Corporation – Washington DC
Ignazio Visco	Chief Economist, Head of Economics Department, OECD – Paris
Ernst-Ludwig von Thadden	Professor, DEEP-HEC, University of Lausanne – Lausanne
William R White	Economic Adviser, Head of the Monetary and Economic Department, Bank for International Settlements – Basel
Bernhard Winkler	Counsellor to the Executive Board, European Central Bank – Frankfurt am Main
Ian Woolford	Manager, Financial Markets Department, Reserve Bank of New Zealand – Wellington
Charles Wyplosz	Professor, Graduate Institute of International Studies – Geneva
Jean Zwahlen	Vice-President, Union Bancaire Privée – Geneva

---

## List of Tables

Table 2.1	Balance sheet of a company sponsoring a defined-benefit pension plan	6
Table 2.2	Balance sheet effects of the minimum liability requirement in the case of unfunded defined-benefit plans (US\$ billion)	7
Table 2.3	Largest 50 US corporate defined-benefit pension funds as of 31 December 2001	8
Table 2.4	Risk transfer from the corporate sector to the government through defined-benefit company pension funds	11
Table 3.1	The balance sheet of a bank that issues guaranteed debt	15
Table 3.2	Transferring risk onto the government (\$)	15
Table 4.1	Output volatility and debt events	24
Table 6.1	Taiwan: Export shares and sectorial shares in manufacturing value added (2000)	37
Table 6.2	Outstanding OTC derivatives by underlying instrument	41
Table 6.3	The global credit derivatives market	44

---

# List of Figures

Figure 3.1	Value and pay-off of a guarantee	18
Figure 3.2	Government's exposure to the guarantee (hedge ratio)	18
Figure 3.3	'Market' value of corporate debt and cost of government guarantee to banks as a function of corporate sector asset value	19
Figure 3.4	Incremental cost of guarantee to banks compared to corporate sector assets	19
Figure 4.1	Sovereign spreads and asset volatility: high and low asset volatility	23
Figure 4.2	Sovereign spreads and debt duration	25

---

## List of Boxes

BOX 4.1	Using option theory to compute sovereign spreads	22
BOX 4.2	A fall in output can lead to a reduction in the value of a country's sovereign assets	26
BOX 6.1	Diversifying Taiwan's exposure to electronics	39
BOX 6.2	Other derivatives used to diversify a country's risk	42

---

# Acknowledgements

An earlier version was presented under the same title as the Geneva Report at the Fourth Geneva Conference on the World Economy, 'Financial Markets: Shock Absorbers or Shock Creators?', held at the International Center for Monetary and Banking Studies, Geneva, Switzerland, May 10 2002. Aid from the Centre for Economic Policy Research and the Swiss National Science Foundation is gratefully acknowledged. We thank Alberto Giovannini, Charles Goodhart, Michael Mussa and Elu von Thadden for their comments on an earlier draft, and Agostino Consolo for helpful assistance. Francesco Giavazzi thanks the Houblon-Norman Fund at the Bank of England for its hospitality while part of this work was conducted.





---

# Foreword

The catastrophic failure of the Enron Corporation, the losses sustained by pension funds in the recent bear market, and the international crises of the last decade have revealed widespread financial fragility. Executives and policy-makers have intensified their efforts to assess and manage risk as a result.

This fourth *Geneva Report on the World Economy*, written by a distinguished team of economists with extensive experience in financial markets, institutions and public policy, presents a novel framework for evaluating and managing financial risk. The authors contend that it is the unintended or unanticipated accumulation of risk on the balance sheets of individuals, institutions and governments – and not risk *per se* – that is at the root of many financial crises. The Report shows how explicit or implicit government guarantees of bank loans and defined-benefit pension plans can lead to the accumulation of unanticipated risk on public sector balance sheets. These cases demonstrate that this can occur in 'plain vanilla' financial arrangements, where no derivative financial instruments are used, and still give rise to significant off-balance-sheet leverage. Inadequate accounting principles have the effect of concealing the risk. It is therefore hardly surprising that governments fail to assess their financial position correctly and take on unsustainable levels of debt.

Drawing on options theory, the Report develops an analytic framework for measuring the extent of a government's exposure to risk and how this changes over time. This leads to recommendations for the design of prudential rules for financial institutions and their shareholders and for managing risk to reduce financial fragility. Ironically, derivatives, so often viewed as a destabilizing force, can offer more flexibility for risk diversification than a straight transfer of assets. Thus they may be a positive tool in controlling the accumulation of risk, particularly for emerging economies.

The annual series of *Geneva Reports on the World Economy* was launched by ICMB and CEPR in 1999. Previous titles in the series, 'An Independent and Accountable IMF, Asset Prices and Central Bank Policy', and 'How Do Central Banks Talk?' have attracted considerable interest among policy-makers, central bankers and executives. The series is a respected forum for reasoned discussion on the opportunities for reform of the international financial and economic system. We hope that you find the insights in this latest Report valuable.

Richard Portes  
CEPR

Tommaso Padoa-Schioppa  
ICMB

July 2003



---

# Executive Summary

Discussions of the role of derivatives and their risks, as well as discussions of financial risks in general, often fail to distinguish between risks that are taken consciously and ones that are not. To understand the breeding conditions for financial crises the prime source of concern is not risk *per se*, but the unintended – or unanticipated – accumulation of risks by individuals, institutions or governments, including the concealing of risks from stakeholders and overseers of those entities.

This paper analyses specific situations in which significant unanticipated and unintended financial risks can accumulate. We focus, in particular, on the implicit guarantees that governments extend to banks and other financial institutions, and which may result in the accumulation, often unrecognised from the viewpoint of the government, of unanticipated risks in the balance sheet of the public sector.

Using the structural analogy between guarantees and options, we show that a government's exposure to risk arising from a guarantee is non-linear. For instance, in the case of a government which guarantees the liabilities of the banking system, the additional liability transferred onto the government's balance sheet by a 10% shock to the capital of firms is larger the lower that capital is to start with. Recognising this non-linearity in the transmission of risk exposures is essential to the reduction of the accumulation of unanticipated risks on the government's balance sheet.

Analyses of recent international financial crises recognise that the implicit guarantees governments extend to banks and corporations create the potential to greatly weaken their balance sheets. The attention, however, has mostly focused on the reasons why such guarantees exist, rather than on measurement of the exposures they create. This paper offers just such a framework for measuring the extent of a government's exposure to risk and how that exposure changes over time.

We discuss the correct valuation of the assets of the banking system; drawing on the work of Gray (2001 and 2002) we analyse the issues to be addressed in order to compute a country's value-at-risk (VAR); using these insights we explain why the expected path of future fiscal variables (taxes and spending) should be adjusted whenever the value of the guarantees changes, such as, for instance, when the domestic economy weakens, or following an inflow of short-term capital.

Finally, we discuss ideas on how risk exposures can be controlled, hedged and transferred through the use of derivatives, swap contracts, and other contractual agreements.

In emerging-market economies the domestic financial market typically allows limited diversification of risks. Internal diversification through industrial policy can be inefficient and costly to reverse. In such a situation, diversification through international capital mobility is the obvious alternative. The transfer across borders of the ownership of real and financial assets is, however, only one way to achieve diversification, and it too can be costly to implement and even more costly to reverse. Often implementing these approaches to diversification conflicts

with political objectives and constraints. Over-the-counter (OTC) derivative contracts provide an appealing, non-invasive alternative way to transfer risk. Equity swaps, executed on a large scale, allow a country to diversify risk without shifting the ownership of assets or otherwise disturbing the domestic financial practices.

---

# **1 Risk and Transparency**

Well-functioning financial markets carry out many tasks: the transfer of value over time (borrowing-lending), across borders and industries; the facilitation of payments; and the fragmentation of large investment projects. An important latent function of financial markets is to provide timely information about the expectations of economic agents and on the value of the economy's assets.

But perhaps the foremost function that financial markets perform is the transfer or allocation of risk among different actors; young people, for instance, tend to be better equipped in taking on risk than old people. Given a total amount of risk in the economy, financial markets and financial institutions contribute to its distribution among different actors in a way that better fits individual preferences or conditions.

Financial markets, however, are often 'incomplete', in the sense that they provide only limited possibilities to shift risk across individuals. The role of swaps and other privately negotiated derivative instruments is to complete financial markets, thus increasing the ability of individuals, financial institutions, corporations and governments to manage risk.

## **1.1 Risk and derivatives**

Consider, for example, an emerging market economy. The domestic financial market will typically allow very limited diversification of risks. In such a situation, diversification through international capital mobility is the obvious alternative. The transfer across borders of the ownership of real and financial assets, however, is a rather inflexible way to achieve diversification, in the sense that it is costly to reverse. Often it also runs against political constraints.

Over-the-counter (OTC) derivative contracts provide an appealing alternative. Equity swaps, for instance, allow a country to diversify risk without shifting the ownership of assets. For example, a government could impose tight capital controls, limit foreign ownership of domestic firms and still diversify the country's exposure to domestic risk through equity swap contracts with foreigners that do not require the transfer of ownership of the underlying asset.

The general point is that risk diversification through derivative instruments is more flexible than diversification through the transfer of assets. Interest rate swaps, for instance, one of the most common of these instruments, allow banks to service both their borrowers, who want fixed-interest rate, long-dated loans, and their depositor lenders, who do not wish to be exposed to interest rate risk, without the bank taking interest rate exposure itself. Credit-default swaps allow a

bank to swap credit risk *vis-à-vis* one borrower for credit risk *vis-à-vis* a different set of borrowers: the risk-return performance of the bank may thus be improved without negatively affecting its relationship with customers – as might happen if the bank were to sell the loans. We discuss these instruments further in chapter 6 of this paper.

A volatile economic environment increases the incentive to use derivatives to achieve a better allocation of risk in the economy. During the first half of 2002, as uncertainty in the world economy was increasing, the size of the OTC derivatives market (foreign exchange, interest rate, equity-linked and commodity contracts), increased by 15%, reaching \$127,564 billion. Outstanding credit derivatives, a type of instrument that did not exist up to the mid-1990s, increased by 35%, reaching \$1,600 billion.<sup>1</sup>

As derivatives markets expand, however, so do the concerns regarding the possibility that the use of these instruments might increase the vulnerability of the financial system, rather than contribute to a better allocation of risks. These concerns were well summarized in a recent International Monetary Fund (IMF) paper:

'OTC derivative contracts bind institutions together in an opaque network of credit exposure, the size and characteristics of which can change rapidly and, moreover, are arguably not fully understood with a high degree of accuracy even by market participants themselves ... Risk assessments and management of exposures are seriously complicated by a lack of solid information and risk analyses about the riskiness of both their own positions and those of their counter-parties. As a result this market is characterized by informational imperfections about current and potential future credit exposures and market-wide financial conditions.'<sup>2</sup>

The collapse of Enron and the view that the company's use of derivatives was a factor in its demise – a view by no means uncontroversial, as discussed in ISDA (2002) – only added to these concerns.

Discussions of the role of derivatives and their risks, as well as discussions of financial risks in general, often fail to distinguish between different types of risk. To understand the breeding conditions for financial crises the prime source of concern is not risk *per se*, but the *unintended*, or *unanticipated* accumulation of risks by individuals, institutions or governments including the concealing of risks from stakeholders and overseers of those entities.

To make this point, the paper analyses specific situations in which significant unanticipated and unintended financial risks are accumulated. Among the examples concerning the public sector are the explicit and implicit guarantees that governments extend to banks and other financial institutions. Such guarantees can be the source of unrecognized accumulation by governments of unanticipated risks and resulting liabilities in the balance sheet of the public sector.<sup>3</sup>

We shall analyse how the value of such guarantees changes with the change in the value of the economy's assets, and what this implies for a government's financial policy, and thus for the sustainability of the public debt. This analysis will nat-

---

1 Data from the Bank for International Settlements (BIS) and the International Swaps and Derivatives Association (ISDA).

2 Schinasi *et al.* (2000, p. 50). The paper provides a thorough review of the problems associated with the use of derivative instruments.

3 These unexpected outcomes of economic actions are specific instances of the more general concept of unanticipated consequences of social actions. See R K Merton (1936, 1989).

urally lead to a set of reflections on the correct evaluation of a country's exposure to risk and on the design of prudential rules for banks and for their shareholders. It will also lead to a discussion of the way financial instruments, such as swaps, could be used to control the accumulation of risk.

## **1.2 Transparency and accounting principles**

There are situations where the unintended, or unanticipated accumulation of risks may be a sheer consequence of inadequate accounting principles that conceal risk itself. An important example of the limitations of standard accounting principles in identifying and revealing large risk exposures is offered by the treatment of company pension funds – a topic we take up in the next section of the paper.

The demise of Enron has attracted much attention on the lack of transparency of leverage and risk-taking by firms that move liabilities and risk exposures off their balance sheets by using complex special-purpose partnerships and derivatives. The same financial engineering tools that have served well in the efficient transfer of risks across otherwise incompatible institutional systems, may also be used to disguise large risks and value losses from even the most diligent of detectors.

The danger of abuse, and thus the need for corporate managers, board members and other external overseers to understand these instruments, has been rightly emphasized following the Enron events. Indeed, the boards of many firms are engaging outside risk specialists to search for what they call 'Enronitis' among their subsidiaries and capital structures. This focus on modern financial technology, however, can blind us to more fundamental issues surrounding the limitations of traditional accounting. The familiar, plain-vanilla, 'well-understood' defined-benefit corporate pension plan is an example of these limitations. Such plans present a far larger in magnitude and more widespread off-balance sheet leverage than any of the Enron transactions, and without reliance on complex derivative contracts at all.





---

## **2 Risk and (Lack of) Transparency in US Balance Sheets: the Economic Effects of the Accounting Treatment of Defined-Benefit Pension Plans**

A defined-benefit (DB) pension plan represents a secured claim by the plan's beneficiaries against the company – typically a guarantee of a pension of up to two-thirds of final salary. The plan's assets constitute collateral-like security for promised benefits. From an economic standpoint, this is equivalent to the company borrowing money to invest in assets. For this reason, a company that does not wish to use the DB pension plan that it sponsors to increase its asset risk and its leverage should invest 100% of the plan's assets in highly-rated, fixed-income, securities, the duration of which matches the duration of the plan's liabilities. This, however, is not what most companies do.<sup>1</sup>

### **2.1 GAAP rules and companies' exposure to risk via the pension plans they sponsor**

Generally accepted accounting principles (GAAP) in the United States (Statement of Financial Accounting Standards No. 87 – SFAS 87) direct public companies that sponsor a DB pension plan to report, in their balance sheet and income statement, only the net difference between the company's pension assets and liabilities, as a corporate asset or liability. Thus, what enters the company's balance sheet is only the surplus (deficit), which is the difference between the value of the plan's assets and its liabilities. For example, a plan with \$65 billion in assets and \$64 billion in pension liabilities would report a net amount of surplus of \$1 billion, the same as a plan with \$2.5 billion in assets and \$1.5 billion in liabilities. The amount of risk a company accumulates in its balance sheet, via the exposure to its pension plan, thus is not immediately visible.

Table 2.1 shows the balance sheet of a hypothetical company which sponsors a DB pension plan. The case shown in the table is that of a company whose plan is fully-funded – that is, at current market prices assets and liabilities are matched. This, of course, would not be the case if, for instance, interest rates subsequently changed.

For example, if the pension plan's assets are partly (for the typical US plan, around 60%) invested in stocks, then a simultaneous fall in both interest rates and stock prices – as might happen during a recession or in a financial crisis with a flight to quality – would increase the value of the plan's liabilities, which rise as interest rates fall, and at the same time reduce the value of the assets held as col-

---

1 For an extended discussion see Bodie *et al.* (2002).

**Table 2.1** Balance sheet of a company sponsoring a defined-benefit pension plan

Assets	Liabilities
Capital	-Equity -Debt
<i>Off-balance sheet:</i>	
Pension fund assets:	DB plan liabilities
-Bonds 40	100
-Stocks 60	

**Note:** The case shown is that of a company whose plan is fully-funded

lateral for those liabilities. The company's economic balance sheet is thus exposed to the volatility of the plan's assets and liabilities.<sup>2</sup>

The accounting treatment of a DB pension plan is thus little different from the treatment of an off-balance-sheet long-dated swap derivative contract in which the company receives the total return on an equity portfolio and pays a fixed rate of interest in return applied to a notional amount equal to pension liabilities.

Therefore, a standard US corporate pension plan may produce the same leverage and potentially large risk as would the use of an equivalent derivative contract, with neither directly reported on the balance sheet.

## 2.2 Pension plans, income statements and bonuses

GAAP rules allowing a company to account for the surplus income from its DB pension plan as operating income can obscure any assessment of the company's performance. Consider, for example, a good-performing year, that is a year in which the return on the pension plan's assets is particularly good and exceeds what would be required to match the increase in the plan's liabilities. GAAP rules allow this excess return to be credited as a new intangible asset, called 'prepaid benefit expense'. The opposite adjustment can be made in a bad year.

The beneficiaries of excess return are not the plan's beneficiaries, but the company's shareholders who can draw on this intangible asset to top up the company's net income. For example, in 2001 Verizon Communications Inc. reported a net income of \$389 million, after taking losses for a variety of telecom investments. The 'true' net income, however, was a loss of \$1.8 billion. The net income was turned positive by drawing on the excess return on the assets of the company's pension plan.

Milliman USA, a benefits consulting firm, reports that in 2001 the net income declared by 50 large US corporations included \$54.4 billion of excess returns from pension funds' assets. In fact, these assets lost \$35.8 billion.<sup>3</sup>

2 We believe that the correct way to compute the value of a plan's liabilities is to use the yield on a long-term default-free bond as the discount rate since in this case liabilities are valued using a discount rate that has the same risk and timing characteristics as the payments the plan will make. This belief, however, is not undisputed. When stock markets fall, some actuaries hold that the fall in asset prices does not matter for the solvency of a pension plan, because, as share prices decline, the dividend yield rises and the expected return on the market increases. Accordingly, as the assets decline, so does the actuarially measured values of the liabilities – assuming this is computed using the dividend yield, as discount rate.

3 [www.milliman.com](http://www.milliman.com)

Discretion on the part of companies in their treatment of the returns on pension fund assets, and thus lack of transparency, extends far beyond. Keeping to the Verizon example, if the company pension plan is examined more closely, it is found that in 2001 the return on the plan's assets was negative, and resulted in a reduction in the value of total assets amounting to \$3.1 billion. How then could the company claim an excess return and report it on its income statement?

GAAP rules are based on the assumption that over time positive and negative returns on a pension plan's assets will balance out. A company's accounting is thus expected to understate the plan's losses in bad years and its plan's gains in good years. In economic terms, shareholders should benefit from the pension plan's income with smaller contributions in good years, and pay more into the plan in bad years. This is not what always happens in accounting terms. Verizon's 2001 income statement 'assumes' that its pension plan had earned a return of 9.25% and it reported income as if that assumption were true. Other companies made even more bold assumptions: IBM assumed a return of 10%, General Electric assumed 9.5%. In Verizon's case, the income associated with a return of 9.25% would have exceeded the amount required to balance the increase in the liabilities of the company's pension plan: thus the origin of the 'excess' return.

The incentives to legally manipulate the return on a company pension plan are enhanced by the practice of including the income assumed to have been originated from the pension plan's assets when computing management's performance bonuses.

When a plan slips into underfunded status, however – as might happen when the fall in asset prices and interest rates do not reverse and eventually must be recognized in the company's accounts – a corporation's equity may take a hit that can disproportionately exceed the year's charge to the DB pension plan. This is because SFAS 87 requires a corporation whose plan falls into unfunded status to take two actions:

1. Charge to the balance sheet a minimum liability equal to the amount underfunded. Thus, for a pension plan for which the minimum liability is required, all losses of the plan for the year – including the full effect of higher liability measured at the new lower interest rates and asset losses in the weak markets – are immediately reflected as reductions in shareholder equity.

**Table 2.2** Balance sheet effects of the minimum liability requirement in the case of unfunded defined-benefit plans (US\$ billion)

	Initial measurements	Adjustment for minimum liability	Final figures
Accumulated benefit obligation	50		50
Assets	49		49
Unfunded	1		1
Accrued/(Prepaid) pension expense	5	6	1

**Note:** The US\$6 billion adjustment is treated as a direct reduction in shareholder equity.

**Table 2.3** Largest 50 US corporate defined-benefit pension funds as of 31 December 2001

Company name		US defined benefit pension assets, 31/12/01, \$ million <sup>a</sup>	U.S.defined benefit pension liabilities (PBO as of 31/12/01), \$ million <sup>a</sup>	Total assets of sponsor, 31/12/01 \$ million	Market value of sponsor, 31/12/01 \$ million
1	GENERAL MOTORS CORP	73,662	86,333	323,969	26,997
2	INTL BUSINESS MACHINES CORP	61,096	60,410	88,313	208,371
3	FORD MOTOR CO	48,754	51,214	276,543	27,368
4	VERIZON COMMUNICATIONS	48,558	36,391	170,795	128,828
5	GENERAL ELECTRIC CO	45,006	30,423	495,023	398,105
6	LUCENT TECHNOLOGIES INC <sup>b</sup>	35,539	29,850	33,664	21,510
7	BOEING CO	33,810	32,693	48,343	30,945
8	SBC COMMUNICATIONS INC	32,715	25,060	96,322	131,672
9	DAIMLERCHRYSLER AG	28,152	30,817	184,616	42,295
10	BP PLC	22,505	20,402	141,158	177,026
11	ROYAL DUTCH PETROLEUM	21,852	19,343	66,926	105,075
12	LOCKHEED MARTIN CORP	20,300	19,713	27,654	20,559
13	AT&T CORP	18,485	14,035	165,282	64,180
14	DU PONT (E I) DE NEMOURS	17,923	18,769	40,319	44,197
15	BELLSOUTH CORP	16,617	11,928	52,046	71,606
16	NORTHROP GRUMMAN CORP	13,889	12,404	20,886	11,211
17	EXXON MOBIL CORP	12,170	19,419	143,174	268,833
17	PHILIP MORRIS COS INC	11,720	12,222	84,968	99,343
19	DOW CHEMICAL	11,424	11,341	35,515	30,466
20	QWEST COMM'N INTL INC	11,121	9,625	73,781	23,526
21	HONEYWELL INTERNATIONAL INC	11,051	10,952	24,226	27,502
22	CITIGROUP INC	10,323	10,388	1,051,450	259,710
23	RAYTHEON CO	10,164	11,171	26,636	12,693
24	UNITED TECHNOLOGIES CORP	10,025	12,354	26,969	30,282
25	UNITED STATES STEEL CORP	8,583	7,358	8,337	1,608

26	CATERPILLAR INC	8,481	8,611	30,657	17,935
27	ALCOA INC	8,434	8,488	28,355	30,196
28	DELTA AIR LINES INC	8,304	10,657	23,605	3,606
29	BANK OF AMERICA CORP	8,264	8,135	621,764	99,041
30	3M CO	8,008	8,998	14,606	46,348
31	EASTMAN KODAK CO	7,942	7,439	13,362	8,562
32	TRW INC	7,902	7,482	14,444	4,687
33	UAL CORP	7,575	10,095	25,197	736
34	PG&E CORP	7,175	6,087	35,862	7,451
35	XEROX CORP	7,040	7,606	27,689	7,502
36	CONSOLIDATED EDISON INC	6,634	5,904	16,996	8,566
37	INTL PAPER CO	6,502	6,419	37,158	19,447
38	UNITED PARCEL SERVICE INC	6,496	5,347	24,636	18,302
39	GENERAL DYNAMICS CORP	6,107	5,162	11,069	16,070
40	DEERE & CO	5,951	6,440	22,663	10,364
41	CHEVRONTEXACO CORP	5,947	7,028	77,572	95,640
42	PFIZER INC	5,648	6,956	39,153	250,526
43	FEDEX CORP <sup>c</sup>	5,510	6,227	13,812	15,467
44	AMR CORP/DE	5,482	7,422	32,841	3,445
45	UNISYS CORP	5,215	4,816	5,769	4,002
46	SOUTHERN CO <sup>b</sup>	5,109	3,760	29,824	17,341
47	BETHLEHEM STEEL CORP.	4,753	6,495	4,244	59
48	AMERICAN ELECTRIC POWER	4,510	4,391	47,281	14,027
49	TEXTRON INC	4,480	3,908	16,052	5,853
50	JOHNSON & JOHNSON	4,355	5,026	38,488	181,286

Note:

<sup>a</sup> Data in these columns were derived from 10-Ks which use FASB valuation guidelines. Liabilities are based on Projected Benefit Obligations (PBOs) and assets may be fair market or market-related values.

<sup>b</sup> Pension valuation data as of 30/9/01.

<sup>c</sup> Pension valuation data as of 31/5/01.

**Source:** Compustat, adapted by Akiko M. Mitsui, Research Associate, Harvard Business School on 1 December 2002.

2. Cancel any asset that had been created in the corporation's balance sheet as a result of the accumulation of excess returns on the pension plan's assets during the previous years. The charge for such cancellation is taken by shareholders' equity.

To illustrate, assume a plan was previously overfunded, generating a positive contribution (negative annual cost of the plan) to the income statement in prior years. These positive contributions appear as a prepaid pension cost, an asset item on the company's balance sheet. Now assume that the plan is no longer overfunded due to investment losses and/or an increase in obligations. The consequence of the minimum liability calculation is that:

1. the prepaid pension cost (an asset) must be eliminated; and
2. an accrued pension cost (a liability) equal to the amount of underfunding must be carried on the balance sheet.

The combined effect of these changes can be a significant adjustment to shareholder equity, as illustrated in Table 2.2. Note that in this example, the company's equity is reduced not merely by the \$1 billion underfunding, but by the reversal of all of the previously accumulated prepaid pension cost as well.

### **2.3 The transfer of risks onto the government**

GAAP accounting principles thus conceal on a year-on-year basis a company's true exposure to market volatility, which should include the substantial exposure acquired through the assets and liabilities of its pension plan.

Full disclosure, on corporate balance sheets, of the composition of a pension plan's assets (or, in the absence of it, continuous matching of the marked-to-market value of the plan's assets with that of its liabilities) would reveal the true degree of the company's leverage and risk. This is not something that is being considered in current proposals for an overhaul of GAAP rules.<sup>4</sup>

How widespread is the problem? For many of the 50 largest US companies (see Table 2.3) DB plans account for the bulk of the company's pension plan assets. The remaining pension assets are accounted for by defined-contribution plans, such as 401(k). These assets collectively can be a multiple of the company's market capitalization. In December 2001 the pension assets of General Motors (GM), the largest corporate pension plan in the United States with over \$73 billion in DB plan assets, were 2.7 times the company's stock market value. As inspection of Table 2.2 reveals, GM is certainly not alone in this position among US corporations. Corporate pension assets in total represent a significant fraction of the overall market value of US corporate equity, over one-quarter. On average, 60% of the assets of DB plans are invested in common stocks: the fraction has increased from about 50% in the 1980s.<sup>5</sup>

As long as the company is solvent, the risks and rewards of allocating the plan's assets to equities are borne by shareholders, since the fund's beneficiaries enjoy a defined benefit with no upside. If the company were to go into bankruptcy, however, the risks are transferred in part to the beneficiaries, and in part to the

---

4 For a proposal in this direction see Hancock and Mendoza (2002).

5 GM announced in January 2003 that its pension fund assets were unfunded by \$19.3 billion, compared with \$9.1 billion a year earlier (*Financial Times*, 10 January 2003, p. 21).

**Table 2.4** Risk transfer from the corporate sector to the government through defined-benefit company pension funds

Corporate balance sheet			
Assets		Liabilities	
Corporate assets	160	Debt	90 (-10)
	(-40)	Equity	70 (-30)
Pension plan			
Assets		Liabilities	
Bonds	10	Present value of benefits	
Corporate equity	7	20	
	(-3)		
Financial guarantee	3		
	(+3)		
Government balance sheet			
Assets		Liabilities	
	A	A	
		Guarantee to the pension plan	
		3	
		(+3)	

federal government through the Pension Benefit Guarantee Corporation (PBGC), the government institution offering partial guarantee to the beneficiaries of the companies' DB plans. Therefore, when a company invests the assets of its pension plan in common stock it is *de facto* raising its leverage, and transferring, at least in part, the risk onto the plan's beneficiaries and onto the government.

Negative shocks to the corporate sector can thus be transferred, through company pension funds to the government. An example is shown in Table 2.4. We assume that the pension plan (a DB plan with government guarantee) is invested 50% in equity. A negative shock to the corporate sector reduces the value of its assets by 40%, causing a 30% fall in equity. The fraction of the pension plan's assets invested in equity also falls by 30%. In a DB plan the liabilities are unaffected by the shock. Therefore, the government's financial exposure to the plan increases by a corresponding amount.

The effects of the transfer of risk onto the government are apparent in the balance sheet of the PBGC for the year ended on 30 September 2002.<sup>6</sup> During this period the operating loss of the corporation amounted to \$3.64 billion, a \$11.37 billion net turnaround from a \$7.73 billion surplus a year earlier, the largest in the federal pension insurer's 28-year history. Of these losses, by far the largest fraction – \$9.31 billion – is accounted for by the increase in 'claims for actual and probable pension plan terminations', that is for the pension obligations transferred to the PBGC by company plans in default, plus the increase in the value of the guarantees extended. This loss arises because, under GAAP, the PBGC recognizes as a loss both actual and probable pension plan terminations. During fiscal year 2002, \$5.91 billion of the \$9.31 billion in losses were from 'probables'. Since the close of the 2002 fiscal year, the agency has assumed full responsibility for the pension plans of two companies – National Steel and Bethlehem Steel – that together accounted for \$5.16 billion of the losses estimated as 'probable' on 30 September. Another key factor was the decline in interest rates, which increased the programme's liabilities by \$1.65 billion.

<sup>6</sup> The balance sheet is available at [www.pbgc.gov](http://www.pbgc.gov).





---

## **3 Balance Sheets and Financial Guarantees<sup>1</sup>**

The pension plan example shows how the government can become exposed to shocks that originate in the private sector. Financial guarantees can transfer risk across different sectors in the economy and also produce negative feedback loops that can trigger severe crises. In this section we develop this theme further, showing how the implicit guarantees that governments extend to banks and other financial institutions result in the accumulation, often unconscious from the viewpoint of the government, of unanticipated risks in the balance sheet of the public sector.

### **3.1 Loans and guarantees**

Any time a bank makes a loan, an implicit guarantee of that loan is involved. To see this, consider the following identity, which holds in both a functional and a valuation sense:

$$\text{Risky Loan} + \text{Loan Guarantee} \equiv \text{Default-free Loan}$$

this can also be re-written as:

$$\text{Risky Loan} \equiv \text{Default-free Loan} - \text{Loan Guarantee}$$

Lending by a bank thus consists of two functionally distinct activities: pure default-free lending and the bearing of default risk by the lender.<sup>2</sup> This equivalence of course applies more generally to other forms of debt obligations, not only to bank loans. Whenever a lender makes a loan to anyone other than a default-free government, they are implicitly also selling a guarantee.

To see this point more clearly, it will perhaps be helpful to think of the lending activity as taking place in two steps:

1. purchasing a guarantee; and
2. taking up a loan

---

1 This section draws heavily on Merton and Bodie (1992).

2 This identity strictly applies only if (a) the guarantee itself is default-free, and (b) it covers the entire loan. That is, the guarantor will not default on this obligation, and their obligation is to make up fully for any loss on promised payments. Some guarantees have deductibles, or require co-insurance with the debt holder. Tax treatments and other regulatory factors could also affect the identity. While such factors are important in analysing specific situations, they are not essential in understanding the fundamental functional activity of lending as discussed in the text.

Suppose that the guarantor and the lender are two distinct entities. In the first step, the borrower buys a guarantee from the guarantor for, say, \$10. In the second step, the borrower takes this guarantee to the lender and borrows \$100 at a default-free interest rate of, say, 10% per year. As a result the borrower receives a net amount of ( $\$100 - \$10 =$ ) \$90 in return for a promise to pay back \$110 in a year.

Often, of course, the lender and the guarantor are the same entity – for example, a commercial bank – and the borrower simply receives the net \$90 from the bank in return for a promise to repay \$110 in a year. The interest rate on the loan is then stated as 22.22%, that is,  $(\$110 - \$90)/\$90$ . This *promised* rate reflects both the risk-free interest rate and the charge for the guarantee. To see that the two are separable activities, note that the holder of the risky debt could buy a third-party guarantee for \$10, as shown in Table 3.1. The holder would then be making a total investment of  $\$90 + \$10 = \$100$  and would receive a sure payment of \$110.

The purchase of any real-world loan is thus functionally equivalent to the purchase of a pure default-free loan and the simultaneous issue of a guarantee on that loan. In effect, the creditor simultaneously pays for the default-free loan and receives a 'rebate' for the guarantee of that loan. The magnitude of the value of the guarantee relative to the value of the default-free loan component varies considerably. A high-grade bond (rated AAA) is an almost default-free loan with a very small guarantee component. A below-investment-grade or 'junk' bond, on the other hand, typically has a large guarantee component.

### **3.2 Transferring risk onto the government**

The liabilities that banks issue to fund their lending are often guaranteed by the government – typically through deposit-insurance schemes. Here, we analyse the effects of these guarantees for the public sector. In particular, and more importantly, we wish to understand how the risk exposure of the government changes as the value of the banks' assets changes.

Table 3.2 shows the balance sheets for a corporation, for a bank which holds its debt, and for the government. The bank itself is financed in part with debt, in part with equity; the value of the debt, if its promised payments were risk-free, is \$90. In panel A there is no guarantee, therefore the debt is risky: its market value is \$85, lower than its default-free value of \$90. This is because, as in the example discussed above, it reflects the prospect of a lower-than-promised payment in the event of default. In panel A the government is not involved in guaranteeing the bank: its balance sheet is balanced with assets and liabilities both equal to A.

Next, in panel B we examine what happens following a shock that reduces the capital of the corporation, and thus also the market value of the bank's asset. The loss is absorbed in part by bondholders and in part by the bank's shareholders – say one-third by the former, and two-thirds by shareholders. The market value of the debt falls to  $\$82 = \$85 - \$3$ ; the bank's equity to  $\$8 = \$15 - \$7$ . The government's balance sheet is again unaffected.

Now let us introduce a government guarantee that makes the bank's debt risk-free. This is shown in panel C. Before the shock, when the capital of the corporation is worth \$200, and the bank's assets are worth \$100, the value of the guarantee is \$5, exactly the amount of the default discount on the non-guaranteed debt. Since the debt is fully guaranteed by the government, the value of shareholders' equity does not change. In the balance sheet of the bank the guarantee is an 'off-balance-sheet' item (this is why we write it 'below the line'),

**Table 3.1** The balance sheet of a bank that issues guaranteed debt (\$)

Assets	Liabilities
Risky asset 90	Guaranteed debt 100
Guarantee 10	

**Table 3.2** Transferring risk onto the government (\$)

Corporation	Bank	Government																						
A)																								
<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Capital 200</td> <td>Loan 100</td> </tr> <tr> <td></td> <td>Equity 100</td> </tr> </tbody> </table>	Assets	Liabilities	Capital 200	Loan 100		Equity 100	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Loan 100</td> <td>Debt 85</td> </tr> <tr> <td></td> <td>Equity 15</td> </tr> </tbody> </table>	Assets	Liabilities	Loan 100	Debt 85		Equity 15	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A</td> </tr> </tbody> </table>	Assets	Liabilities	A	A						
Assets	Liabilities																							
Capital 200	Loan 100																							
	Equity 100																							
Assets	Liabilities																							
Loan 100	Debt 85																							
	Equity 15																							
Assets	Liabilities																							
A	A																							
B)																								
<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Capital 160</td> <td>Loan 90</td> </tr> <tr> <td></td> <td>Equity 70</td> </tr> </tbody> </table>	Assets	Liabilities	Capital 160	Loan 90		Equity 70	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Loan 90</td> <td>Debt 82</td> </tr> <tr> <td></td> <td>Equity 8</td> </tr> </tbody> </table>	Assets	Liabilities	Loan 90	Debt 82		Equity 8	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A</td> </tr> </tbody> </table>	Assets	Liabilities	A	A						
Assets	Liabilities																							
Capital 160	Loan 90																							
	Equity 70																							
Assets	Liabilities																							
Loan 90	Debt 82																							
	Equity 8																							
Assets	Liabilities																							
A	A																							
C)																								
<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Capital 200</td> <td>Loan 100</td> </tr> <tr> <td></td> <td>Equity 100</td> </tr> </tbody> </table>	Assets	Liabilities	Capital 200	Loan 100		Equity 100	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Loan 100</td> <td>Debt 90</td> </tr> <tr> <td>-----</td> <td>Equity 15</td> </tr> <tr> <td>Gov. Guar. 5</td> <td></td> </tr> </tbody> </table>	Assets	Liabilities	Loan 100	Debt 90	-----	Equity 15	Gov. Guar. 5		<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A</td> </tr> <tr> <td></td> <td>-----</td> </tr> <tr> <td></td> <td>5 Bank Guar.</td> </tr> </tbody> </table>	Assets	Liabilities	A	A		-----		5 Bank Guar.
Assets	Liabilities																							
Capital 200	Loan 100																							
	Equity 100																							
Assets	Liabilities																							
Loan 100	Debt 90																							
-----	Equity 15																							
Gov. Guar. 5																								
Assets	Liabilities																							
A	A																							
	-----																							
	5 Bank Guar.																							
D)																								
<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Capital 160</td> <td>Loan 90</td> </tr> <tr> <td></td> <td>Equity 70</td> </tr> </tbody> </table>	Assets	Liabilities	Capital 160	Loan 90		Equity 70	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Loan 90</td> <td>Debt 90</td> </tr> <tr> <td>-----</td> <td>Equity 8</td> </tr> <tr> <td>Gov. Guar. 8</td> <td></td> </tr> </tbody> </table>	Assets	Liabilities	Loan 90	Debt 90	-----	Equity 8	Gov. Guar. 8		<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A</td> </tr> <tr> <td></td> <td>-----</td> </tr> <tr> <td></td> <td>8 Bank Guar.</td> </tr> </tbody> </table>	Assets	Liabilities	A	A		-----		8 Bank Guar.
Assets	Liabilities																							
Capital 160	Loan 90																							
	Equity 70																							
Assets	Liabilities																							
Loan 90	Debt 90																							
-----	Equity 8																							
Gov. Guar. 8																								
Assets	Liabilities																							
A	A																							
	-----																							
	8 Bank Guar.																							
E)																								
<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Capital 120</td> <td>Loan 75</td> </tr> <tr> <td></td> <td>Equity 45</td> </tr> </tbody> </table>	Assets	Liabilities	Capital 120	Loan 75		Equity 45	<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>Loan 75</td> <td>Debt 90</td> </tr> <tr> <td>-----</td> <td>Equity 2</td> </tr> <tr> <td>Gov. Guar. 17</td> <td></td> </tr> </tbody> </table>	Assets	Liabilities	Loan 75	Debt 90	-----	Equity 2	Gov. Guar. 17		<table border="1"> <thead> <tr> <th style="text-align: center;">Assets</th> <th style="text-align: center;">Liabilities</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>A</td> </tr> <tr> <td></td> <td>-----</td> </tr> <tr> <td></td> <td>17 Bank Guar.</td> </tr> </tbody> </table>	Assets	Liabilities	A	A		-----		17 Bank Guar.
Assets	Liabilities																							
Capital 120	Loan 75																							
	Equity 45																							
Assets	Liabilities																							
Loan 75	Debt 90																							
-----	Equity 2																							
Gov. Guar. 17																								
Assets	Liabilities																							
A	A																							
	-----																							
	17 Bank Guar.																							

but its value is fully reflected in the equity of the shareholders. Finally, the guarantee shows up in the government's balance sheet as an additional liability: here too we write it below the line, to reflect that such guarantees are seldom accounted for in the government's books.<sup>3</sup>

The guarantee protects the debt from the effects of the shock to the corporation's balance sheet. This is shown in panel D. Equity falls to \$8, as in the absence of the guarantee, while the market value of the debt does not move from its risk-free value, \$90. This of course is possible because the value of the government's guarantee has risen from \$5 to \$8, an increase that matches the loss that the debt would have incurred in the absence of the guarantee. The government's balance sheet now reflects the greater value of its guarantee to the banks.

The government's exposure to the guarantee changes as the value of the underlying variables changes. This is because the government guarantee protects the debt from the effects of any shock to the corporation's balance sheet. In the last panel of Table 3.2, panel E, we examine by how much the value of the guarantee would rise, following a further shock to the capital of the corporation, one that reduces it to \$120, a further loss of \$40.

The decline in the value of corporate assets increases the prospect of a default and a lower-than-promised payment to the bank: this reduces the value of the corporation's debt to, say, \$75. The value of the corporation's equity thus falls to \$45. Now consider the balance sheet of the bank. Without the guarantee, the market value of the bank's debt would have fallen, say, to \$73 and the bank's equity to \$2. The government's guarantee protects the value of its liabilities: it thus amounts to \$17.

In our examples, the relative proportions in which a fall in the value of the bank's assets is borne by debt and equity – or by equity and the government guarantee – were simply given exogenously. Understanding the underlying structure and variables that determine the increase in the value of the guarantee, as the capital of the corporation falls, will assist our understanding of how governments, by guaranteeing the bank's debt, can accumulate unanticipated risks – and why even recognizing the liability incurred at a given point in time on a marked-to-market basis is not enough to fully capture the government's changing risk exposure.

### **3.3 Using option theory to measure the exposure to risk**

Guarantees, like options, are contingent liabilities for their issuers, with required future pay-offs contingent on the values of other assets. Indeed, the equivalence between a risk-free loan and the combination of a risky loan plus a guarantee suggests the analogy between a loan and a put option on that loan. The guarantee component of a risky loan is analogous to a put option that is a binding commitment to buy the loan for  $V_0$ , the promised value of the loan, in case the borrower, when the loan contract expires, is unable to repay – fully or partially.<sup>4</sup>

In the previous example the position of the holders of the corporation's debt is analogous to a default-free debt combined with a short position in a put option on corporate assets. The economic balance sheet of the bank includes assets consisting of loans to the corporation, which can be decomposed into default-free

3 In the United States, the Office of Management and Budget is supposed to estimate the value of all guarantees issued by the government.

4 If the loan can default before maturity, the guarantee corresponds to an American option, where the exercise date is not predetermined. See Merton (1974, 1977).

debt as an asset and the put option as a liability. The bank also holds, among its assets, a government financial guarantee. The government, as the issuer of that guarantee, has it as a liability on its economic balance sheet.

The three economic balance sheets can be used to demonstrate the interdependence among sectors. One is 'long' on a certain implicit option; another is 'short' on the same implicit option. These implicit options thus create important risk inter-linkages among different sectors.

The analogy between guarantees and options suggests a simple way to measure the exposure to risk arising from a guarantee. For instance, if a government guarantees the liabilities of the banking system, how does its exposure change, as the value of corporate assets changes? Option theory suggests a number of ways to measure exposure to risk. The most common one, 'delta', is the change in the value of an option as the value of the underlying asset changes. 'Delta' is thus an appropriate measure of an institution's exposure to risk. In our example 'delta' could be used to measure to what extent the government's exposure to its guarantee changes, as the value of corporate assets, and thus of the assets of the banking system, change.<sup>5</sup>

To construct a measure of exposure to risk using option price theory, we start, in Figure 3.1, showing two relations. The piecewise linear line is the *pay-off*, at the maturity date, for the holder of a guarantee (the option), as a function of the mark-to-market price of the underlying asset – the bank's loan or the capital of the corporation in the particular case analysed in the previous section. The pay-off is positive if  $V$  is less than  $V_0$ , zero if  $V$  is equal or greater than  $V_0$ . The other relation plotted in Figure 3.1 describes the *value of the guarantee* (the option), as a function of the mark-to-market price of the underlying asset. This is inversely and non-linearly related to the price of the underlying stock.<sup>6</sup>

Figure 3.2 shows the government's exposure to risk for any given value of the bank's assets. The curve plotted in this figure is (the absolute value of) the tangent slope of the curve shown in Figure 3.1 – that is, of the value of the guarantee, for a date prior to the maturity of the asset. This curve (the 'delta') measures by how much the value of the guarantee changes as the value of the bank's assets change. It shows that the government's exposure, acquired through the guarantee, for certain ranges of values increases more than proportionately as the market value of the bank's assets falls.

The reference to the activities of investors is suggestive of how the government's exposure changes as asset prices fluctuate. The additional liability transferred on the government's balance sheet by a 10% shock to the capital of firms is larger the lower is that capital to start with. Recognizing this point about the non-linearity in the transmission of risk exposures is essential to prevent the accumulation of unanticipated risks on the government's balance sheet.

5 'Delta' is sometimes also called the 'hedge ratio'. This is with reference to the activities of investors who 'hedge' their position in put options by buying shares in the underlying stock. Because the price of the option rises as the value of the underlying asset falls, an investor who owns one put option, and wishes to hedge, must buy a number of shares that is larger the lower is the price of the stock. The 'hedge ratio' increases as the value of the underlying asset falls. See, for example, Hull (2000, pp. 310-19).

6 The figure is created using the option formulas developed in Black and Scholes (1973) and in Merton (1973) with the following parameter values: risk free rate = 0.04; time to maturity = 1 year; volatility = 0.50; and strike price = 105.

Figure 3.1 Value and pay-off of a guarantee

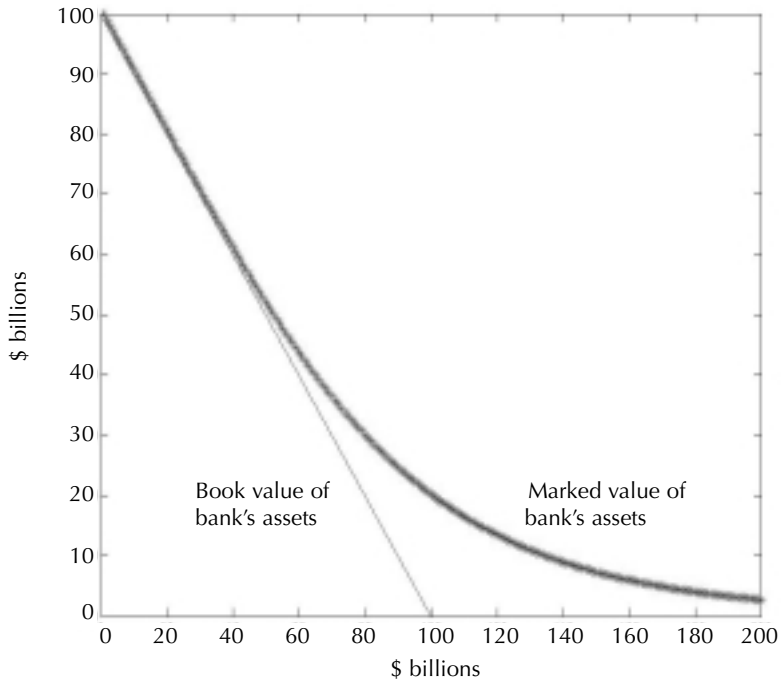
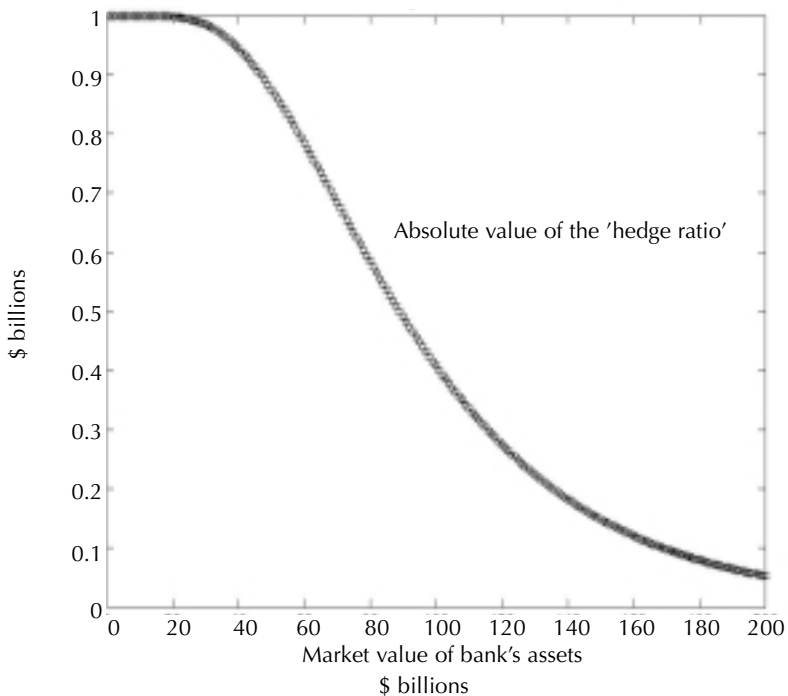
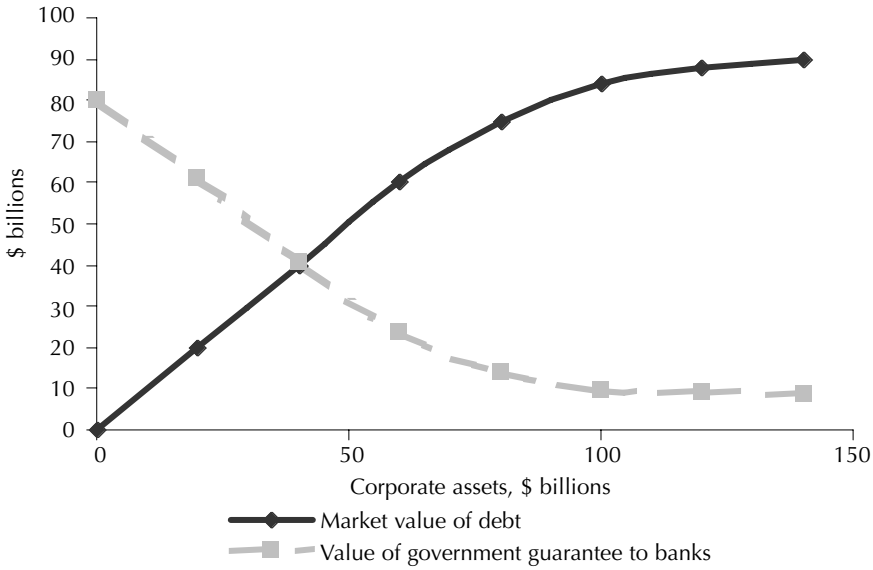


Figure 3.2 Government's exposure to the guarantee (hedge ratio)



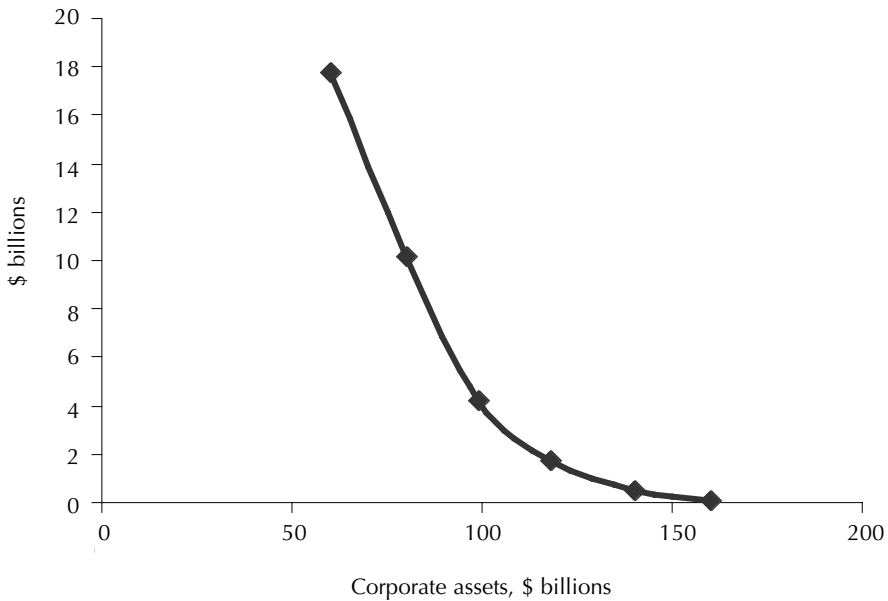
Source: Gray *et al* (2002).

**Figure 3.3** 'Market' value of corporate debt and cost of government guarantee to banks as a function of corporate sector asset value



**Source:** Gray *et al* (2002).

**Figure 3.4** Incremental cost of guarantee to banks compared to corporate sector assets



**Source:** Gray *et al* (2002).



### **3.4 The non-linear transmission of risk from corporate balance sheets to the government**

The framework described helps explain how volatility can be transferred in a non-linear way from the corporate and banking sectors onto the government. In the example, risk is transferred through the guarantee. Following a negative shock to the corporate sector (for instance following a devaluation in the presence of unhedged foreign corporate debt), the value of corporate assets decline, and the value of the government guarantee to the banks increases in a *non-linear* way. This is also shown in Figures 3.3 and 3.4.

### **3.5 Financial guarantees and negative feedback loops**

Financial guarantees can produce negative feedback loops that can trigger severe crises. For instance, rating agencies may react to the information that the value of a government's guarantees has increased by downgrading its sovereign bonds. The downgrade will raise the cost of servicing the public debt and lower the present discounted value of future budget surpluses. This will lower the value of the government's assets precisely when the value of its liabilities has increased.

---

## 4 Sovereign Spreads, Macroeconomic Volatility and Debt Maturity<sup>1</sup>

Countries that issue large amounts of sovereign debt – especially, but not only, in emerging economies – often only do so by issuing financial instruments with a very short duration. In Brazil, for instance, the duration of two-thirds of the entire public debt is currently shorter than 12 months. Thus, when the spreads that such sovereigns must pay exceed a certain threshold level, the debt becomes unsustainable. We can think of this threshold level as one beyond which the country can no longer continue to service its debt without default, or restructuring, or ‘unrealistically large’ adjustments in fiscal variables or in the balance of payments.

Applying options theory to the analysis of spreads offers a new way to evaluate the risk of default. As illustrated in BOX 4.1, spreads depend on the average maturity of the debt, on the level of the risk-free interest rate, on the country’s leverage and on the volatility of its assets. These include, if the debt is denominated in foreign currency, the reserves of the central bank plus the (foreign currency value) of the government’s fiscal assets; that is, the present value of residual fiscal surpluses and other assets.

Consider, as an example, the effect of a shock that both lowers the value of a country’s assets and raises their volatility. This could happen, for instance, following a shock that lowers the relative price of a commodity in which a country specializes, and increases its volatility.<sup>2</sup> As shown in Figure 4.1, the combination of a lower value of domestic assets and a higher volatility can produce a very large increase in spreads, due to the non-linearity in the relationship between spreads and asset values.

The relations shown in Figure 4.1 differ from the arithmetic commonly used to evaluate debt sustainability in two respects:

1. The standard sustainability calculation considers the value of a country’s assets – and how this changes, for instance following a devaluation – but fails to realize that changes in volatility also shifts default probabilities, and both affect bond spreads for a given value of a country’s assets.
2. The standard computations also fail to realize that the relation between spreads and underlying supporting asset values is non-linear and convex.<sup>3</sup> In contrast, the options-based model provides a structural specification of the non-linear relation between the value of the guarantee and the asset values and their return volatilities.

---

1 The conceptual framework of the section was first developed in Gray (2001, 2002) and in Gray *et al.* (2002).

2 Caballero (2003) discusses the effects of such a shock in the context of Chile in the mid-1990s, when a fall in the relative price of copper worsened the country’s terms of trade.

3 For a rare recognition of this point in the literature of financial crises, see Fischer (2002).

**BOX 4.1** Using option theory to compute sovereign spreads

Consider a firm with risky assets  $V$ , which are financed by equity,  $S$ , and zero-coupon debt with face value  $F$ , maturing at  $T$ . Debt is risky: the risk is related to the probability that at time  $T$  the value of the firm will be smaller than  $F$  and the expected recovery amount in the event of default. Thus, at time  $0$ , the value of the firm's debt,  $B_0 < Fe^{-rT}$ , that is, the promised yield to maturity on the debt is higher than the risk-free rate  $r$ . This defines the yield spread that compensates bond holders for the default risk they bear.

To determine the value of this spread we shall consider, as above, the identity, in value, between the risk-free loan and the combination of a risky loan plus a guarantee. By purchasing a put option on  $V$ , with strike price  $F$ , the lenders could completely eliminate the default risk and convert the risky corporate loan into a risk-free loan with face value  $F$ . If the risk-free rate is  $r$ , then:

$$B_0 + P_0 = Fe^{-rT}$$

The Black-Scholes model (assuming its assumptions are satisfied) gives us the value of this (put) option:<sup>4</sup>

$$P_0 = -N(-d_1)V_0 + Fe^{-rt}N(-d_2)$$

where  $N(\cdot)$  denotes the cumulative standard normal distribution, and

$$d_1 = \left[ \ln \left( \frac{V_0}{Fe^{-rT}} \right) + 1/2\sigma^2 T \right] \frac{1}{\sigma T^{1/2}}$$

$$d_2 = d_1 - \sigma T^{1/2}$$

where sigma is the standard deviation of the return on the firm's assets. As Crouhy *et al.* (2001, p. 364) show, the formula has intuitive interpretation in the special case when there are no risk premiums on any asset – a so-called 'risk-neutral' equilibrium world.<sup>5</sup>

Rewriting the value of  $P_0$ , as:

$$P_0 = \left[ -\frac{N(-d_1)}{N(-d_2)}V_0 + Fe^{-rT} \right] N(-d_2)$$

(continued)

4 See Merton (1994, 1997). For a recent book explaining these concepts applied to credit risk, see Crouhy *et al.* (2001).

5 A key characteristic of the option pricing methodology for pricing risky debt that makes it attractive to practitioners is that it does not require estimates of the expected returns on any assets. Indeed, as a computational device, one can value options or risky debt 'as if' there were no risk premiums. See Cox and Ross (1976). Hence, the jargon term 'risk-neutral' valuation is used to describe this pricing approach. Since the actual expected return of the firm's underlying assets is never used in the pricing formula, the actual probability of default and the actual expected recovery rate are not deducible from bond prices or the formula. Only 'risk-neutral' probabilities can be so deduced. If the assets of the firm have a positive risk-premium and thus an expected return greater than the risk-free rate, then the 'risk-neutral' probability of default will give a biased-high estimate of the actual probability of default.

(BOX 4.1 continued)

we observe that the premium on the put option can be decomposed into two terms:

- 1 the discounted expected recovery value of the loan, conditional on  $V_T \leq F$ . This is the absolute value of the first term in parentheses;
- 2 the current value of a risk-free bond paying  $F$  at time  $T$ . This is the second term in parentheses.

Hence the sum of the two terms inside the brackets yields the (risk-neutral) expected shortfall, in present value terms, conditional on the firm being bankrupt at time  $T$ . The final factor is the (risk-neutral) probability of default,  $N(-d_2)$ . The product of the default probability times the expected shortfall determines the premium for insurance against default.

The same expressions can be used to compute the default spread, that is, the difference between the yield to maturity on the risky loan, and the risk-free rate. This is:

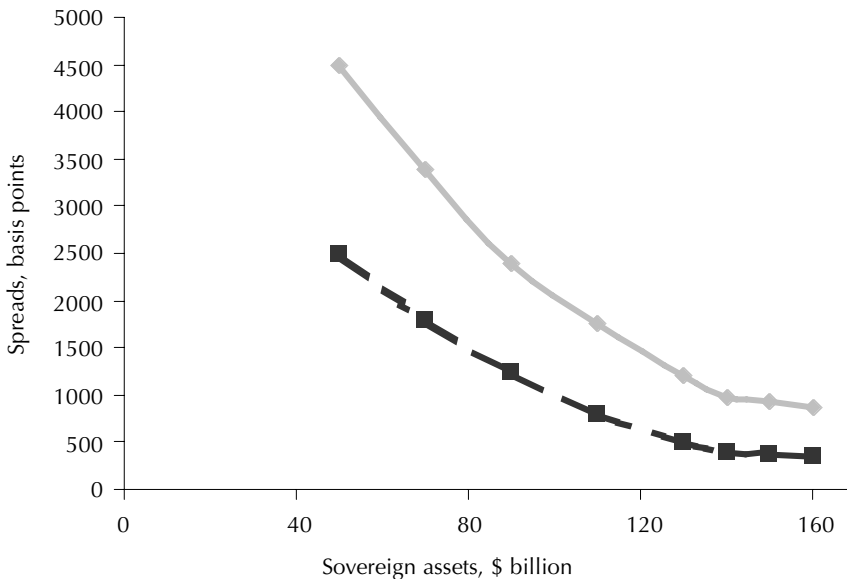
$$-1/T \ln(N(d_2) + \frac{V_0}{Fe^{-rT}})N(-d_1)$$

The spread is a function of the firm's leverage ratio

$$\frac{Fe^{-rT}}{V_0}$$

of the volatility of the underlying assets, and of the maturity of the debt  $T$ . Note that, as volatility and leverage rise, the spread increases in a *non-linear* way – exactly as in the case of the guarantees discussed in the previous section.

Figure 4.1 Sovereign spreads and asset volatility: high and low asset volatility



Source: Gray et al (2002).

**Table 4.1** Output volatility and debt events

	Default events per country (*)	Standard deviation of:				
		GDP growth	Government revenues as a percentage of GDP	Government expenditure as a percentage of GDP	Terms of trade	Real exchange rate
<b>1971-1980</b>						
Latin America	0.44	3.8	3.2	13.4	33.6	6.6
Emerging Asia	0.25	2.9	1.8	8.5	14.1	5.2
Advanced economies	–	2.5	2.6	4.4	17.6	2.5
<b>1981-1990</b>						
Latin America	0.89	4.9	3.8	16.5	27.4	39.2
Emerging Asia	0.13	2.9	2.0	10.3	7.7	24.8
Advanced economies	–	2.5	1.1	5.3	7.2	6.2
<b>1991-2000</b>						
Latin America	0.33	3.7	2.2	7.9	8.7	18.0
Emerging Asia	0.25	4.1	1.8	8.3	5.9	8.7
Advanced economies	–	2.1	1.0	7.2	3.7	5.9

**Note:** (\*) Number of delegates or reschedulings per country group.

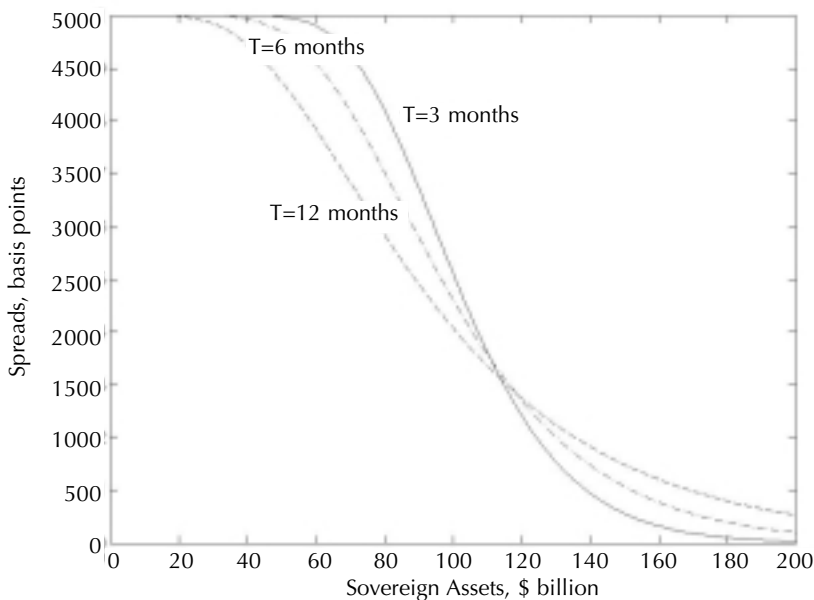
**Source:** IMF (2002), p66.

The relation between volatility and sovereign spreads is perhaps suggested in the April 2002 *World Economic Outlook* (IMF, 2002, p. 66), which reports various measures of macroeconomic volatility: the standard deviation of GDP, of government revenues and spending, of the terms of trade and the real exchange rate for different groups of countries. Along with these data it shows the frequency of debt-related events, defined as the number of defaults or rescheduling per country group in each period. The data shown in the *World Economic Outlook* are reproduced in Table 4.1. During times of relatively high macroeconomic volatility, the frequency of debt events increases. Advanced countries show, on average, less volatility and no defaults. When volatility in advanced countries increased, as in the 1970s and 1980s, compared with the 1990s, it had little effect on the number of defaults because advanced countries start from such a high level of assets relative to their debt – which is consistent with the non-linear relation between sovereign assets and spreads shown in Figure 4.1.

For the purpose of our discussion here, consider a simple model (we outline such a model in BOX 4.2) in which future flows of payments to a country's assets are proportional to GDP. If we posit further that flows to the assets are proportional to GDP, and expected future GDP is proportional to current GDP, then expected future cash flows will be proportional to current GDP. The volatility of a country's assets will thus be proportional to the volatility of GDP, and spreads will on average be higher in countries in which GDP volatility is higher. The data shown by the *World Economic Outlook* hint at this relation, but fail to recognize the effect of the non-linearity in the relation between spreads and volatility.

Finally, note that a relation similar to that shown in Figure 4.1 holds for different values of the average duration of the debt, for a given level of asset volatility. In Figure 4.2, as the average duration of the debt falls from 1 year to 6 months and to 3 months, spreads are higher for any given value of the country's assets.

**Figure 4.2** Sovereign spreads and debt duration



**BOX 4.2** A fall in output can lead to a reduction in the value of a country's sovereign assets

The ability to tax is a government's most valuable asset.<sup>6</sup> Thus the sovereign assets of a country include, along with physical assets, the present discounted value of future budget surpluses (i.e. the government's taxing capability minus those government expenditures that will not be cut to accommodate foreign debt distress). We can therefore express the net sovereign assets of a country as:

$$(Net\ Assets)_0 = A_0 + \int_0^{\infty} e^{-kt} E_0[bs(t)] - B_0$$

where  $A_0$  represents the value, at time 0, of the physical assets controlled by the government and  $B_0$  the stock of public debt.

$$bs(t) = \tau_t - g_t$$

is the primary budget surplus, that is, tax revenue minus essential government expenditure, net of interest payments, at time  $t$ , measured in constant dollars as of time 0.  $E_0$  is the expectation operator, conditional on information at time 0 and  $k$  is the real risk-adjusted discount rate, assumed to remain constant over time.  $bs(t)$  is assumed proportional to the level of the country's output at time  $t$ :

$$bs(t) = a \cdot y(t)$$

If we further assume that shocks to GDP are persistent, that is

$$dy = \alpha \cdot y dt + \sigma y dz$$

the value of a country's sovereign net assets will be linearly related to its current level of output:

$$A_0 + ay(0)/(k - \alpha) - B_0$$

The above equation assumes that the real cost of debt remains constant over time. Sovereign spreads, however, as discussed above, increase (non-linearly) when the value of sovereign assets fall. Thus the increase in sovereign spreads induced by a fall in output will be amplified, because lower output, for a given spread, reduces net sovereign assets, and lower net assets raise spreads and thus the cost of debt, which in turn reduces net sovereign assets. This is another instance of the negative feedback loops discussed in Section 3.5 (p20).

6 Except where large amounts of the country's assets are directly owned by the government, as for example in the Middle East.

---

## **5 Observations for the Correct Evaluation of a Country's Exposure to Risk and for the Design of Prudential Rules for Financial Institutions and their Shareholders**

As discussed at length in Gray *et al.* (2002), explicit recognition of the chain of financial guarantees offers a rich framework for analysing the risk exposure of a country. The main benefit comes from the ability to assess dynamically the transfer of risk across sectors correctly. Here are a few examples:

- distress in the corporate sector can be transmitted to the financial sector, e.g. following a change in commodity prices;
- distress in the financial sector can be transmitted to the government, e.g. through the government guarantee of bank deposits;
- sovereign distress or default can be transmitted to the private sector, e.g. through the increase in spreads. The same happens following a devaluation which can raise firms' leverage and unbalance the balance sheets of financial institutions to the extent that their liabilities are denominated in a foreign currency.

These issues of risk transmission across sectors were a focus of attention following the financial crises of the late 1990s, whose characteristics did not fit the pattern of the traditional balance-of-payments crises of the previous decade. In this section we try our hand at relating our work to the recent literature on financial crises. The analysis of financial guarantees offers a rich tool for evaluating the extent of a country's exposure to risk and how this changes over time. The importance of this issue is recognized in the traditional literature, but the analogy with the analysis of financial guarantees has not been made. This analogy provides a straightforward tool for analysing how risk exposure builds up through the economy and eventually cumulates in the government's exposure.

We shall then draw, from the analysis of financial guarantees, some implications for risk monitoring, with the goal of offering some guidelines for the design of prudential rules for financial institutions and their shareholders.

In the following section we analyse how risk exposures can be controlled, hedged and transferred through the use of derivatives, swap contracts and other contractual agreements.

### **5.1 Balance sheets and financial crises**

Traditionally, international financial crises were characterized as predominantly current-account crises. A country would run a large budget deficit, finance it by printing money, with the inflation tax. The currency would, more often than not,



be fixed to the dollar – often because the resulting appreciation of the real exchange rate raises real wages. Eventually the trade deficit produced by the over-valued real exchange rate could no longer be financed: reserves dried up, and so did the supply of international loans. What followed was a devaluation and a sharp cut in real wages which in turn helped a recovery of economic activity.

More recent crises, starting with Mexico in 1994-5, and then Asia and Russia in 1997-8 are fundamentally different in that balance-sheet issues are central to the descriptions and almost surely to the propagation of the crisis, as vividly described in Dornbusch (1998):

'In Mexico's massive earthquake, some years back, many of the splendid new buildings collapsed burying and killing a large number of people in the debris. Without the earthquake they surely would not have crashed, in fact they had graced the skyline for years, monuments to their proud owners and builders. But examination revealed that the concrete had far too much sand and too little of the real stuff. Not surprisingly, under stress they went. That surely was not an accident – the building codes were there, and the inspectors stood by collecting the payoffs for overlooking unsound construction. Just the same has been happening in cross border finance. Emerging market balance sheets stand up in fair weather but under stress they collapse. Vulnerability is the key word; risk is another way of looking at it.'

The observation that the origin of many international financial crises lies in the accumulation of risk in balance sheets is central to the recent macroeconomic literature on such crises (for recent statements see Calvo, forthcoming, and Jeanne and Zettelmeyer, 2002). Understanding the effects of risk accumulation in balance sheets is important because it explains why, in crises of this type, monetary and fiscal policies tend to become ineffective. Banks with weak balance sheets do not react to an increase in central bank money by raising the supply of loans; and if a government with a weak balance sheet attempts a fiscal expansion, spreads on government debt issues will go up, which often translate into higher spreads on private-sector borrowing as well.

These observations also underscore Dornbusch's recommendation that:

'the right answer to crisis avoidance is controlling risk. The appropriate conceptual framework is value at risk (VAR) – a model-driven estimate of the maximum risk for a particular balance sheet situation over a specified horizon. There are surely genuine modelling issues with the specifics of VAR surrounding modelling has been widely discussed with respect to bank risk models used for meeting BIS requirements (cf. Crouhy *et al* 2001). But just as surely there is no issue whatsoever in recognizing that this general approach is the right one. If authorities everywhere were to enforce a culture of risk-oriented evaluation of balance sheets, extreme situations such as those of Asia in 1997 would disappear or, at the least, become a rare species.'

This literature on international financial crises<sup>1</sup> recognizes that the implicit guarantees that governments extend to banks and, through them, to firms create the potential for greatly weakening government balance sheets. The attention, however, has mostly focused on the reasons why such guarantees exist, rather than on

<sup>1</sup> For an introduction to this literature see Dornbusch (2002). For a review of recent contributions see Feldstein (2003).

the correct measurement of their cost and changing risk exposures. One view (e.g. Burnside *et al.*, 2002), emphasizes government bailouts, which encourage banks to expose themselves willingly to exchange rate risk: it is the government guarantee that makes it optimal for banks to have an unhedged currency mismatch between their assets and their liabilities, and thus transfer the exchange rate risk onto the government. Of course, the strength of that incentive is affected by whether current shareholders will lose their ownership in the event of failure or retain it. Subtler is the view exposed by Caballero and Krishnamurthy (2000) who ask why private borrowers under-insure against country shocks and exchange rate depreciation by contracting foreign-currency denominated debt. The answer they provide is that under-insurance is a feature of underdeveloped financial markets: if financial markets are well developed, firms have no incentive to take up excessive foreign-currency denominated debt.<sup>2</sup>

The contribution of our report is in the spirit of the Dornbusch recommendation, in that it provides a framework for correctly evaluating the extent of a country's exposure to risk and the changes in that exposure over time.

## **5.2 Government exposure to the financial system: computing a country's value-at-risk**

A country's exposure to risk, at any given point in time, results from the risk exposure of each sector in the economy and from the transmission of risk across sectors through financial guarantees. Understanding how a sector's exposure changes when events hit a different sector, and realizing that exposure to risk changes non-linearly, is the main benefit of the financial guarantees approach. The approach suggests a new way of thinking about macro risk: describe the economy as a set of interconnected portfolios of assets, liabilities and contingent claims and ask how the values of these portfolios react to external shocks (shocks to fundamentals).

To appreciate the extent of a government's exposure to its financial system correctly, three steps are involved:

1. The traded and non-traded assets of financial institutions, banks in particular, should be systematically marked to market: this is the first step to evaluate correctly the dimension of any existing guarantee.
2. The guarantees extended to financial institutions, whether explicit or implicit, should be recognized openly in the government's balance sheet. Rather than precise rules for governments to consider adopting, we frame a general orientation towards helping markets appreciate the extent of the guarantees.
3. A government's exposure to its domestic financial institutions, incurred through the outstanding guarantees to these institutions – explicit or implicit – increases more than proportionately with changes in the weakness of the balance sheet of these institutions. The additional liability transferred on the government's balance sheet by a 10% shock to the capital of firms is larger the lower that capital is to start with. If the balance sheets of corporations and financial institutions are weak when the economy is weak – as is generally the case – then it is precisely when tax revenue is low, and

---

<sup>2</sup> For a discussion of these alternative views, see Tirole (2002).

the cost of debt service high because sovereign risk has increased, that the value of the guarantees will be particularly high. This observation offers a powerful argument for diversification of a government's exposure to local shocks, for instance by swapping tax revenue – an issue we take up in the next section of the report.

As noted in Merton (2002, pp. 66-7):

'A prospective application of modern financial technology by government is the measurement and management of country risk...

A non-traditional approach to address the performance issue and its implication for evaluating policy is to apply the technology of a well-studied problem in risk and performance measurement for investment management and financial firms. This is the problem of configuring all the decomposition and reintegration of risk-factor exposures that must be determined within a financial institution before the aggregate risk measures such as value-at-risk (VAR) can be applied. I believe that this technology, if properly adapted, can be used to measure country risk exposures.

...this is structurally the same problem faced in the risk measurement of non-traded assets and liabilities in financial institutions. In short, it is like the challenges of extending the VAR and stress-testing concepts to include the domain of non-traded assets and liabilities. But as with the application to financial institutions, I see this as a tough engineering problem, not one of new science ... we know how to approach it in principle and what we need to model, but actually doing it is the challenge.

As with conventional private-sector applications, the country risk exposures give us important information about the dynamics of future changes that cannot be inferred from the standard "country" accounting statements, either the country balance sheet or the country income or flow-of-funds statement.

As we discover with more conventional applications of risk management systems, once we can measure the risk exposures we have, it is difficult to resist exploring whether we could improve economic efficiency and risk sharing by changing those exposures.

With the developed countries, Japan and EMU Europe in particular, and the emerging ones both working on major changes in their financial systems, this may be an especially opportune time to explore country risk management.'

Gray (2001, 2002) has implemented this framework to build multi-sector economic-value balance sheets of countries. Such balance sheets explicitly compute to what extent the values of financial guarantees change as assets and liabilities change and thereby provide ways to capture changing risk exposures as well as changing values (see also Gray *et al.*, 2002). This approach goes well beyond the simple recognition, pointed out in Blejer and Schumacher (2000), that the correct measure of a central bank's exposure to risk should take into account the option value of any foreign-exchange derivative contracts the bank might have entered into.

For instance, using data for Thailand at the end of 1996, Gray (2001) has estimated the value of the Thai government's exposure through its implicit financial guarantees. At 33 baht per US dollar (the December 1996 exchange rate was 25.6 baht per dollar) the government exposure was short a put option whose value was

less than 10% of GDP, provided equity prices remained unchanged and liquidity, measured by the willingness of lenders to roll over or refinance Thai US\$ loans, also remained unchanged. If equity prices declined 50% and liquidity were reduced, a devaluation beyond 33 baht per dollar would have raised the value of the implicit put option to 30-50% of GDP – a clear implication of the power of the non-linearity in option values. (By December 1997 in the crisis, the exchange rate reached 47 baht per dollar and equities had lost 60% of their pre-crisis value.

### 5.3 The valuation of banks' assets

Bank loans should be valued on a systematic and ongoing basis taking into account the borrowers' ability to repay. There are several appropriate ways to do this, depending on circumstances. If the borrower issues debt, and the bonds are liquid, then use those marked-to-market prices to value the loans. If the borrower's credit rating is known and frequently updated, so-called matrix pricing based on rating spreads can be applied. (The default probability can be computed in the first case from bond prices, in the second case using historical data on default probabilities.) Financial market prices such as the underlying firms' equity prices can also be used to provide up-to-date estimates of the value and risk sensitivities of the loans using models like the one developed in Merton (1974). For empirical tests of the model, see Kealhofer (2003) and for its real-world applications, see [www.moodyskmv.com](http://www.moodyskmv.com) and [www.creditgrades.com](http://www.creditgrades.com). The fact that these alternative methods often produce different valuations should not be a reason for inaction.

Standard accounting rules for marking down book values are subject to considerable management discretion. It is interesting to note that the valuation method based on historical cost commonly used is the least effective precisely at times when investors and overseers need the assurance of realistic and current valuations. When uncertainty grows, investors want a system that reflects asset values in the changed market environment, not a book-value valuation, which rarely produces a change in price.

Even if the loans are appropriately marked-to-market, there is an issue about how to measure the *future* risk exposure. The amount of money that one can reasonably expect to lose as a result of a default over a given period is a bank's 'expected risk exposure'.<sup>3</sup> The expected loss will depend on (1) the amount exposed to credit risk; (2) the probability of counter-party defaulting; and (3) the recovery rate. The problem of measuring potential credit losses lies in finding the best way of estimating these variables. With respect to (2) and (3), institutions should develop techniques to compute the default rate path and the recovery rate path, and distributions around these paths estimated by examining those distributions at specific points in time in the future. As for the recovery rate, it is possible to use the recovery rate distribution as derived from surveys of recovery rates of senior corporate bonds that have defaulted. This analysis produces estimates of future recovery rate distributions that vary as a function of time. Just like default rate distributions they do not typically follow a normal probability density function. Finally, the distribution estimates of (1)-(3) are to be combined to produce an overall assessment of the expected risk exposure.<sup>4</sup>

<sup>3</sup> See, e.g., Crouhy *et al.* (2001, p. 551).

<sup>4</sup> A step in this direction is the CreditRisk+ model developed by Credit Suisse Financial Products and described in Credit Suisse (1997). Valuation of debt does not necessarily require estimates of those factors or a discount rate, as in Merton (1974).

As for derivative instruments, starting with 2001:Q1 the Financial Accounting Standards Board (FASB) requires most US companies to adopt rule FAS 133 'Accounting for Derivative Instruments and Hedging Activities'. This means that derivatives or hedged positions, even those embedded in contracts, should be reported on the balance sheet using their fair value (marked-to-market). Prior to this ruling derivative financial instruments were not recorded on balance sheets.<sup>5</sup>

#### **5.4 Can equity and and/or subordinated debt substitute for risk monitoring?**

The previous analysis suggests that careful monitoring of all the items on and off the balance sheet is essential for proper risk management. How strong are the off-balance sheet guarantees in the face of an unexpected fall in the correctly computed value of the bank's assets? Can equity be a substitute for risk monitoring? Shareholders may be reluctant to commit large quantities of equity capital because of the agency costs related to this strategy and because of its unfavourable taxation. Subordinated debt, provided it is really junior to the depositors' claims, could be preferable to large equity commitments. Its subordinated nature can be more apparent than real, however. In the United States, its economic subordination need not be followed by the courts within the context of Chapter 11 proceedings. Therefore, neither equity capital nor subordinated debt is a substitute for careful risk monitoring of assets' values. Just as important is the marking to market of the liabilities and more specifically the monitoring of the market prices of the bank's equity and subordinated debt, reflecting in effect the value of the collateral guarantee by the shareholders.<sup>6</sup>

#### **5.5 Hedging macro risks**

The approach to risk management discussed above has implications for the banking industry in emerging markets in which there is a high degree of macro risk and correlation among all assets' values. In this context, a common sense rule of asset diversification would suggest that an emerging-market bank that invests part of its assets in domestic government bonds increases its exposure to local macro shocks: the value of government bonds will be low precisely when the value of the loan book is low. Therefore, in such economies, banks should hedge the exposure of their loan book more than they would normally do in the context of advanced economies, for example investing in non-domestic assets – be they bonds or otherwise.

This issue came up during the recent crisis in Turkey. Turkish banks, like most emerging market banks, own large fractions of the domestic public debt: the general macroeconomic crisis which depressed the value of the loan books also brought the Turkish government close to defaulting on its bonds. Also the value of other assets in the banks' balance sheets and their own equity value collapsed,

---

5 Rule FAS 133 is currently under review, see <http://www.fasb.org/project/133>. FAS rules in which fair value plays a prominent role for initial recognition or ongoing valuation are: FAS 115 (valuing equity investments), FAS 123 (stock-option accounting), FAS 133 (hedging derivatives), FAS 141 (business combinations), FAS 142 (purchased intangibles), FAS 143 (asset retirement obligations) and Interpretation 45 (Guarantees – affects FAS 5, 57 and 107).

6 On this point see Bodie and Merton (1993) and Merton and Bodie (1992).

resulting in a credit crunch and a further fall in the loan book values. On the basis of our previous analysis one would conclude that lack of proper monitoring and of proper risk diversification amplified the crisis. Our guarantee-based approach to risk management would have suggested the need for additional equity capital for the banks to continue their operations. Certainly the private sector had no incentives to provide such equity, which eventually came in the form of a blanket government guarantee on all bank deposits. The actual value of this off-balance sheet equity was itself dependent on the IMF's financing and on the government's successful fiscal retrenchment effort. Some G7 countries had advocated default on all public debt, and therefore also on the government guarantee, as a way to relieve Turkey's budget from the burden of interest payments. It is now clear that such a course of action, destroying both on-balance sheet and off-balance sheet banks' equity, would have caused a bank run and a worsening of the crisis.

### **5.6 Foreign ownership of an emerging country's banks**

We have just seen how in small emerging market economies especially the value of the government guarantee to the banking industry is highly negatively correlated with the value of the banks' loan assets. When the bank's assets decrease because of a macroeconomic shock, there is an increase in the government's liability from the guarantee because the expected risk exposure is now higher, unless the bank raises adequate additional capital. This requires prompt action by the government or by the shareholder.<sup>7</sup> Unfortunately, when a serious crisis erupts, a statement by the government that it will stand by its guarantee has less credibility, while shareholders lack the incentive to provide additional capital. Incidentally, the same shareholders of the bank may have less new investment capacity, having invested in other sectors of the same economy.

Spain's direct investment in Argentina provides an example. The 'cultural proximity' between the two countries resulted in direct investments being cumulated. Some large Spanish banks directly owned Argentinian banks, while at the same time also owning (often indirectly through their shareholding in Spanish companies) Argentinian firms operating in the industrial and service sectors. When the country's economy collapsed the value of those firms also collapsed. Spanish banks had anticipated this event by creating, on their balance sheet, loss reserves to be used to write off their investments both in the banks and in the industrial and service companies they owned-which in the event they did. Following these large write-offs they were either unwilling or unable to infuse additional equity capital in the Argentinian banks they owned, thus accelerating their demise and shifting to the government the responsibility for guaranteeing the bank's liabilities.<sup>8</sup>

It has been suggested rightly that governments in emerging markets perform risk audits of their assets and liabilities using VAR-like methods in their assessments. We recommend that they should also periodically reassess the value of the guarantee they are implicitly and explicitly giving to the banking system and measure the expected risk exposure. There would arise a strong case for prudential

---

7 Such action, because of the non-linear relation between the price of the option and the value of the loan, must be of a bigger size than what is suggested by the static comparison of the two values in the new state.

8 Most foreign banks, not only Spanish banks, simply wrote their investments off and failed to invest additional capital when the crisis erupted.

regulation requiring the banks operating in these countries to sell or to diversify their loan portfolios into other countries' assets through securitizations, credit default swaps and credit derivatives. Furthermore, as Spain's example shows, the foreign shareholders of the banks should comply with similar rules especially if they are banks themselves.

## **5.7 Guarantees and governments' financial policies**

A weakening of the domestic economy affects a government's balance sheet in two ways. On the side of liabilities, the value of the implicit guarantee that the government provides to local banks increases – because, when the economy weakens, the value of the banks' loans is likely to fall. The weakening of the economy is also associated with a fall in tax revenues: this in turn lowers the value of the government's assets, as discussed in BOX 4.2.<sup>9</sup> The two effects interact, because the percentage increase in the liability transferred onto the government's balance sheet caused by, say, a 10% decline in the capital of firms, and thus in the value of bank loans, is larger the smaller is that capital to start with.

This analysis suggests four remarks:

1. Given the amount of short-term liabilities of the banking system in an emerging market country, given an estimate of the probability of default and of the recovery rate distributions (as discussed in section 5.2 above), it should be possible to compute the level of the government's assets that is necessary to provide a guarantee to those short-term liabilities and how this should be adjusted following changes in the value of the loan book.

As shown in BOX 4.2, the present value of future available budget surpluses (i.e. the governments' taxing capability minus those government expenditures that will not be cut to accommodate foreign debt distress) is an important, often the most important, asset available to a government to support its debt. Therefore, the path of future fiscal variables should be adjusted whenever the value of the guarantees changes. This observation provides a rationale for IMF plans which commit countries to a future path of primary surpluses.

2. The greater the short-term capital inflow and the consequent domestic credit expansion, the greater the risk exposure and, therefore, the greater should be the collateral asset value of the government. Sizeable short-term capital inflows should thus be accompanied by the establishment of formal reserves in the accounts to reflect the higher liabilities. As already mentioned, however, in many countries the government's most important asset is represented by the path of projected budget surpluses: therefore, short-term capital inflows should be accompanied by an increase in the path of projected budget surpluses, which would thus act as reserves.
3. As we have seen in the case of Argentina, these governments should avoid currency mismatch between the base of their guarantee (the tax revenue) and the risk exposure. Therefore monetary arrangements like fixed exchange rates, and especially currency boards, are particularly vulnerable when they are accompanied by a currency mismatch in the balance sheet of financial institutions.

---

<sup>9</sup> The fall in the government's assets can be even bigger if, as discussed in BOX 4.1, the initial fall in the value of assets raises spreads and thus the cost of debt service.

4. Private-sector equity can hardly be expected to substitute for the guarantee provided by the domestic government. Private-sector equity is at most a cushion and can hardly be expected to perform the role of a guarantee. In the case of financial intermediaries, equity is a tiny fraction of total liabilities and its value is correlated with the value of the loan book.

The above observation offers a powerful argument for diversification of the government exposure to local shocks, for instance by swapping tax revenue – an issue we take up in Chapter 6 of this report.

## **5.8 Observations on Basel II**

It has been argued (see, for example, Persaud, 2000; Borio *et al.*, 2001; and Reisen, 2001) that Basel II will raise the volatility of private-sector capital flows to developing countries. Basel II retains from Basel I the fixed link between banks' lending and equity, in the form of the fixed minimum capital requirement of 8%. Furthermore, risk weights are assessed on the basis of indicators that are pro-cyclical: under the 'standardized approach' the external ratings, under the 'internal ratings-based approach' the probability of default. It can be argued that both indicators behave pro-cyclically so that the borrowers' risk category worsens and correspondingly their credit spreads widen in bad times, therefore increasing both the probability of further downgrades and of default.

Such negative feedbacks, however, are not the result of regulation *per se*. If the reason why a country is downgraded (or its default probability, as assessed by the lenders under the 'internal ratings-based approach', is changed) is a real value problem, then the larger spreads simply reflect the increase in the amount of risk transferred onto the lenders, or onto the government which is providing the lenders with a guarantee. If instead the problem was just one of liquidity, then neither ratings need change, nor spreads increase.

## **5.9 Capital controls**

Institutional environments in emerging market countries may make continuous risk management by governments, banks and banks' shareholders, a rather complex task. More specifically, assessment of risk exposure and prompt response to its changes may be hampered by lack of transparency and poor functioning of financial markets, so that governments can neither charge adequate risk-based premiums for their implicit or explicit guarantee, nor monitor risk exposure properly. In such a situation it may be tempting to conclude that the only alternative is restrictions on both the ownership of assets and the issue of liabilities – for instance to avoid the accumulation in banks' balance sheets of currency mismatches that cannot be diversified away.

Indeed, there are those who argue that some of the capital controls and distortions present in many emerging markets during the 1980s, can be rationalized as responding to that motivation. The large variety of capital controls in the various countries makes it hard to strike any generalization. Indeed, restrictions on capital outflows were hampering in varying degrees just the kind of asset diversification that we have seen to be beneficial especially when there is concentrated country risk. By the same token, however, these restrictions were also applied to banks' domestic liabilities, so that bank runs to shift assets outside the country



were difficult, and governments could always use inflation to make good on their guarantee. In general, tight controls on capital outflows discouraged future capital inflows, serious currency mismatches were rare, and most importantly governments were guaranteeing deposits that were denominated in the same currency as the domestic tax revenue base. That was not the case in Argentina, where ten years after financial deregulation the government was called upon to guarantee US dollar equivalent bank deposits while the peso-denominated tax revenue base was shrinking and the exchange rate was depreciating.

Emerging countries' financial markets were certainly far from being efficient during the 1980s. Removing controls and asset restrictions was viewed by many as a fundamental step to promote growth and efficiency. But this well-intended action may have had the unanticipated and unintended consequence of reducing the intensity of monitoring of government-insured institutions without providing a fully offsetting protection for the guarantor.<sup>10</sup>

---

<sup>10</sup> It is the nature of policy changes in general that they will have unanticipated consequences. See R K Merton (1936, 1989). It does not follow, however, that reinstatement of capital or asset controls is the answer.

---

## 6 Managing Risk to Reduce Financial Fragility

Many emerging countries have large concentrated exposures to specific industries – often the result of the domestic economy being relatively specialized. Table 6.1 provides one example. The table documents Taiwan’s exposure to electronics, which is large both relative to the country’s exports and to its value added.

Industrial policy to encourage the domestic development of other industries has traditionally been the way many countries have tried to diversify their risk exposure to specific sectors. The common policy instrument was public investment, often through state-owned enterprises. The sub-optimality of such policies is obvious, as investment is often directed towards sectors in which the country has no special comparative advantage. Furthermore, once the investments are made and considerable numbers of citizens are working in those newly created domestic industries, it becomes very difficult to reverse policy.

Diversification through capital mobility is one obvious alternative. Financial markets allow a country to diversify its exposure to specific sectors, while exploiting its comparative advantage. Taiwan, for instance, could trade stock ownership of its domestic electronics firms for a world-diversified portfolio of equities. Singapore, through the Government Investment Corporation and related funds, appears to have taken significant steps to diversify through foreign securities holdings. In general, however, this solution runs into at least three obstacles: it is inflexible (once done, deep foreign ownership of domestic shares is not easily reversed or changed); it creates incentive problems, as fear of expropriation of foreigner-held shares in domestic firms is always a possibility; it often runs up against

**Table 6.1** Taiwan: Export shares and sectorial shares in manufacturing value added (2000)

Shares in manufacturing value added	
Electronics products and components	35.6
of which:	
• semiconductor devices	15.0
• communications equipment	7.2
• computing and data processing equipment	30.2
Shares of total exports	
Electronics	42.4

**Source:** Republic of China, *Monthly Bulletin of Statistics*, April 2002.

local political constraints such as the belief that the country's 'best' assets were sold to foreigners at too low a price.

Swap contracts and other derivative instruments provide an appealing alternative. Swaps allow a country to diversify risk without shifting the ownership of assets. For example, a country could impose tight capital controls, limit foreign ownership of domestic firms and still reduce its exposure to risk: swap contracts do not require the transfer of ownership of the underlying asset. Risk diversification through derivative instruments is obviously more flexible than diversification through the transfer of assets.<sup>1</sup>

The analysis of financial guarantees offers a rich framework for comparing alternative ways to control risk. In the remaining paragraphs of this section, we discuss how derivatives (swaps) can be used – and the extent to which they are used in practice – to limit the accumulation of risk and thus reduce a country's financial fragility.

### **6.1 Equity swaps as an instrument to diversify risk internationally<sup>2</sup>**

In this section we illustrate how an equity swap would enable a small country to diversify internationally without violating possible restrictions on investing capital abroad. Suppose that small-country pension funds that already own the domestic equity were to enter into swaps with a global pension intermediary (GPI). In the swap, the total return per dollar on the small country's stock market is exchanged annually for the total return per dollar on a market-value weighted-average of the world stock markets. This exchange of returns could be in a common currency, dollars, as described or adjusted to different currencies along similar lines to currency swaps. The magnitudes of the dollar exchanges are determined by the 'notional' or principal amount of the swap to which per dollar return differences apply.

Without pursuing the details of implementation, we see that the swap effectively transfers the risk of the small-country stock market to foreign investors and provides the domestic investors with the risk-return pattern of a well-diversified world portfolio. Since there are no initial payments between parties, there are no initial capital flows in or out of the country. Subsequent payments, which may be either inflows or outflows, involve only the difference between the returns on the two stock market indices, and no 'principal' amount flow.

---

1 Caballero and Panageas (2003) suggest that Chile could eliminate most, if not all, of its deep recessions by embedding into its external bonds a long put option, yielding US\$6-8 billion when the price of copper falls by more than two standard deviations for a semester or more. They estimate that such insurance, if fairly priced, might cost US\$500 million (lump sum). Caballero (2003) argues, however, that currently 'there is no natural market for holding such an instrument, and the corresponding derivatives markets would not suffice to cover the position of the writer of the option'. Even in the best emerging economies, he argues, aggregate risk management is being done with stone-age instruments and methods. He thus concludes suggesting that the IMF has a key role to play here in resolving this impasse and becoming a catalyst for such a development. He proposes that 'the IMF creates a new Contingent-Markets Department which should have three primary tasks: (i) to help identify each country's contractible contingent basis and develop the corresponding contingent bonds; (ii) to help create and regulate contingent market CDO-like funds; (iii) to help design a macroeconomic policy framework consistent with the insurance mechanism developed for the country, and monitor its fulfilment.'

2 This section draws on Bodie and Merton (2002) and Merton (1990, 1999, 2002).

**BOX 6.1** Diversifying Taiwan's exposure to electronics

Consider Taiwan. Call  $R_T$  the (stochastic) return on Taiwan's GDP and  $R_W^E$  the (stochastic) world return on electronics. Since Taiwan is heavily exposed to electronics

$$R_T = a + b R_W^E + \epsilon_T$$

where  $\epsilon_T$  is a country-specific component and  $b$  is larger the higher the exposure. Let  $R_W^{SM}$  be the return on a well-diversified portfolio of world equities. Consider a swap agreement where Taiwan pays  $\lambda R_W^E$  and receives  $\lambda R_W^{SM}$  thus ending up with

$$R_T = a + (b - \lambda) R_W^E + \lambda R_W^{SM} + \epsilon_T$$

by choosing a value of  $\lambda$  sufficiently close to  $b$ , the country could reduce its exposure to electronics. For  $\lambda = b$  Taiwan would be left with the return on the well-diversified world equity portfolio plus an exposure to its idiosyncratic risk  $\epsilon_T$ .

The swap just described is a 'right-way' swap: in bad years, when electronics firms do worse than the world index of other industries, Taiwan is on the receiving end of the swap. It pays when world electronics outperform other industries. The country pays only in states of the world where the world industry sectors represented in local firms outperform the world index of other industries, i.e. when the country is relatively economically stronger.

Swaps can also be used to reduce the overall risk a country faces: Taiwan could hedge its exposure to risk by swapping (a fraction of) its exposure to  $R_W^E$  for the world risk-free rate.

Swapping the return on world electronics for the return on a well-diversified world equity portfolio, or for the risk-free rate, or both, Taiwan would remain exposed to the idiosyncratic component of the returns of local firms,  $\epsilon_T$ . This may be the efficient thing to do from the point of view of local incentives, since  $\epsilon_T$  is the only component of the return of local firms on which the country has some control.

In principle, Taiwan could also diversify away the exposure to idiosyncratic risk, by swapping the total return on its domestic portfolio of electronic companies (in effect both  $R_W$  and  $\epsilon_T$ ) for the return on the world diversified market portfolio. This would allow Taiwan to eliminate completely its exposure to local electronics firms, thus recreating the same conditions that would prevail if all domestic electronic firms were owned largely by foreign residents and Taiwan invested broadly around the globe. In this case, however, as under foreign ownership of domestic firms, the drawbacks are related to the incentive to expropriate, or the usual agency costs of a non-owner manager.

For example, on a notional or principal amount of \$1 billion, if, *ex post*, the world stock market earns 10% and the small-country market earns 12%, there is only a flow of  $(0.12 - 0.10) \times \$1 \text{ billion}$  or \$20 million out of the country. Furthermore, the small-country investors make net payments out precisely when they can 'best' afford it: namely, when their local market has outperformed the world markets. In those years in which the domestic market underperforms the world stock markets, the swap generates net cash flows into the country to its domestic investors. Hence, in our hypothetical example, if the small-country market earns 8% and the world stock market earns 11%, then domestic investors receive  $(0.11 - 0.08) \times \$1 \text{ billion} = \$30 \text{ million}$ , a net cash inflow for the small country. Moreover, with this swap arrangement, trading and ownership of actual shares remain with domestic investors.

Foreign investors also benefit from the swap by avoiding the costs of trading in individual securities in the local markets and by not having the problems of corporate control issues that arise when foreigners acquire large ownership positions in domestic companies. Unlike standard cash investments in equities or debt, the default or expropriation exposure of foreign investors is limited to the difference in returns instead of the total gross return plus principal (in our example, \$20 million versus \$1.12 billion). Default on the part of a counter-party in a swap contract results in the flow of payments being interrupted: the other party loses the diversification the swap provided, which can be rebooked with a different counter-party.

The potential exposure of foreign investors is probably less for the swap than for direct transactions in individual stocks. Not only because swaps only imply an exposure to flows of returns, rather than to the total value of the underlying asset; it is also more difficult to manipulate a broad market index than the price of a single stock. Even if settlement intervals for swaps are standardized at six months or one year, the calendar settlement dates will differ for each swap, depending upon the date of its initiation. Hence, with some swaps being settled every day, manipulators would have to keep the prices of shares permanently low to succeed.

Furthermore, with the settlement terms of swaps based on the per-period rate of return, an artificially low price (and low rate of return) for settlement this year will induce an artificially high rate of return for settlement next year. Thus, gains from manipulation in the first period are given back in the second, unless the price can be kept low over the entire life of the swap. Since typical swap contract maturities range from two to ten years (with semi-annual or annual settlements), this would be difficult to achieve.

The hypothetical equity swap just described enables pension funds to achieve broader international diversification. A different type of swap could enable them to edge equity risk altogether. This would be particularly important for people in countries where there is no local entity, including the government, capable of issuing fixed-income securities that are free of all risk.

This second type of swap would call for the pension fund to swap the total return on its equity portfolio for a risk-free interest rate denominated in a 'strong' currency or in units of constant purchasing power. This hypothetical swap would work the same way as the one in the previous example, except that the net cash flows produced by the swap would result in the pension fund receiving a risk-free rate of return. The counter-party must have a very good credit rating, or the swap must be guaranteed by a third party with a strong credit rating, or by a two way marked-to-market collateral. As in the previous example, the pension fund would have to make payments to the swap counter-party only in years when its equity portfolio outperforms the risk-free rate.

Swaps are over-the-counter (OTC) instruments, traded outside organized

exchanges. Trading swaps implies no capital requirements; although mark-to-market collateralizing of swaps is wide-spread, there are no specific rules governing conduct, including risk management, imposing centralized trading, defining clearing and settlement rules, and loss-sharing rules in case of defaults. OTC derivative markets lack a formal structure, have no physical central trading place, and no clearing or settlement system. There is also no central mechanism to limit individual or aggregate risk taking and risk management is completely decentralized.

Swaps, however, are very different from traditional negotiated bilateral contracts. The size of the OTC derivatives market (about \$100 trillion of notional contracts outstanding, see Table 6.2) has meant that these contracts have become standardized, in particular with regard to the legal aspects of the contract and the procedure for enforcing them: ISDA provides standardized courts- and market-tested contracts. This makes a swap contract very different in cost and timeliness of execution from a one-off bilateral contract.

The idea of using swaps to diversify risk has been around for a long time. What is different today, and allows swaps to be used in significant size and at low cost in practice, is the convenience of an existing legal infrastructure.

Large macroeconomic risks typically accumulate in the balance sheet of the government. Swaps can be used by governments to stabilize tax revenue and avoid the sudden accumulation of debt. Consider again a country like Taiwan exposed to a specific industry, such as electronics. The accumulation of foreign debt denominated in foreign currency often occurs in states of the world where  $R_W^E$  (the ((stochastic)) world return on electronics) is low and tax revenue is correspondingly low. An instrument that allowed the government to reduce its exposure to a specific industry would stabilize tax revenue and reduce the sudden accumulation of foreign debt. As developed at length in BOX 6.2, there are other examples of instruments besides swaps performing similar functions, including structured notes and other collateralized instruments, which essentially allow a government to borrow against a future flow of income, for example the revenue from oil exports.

**Table 6.2** Outstanding OTC derivatives by underlying instrument

	June 1998	June 2001
Notional amounts outstanding (US\$ billion)	72,143	99,755
Composition (%)		
• Interest rate contracts	66.7	76.1
• Foreign exchange contracts	30.6	20.5
• Equity-linked contracts	1.9	2.0
• Credit linked	0.2	0.7

**Source:** BIS, *Triennial central bank survey of foreign exchange and derivatives market activity in 2001*, Basel, March 2002.

**BOX 6.2** Other derivatives used to diversify a country's risk

Emerging market borrowers have increasingly used innovative financial instruments to maintain access to international capital markets and attract capital flows, particularly at times when financial market turbulence reduces investors' appetite for emerging market debt. It is interesting to note (see Schinasi *et al.*, 2000) that the issuance of this type of securities was particularly large following the South-East Asian and Russian crises and died out as market conditions returned to normal. One example is *structured notes*, a fixed income security linked to a derivative – usually a swap, but also options, futures/forwards, or even credit-linked derivatives. Structured notes, as already mentioned, allow a borrower to hedge almost any risk: they could be designed to link the payment to capacity of the borrower. The very flexibility of this instrument is often the reason for its lack of liquidity in secondary markets. Being tailor-made for a specific country it is not surprising that a structured note is not a very liquid instrument.

*Collateralized bonds* are not properly derivative instruments: they are really the securitization of future high-quality receivables, for instance oil revenue. In this sense they constitute *senior debt*, where the seniority is often guaranteed by incorporation of the issuing entity in a third country – as was the case with Pemex Finance, incorporated in the Cayman Islands, the entity used by the Mexican government to issue securitized notes. The entity is directly assigned the revenue from the receivables, which it uses to service the debt. As with the senior debt issued by some developing countries in the late nineteenth century, the problem with collateralized debt is that these instruments often earmark revenues, which constitute a major source of tax income. This automatically raises the cost of debt service on other forms of debt.

Consider, returning to the example used at the beginning of section 6, a Taiwanese bank that lends to local electronics firms. Taiwan's comparative advantage lies in its firms' ability to produce world-class electronics at low cost; the bank's comparative advantage lies in its local knowledge, that is, the ability to monitor the projects of local firms and their management. The domestic financial market, however, is too small to allow the bank to raise enough funds for its lending activities – the manifestation, at the individual bank level, of a macroeconomic phenomenon: the country needs portfolio capital investment to grow.

By borrowing in the international capital market the bank exposes itself to an array of risks. Not only the traditional maturity mismatch, and possibly also a currency risk, but exposure to an industry sector, world electronics, over which it has limited, if any, control. What the bank monitors is the relative performance of domestic firms, but a slump in the world electronics market weakens the bank, quite independently of its ability in lending and monitoring. The bank would need an instrument that allows it to diversify credit risk, e.g. to swap default risk *vis-à-vis* its domestic borrowers for credit risk *vis-à-vis* a set of international borrowers. This is precisely what a *credit derivative* contract can produce.

A bank holding a concentrated loan portfolio has at least two ways to improve its risk-return performance. First, it can actively manage the portfolio by trading loans: selling a loan, however, might negatively affect the bank's relationship with its customers when they discover that their loan has been transferred to a different

(continued)

(BOX 6.2 continued)

institution. Second, it can use credit derivatives. A credit derivative allows the bank to swap credit risk *vis-à-vis* one borrower for credit risk *vis-à-vis* a different set of borrowers. The two transactions are typically disjoint. First, the bank enters a *default swap* arrangement, essentially an insurance contract through which the bank buys, for a fee, insurance for the event of a default. Next, the bank sells insurance to other banks buying exposure to the default risk of a different loan.

The transfer of credit risk can enhance the efficiency of credit markets by separating credit origination from credit-risk bearing. It can also help reduce the concentration of risk in banks' balance sheets: not only allowing banks to diversify their credit exposure across markets and sectors, as discussed above, but also by making it easier to shift such risks onto the balance sheets of non-bank institutions.

By their very nature, however, these derivatives spread credit risk to a broader set of market participants. This weakens the effectiveness of traditional credit-risk surveillance mechanisms – which are typically limited to banks – and increases the channels through which credit events can spread across institutions and markets.

(continued)

**Table 6.3** The global credit derivatives market

Net protection purchased by market participant	(US\$ billion)
Banks	200
Corporations	80
Securities houses	-10
Hedge funds	-10
Insurance companies	-300
<hr/>	
Breakdown by instruments	(%)
Credit default products	42
Total return swaps	11
Credit linked notes	12
Credit spread products	7
Baskets	8
Collateralized loan obligations	20

**Source:** IMF, *Global Financial Stability Report*, March 2002, pp. 37-8.



(BOX 6.2 continued)

There is also a concern related to the effectiveness of these instruments at transferring default risk in the case of credit events. Sometimes it has been unclear whether the restructuring of a company would qualify as a 'credit event' and thus trigger the insurance clause.<sup>3</sup> Other cases were related to the purchase by banks of protection against the default of a client, triggered by a failure to make good on forward contracts for the delivery of a particular commodity – a form of credit default swap. The institutions selling such protection to the banks, often insurance companies, have argued that the banks never intended to take physical delivery of the commodity on the day the forward contract expired: the forward contract had been used by the bank simply to extend credit to its client – and the credit risk had been effectively transferred to the insurance companies: but this was not the way the insurance companies interpreted the contract.

---

3 On the legal enforceability of OTC derivative clauses see Schinasi *et al* (2000).

---

## **7** Conclusions

Discussions of the role of derivatives and their risks, as well as discussions of financial risks in general, often fail to distinguish between risks taken consciously and ones that are not. To understand the breeding conditions for financial crises the prime source of concern is not risk *per se*, but the *unintended*, or *unanticipated* accumulation of risks by individuals, institutions or governments including the concealing of risks from stakeholders and overseers of those entities.

This report has analysed specific situations in which significant unanticipated and unintended financial risks are accumulated. We have focused, in particular, on the implicit guarantees that governments extend to banks and other financial institutions, and which may result in the accumulation, often unrecognized from the viewpoint of the government, of unanticipated risks in the balance sheet of the public sector.

Using the structural analogy between guarantees and options we have shown that a government's exposure to risk arising from a guarantee is non-linear. For instance, in the case of a government which guarantees the liabilities of the banking system, the additional liability transferred onto the government's balance sheet by a 10% shock to the capital of firms is larger the lower is that capital to start with. Recognizing this non-linearity in the transmission of risk exposures is essential to prevent the accumulation of unanticipated risks on the government's balance sheet.

Analyses of recent international financial crises recognize that the implicit guarantees governments extend to banks and corporations create the potential to greatly weaken their balance sheets. The attention, however, has mostly focused on the reasons why such guarantees exist, rather than on their measurement of the exposures they create. This paper provided a framework for correctly measuring the extent of a government's exposure to risk and how that exposure changes over time.

We have discussed how the assets of the banking system should be valued; drawing on the work of Gray (2001, 2002) we have analysed the issues that must be addressed in order to compute a country's value-at-risk; finally, we have used these insights to explain why the expected path of future fiscal variables (taxes and spending) should be adjusted whenever the value of the guarantees changes, such as, for instance, when the domestic economy weakens, or following an inflow of short-term capital.

Finally we have discussed how risk exposures can be controlled, hedged and transferred through the use of derivatives, swap contracts, and other contractual agreements. In emerging-market economies the domestic financial market typically allows very limited diversification of risks. Internal diversification through industrial policy can be inefficient and costly to reverse. In such a situation, diver-

sification through international capital mobility is the obvious alternative. The transfer across borders of the ownership of real and financial assets, however, is a only one way to achieve diversification, and it too can be costly to implement and even more costly to reverse. Often implementing these approaches to diversification conflicts with political objectives and constraints. OTC derivative contracts provide an appealing non-invasive alternative way to transfer risk. Equity swaps, executed on a large scale, allow a country to diversify risk without shifting the ownership of assets or otherwise disturbing the domestic financial practices.

---

# Discussion

This section summarizes the debates that took place during the fourth Geneva Conference on the World Economy on 10 May 2002, 'Financial Markets: Shock Absorbers or Shock Creators?' It comes in three parts: a general discussion on the Report, a panel debate on defining the problem and solution, and another panel debate on risk assessment in balance sheets.

These are interpretative summaries, prepared by the conference organizers, of the statements made by conference participants. They do not in any way commit the participants. The conference organizers bear sole responsibility for the views ascribed to the conference participants and apologize to them for any error of interpretation.

## 1 Discussion of the Report

Stephen Freedman  
*UBS AG*

Financial instability can be thought of as originating at one of four levels within the economy. Accordingly risk management and surveillance efforts tend to focus on these four levels. The first level is the individual financial institutions and calls for firm-level risk management and micro-prudential supervision. The second level is the financial sector as a whole. Concerns here are about hidden exposures of the financial sector to common shocks and spillover effects between financial institutions. Such concerns call for macro-prudential supervision, as advocated by the BIS in recent years. The third level is macroeconomic risk, which captures the occurrence of events such as currency or debt crises, that affect a country's entire economy. Avoiding problems at this level requires sound macroeconomic risk management by national authorities. Finally, problems arise at the level of the international financial architecture because the internationalization of financial flows has created new interdependencies between countries. Solving problems at this level requires crisis prevention and resolution, as well as better defining the role of the international financial institutions such as the IMF. While these four levels tend to overlap in many respects, making these distinctions is helpful in thinking about these issues.

Alberto Giovannini  
*Unifortune Asset Management (SGR)*

A very interesting suggestion of the Report is that proper risk accounting might indicate that currently many governments and other institutions are significantly under-capitalized. An important problem is the unanticipated accumulation and concealing of risks because of outdated and/or inadequate disclosure rules.

One example is the reporting rules of defined-benefit pension plans which conceal exposure to market volatility. The authors recommend to mark-to-market the balance sheets of financial institutions and to report guarantees in governments' accounts. They also note that many instruments could be used to improve international risk sharing at a low cost.

How do we translate these important principles into practice and what are the problems that will arise? Firstly, accounting for state guarantees requires an understanding of what will happen in different states of the world. Is it possible to write down such an adequate set of rules? The problem here is that the correlation matrix of a bank's portfolio tends to unity at the time of large instabilities. With endogenous behaviour and risk exposure, there are multiple equilibria.

Governments can improve the macroeconomic risk profile of their countries through the simple adoption of over-the-counter derivative transactions. Currently, however, most governments use derivatives, especially swaps, but they do not even disclose year-end statistics. More importantly, these transactions are carried out not just for risk control purposes, but for profit purposes, i.e. to reduce the cost of government debt. Should governments speculate in the market and extract profits from the information that they have? What type of information do governments have? What information should they use?

This example shows that, to implement the Report's recommendation we would have to go deep inside day-to-day practice and address difficult questions for the design of an institutional framework. Functional finance is a powerful instrument but we need to worry about the institutional setup, and this could well be the most challenging step.

Dino Kos

*Federal Reserve Bank of New York*

The Report well illustrates the benefits from international diversification, but are these benefits apparent? Despite the large number of available instruments and the tremendous increase in international capital flows, why are financial crises more frequent? Does international diversification increase or decrease the occurrence of financial crises? The Report does not quite address this issue.

The idea of equity swaps is provocative, but how much benefit would they generate? Looking at monthly correlations of stock returns between three emerging markets and the United States, from 1976 to 1990 and then from 1990 to 1999, confirms that the benefits of diversification are lowest when they are most needed. In addition, swaps are very complicated instruments, which raises issues of opaqueness and disclosure. Moreover, to achieve sizeable benefits, swaps should be done on a very large scale, which raises two further issues. Firstly, how would it affect corporate governance? Since the ownership rights are not transferred, the use of derivatives would weaken governance. Those from whom returns are swapped out would have less incentives to monitor firms' managers, whereas those to whom returns are swapped would not have the right to monitor and control the firms' managers. Secondly, the credit exposure could be quite large. If a significant part of a country's risk is related to its legal and governance regime, then the risk of non-payment becomes large as well.

Looking at the Basel framework, the Report reminds us that almost every risk-based approach towards capital ratios will have some element of pro-cyclicality. How bad is it? During the recent period, the financial system absorbed a number of large shocks and the capital ratios were sufficient. Note also that a risk-sensitive approach leads banks to limit their risk exposure.

Michael Mussa

*Institute for International Economics*

The Report correctly stresses that the existence of under-appreciated or unrevealed risk is likely to cause financial instability and economic disruption. However, it is not certain that the policy prescriptions are the answers.

During the Great Depression, the US banking system survived very well considering the magnitude of the shock. It was able to do so because banks acted very promptly to cut back on their short-term lending, to sell off their assets, and to protect their positions by contracting the supply of credit as the economy went down. It was a healthy response of the system but it did magnify the overall economic downturn.

There are three more recent episodes of similar crises. In late 1981, the United States fell into recession; long-term interest rates on US government bonds topped out at 16% and inflation shot up. The savings industry was in deep trouble and all major commercial banks in the United States were, if their assets had been marked-to-market, very substantially insolvent. A second example – although much less severe – is 1991 when at least a couple of the largest banks in the United States would have been insolvent if the proposal under study had been applied. The Japanese case of the 1990's is much more severe and without doubt on a marked-to-market basis there is hardly any institution in the country that is not deeply insolvent.

Nevertheless, in all of these recent cases the financial system continued to function without a major collapse, and this was largely permitted by the absence of mark-to-market. Indeed, most business firms are like surface ships. If they sink beneath the waves, they drown. On the contrary, banks and others institutions that rely on book value accounting are like submarines. They can survive for a long time deeply submerged. This is because the passengers and crew do not run out opening up the hatches, possibly because they expect a government guarantee, i.e. a bailout. If the submarine cannot surface in adequate times then the deposit insurance system protects the passengers and the crew. This is also helpful in avoiding the panic. In addition to get a submarine back to the surface, two solutions are available. One can either raise the boat or drain the ocean. The latter is what the Fed did in 1982-83 and during the 1990's when it substantially eased monetary policy. The likelihood that the economy will eventually recover, perhaps with the aid of monetary policy, keeps the financial market alive in times of crises.

Clearly there are costs to that system, essentially public sector costs, as demonstrated by the Savings and Loans crisis or the current Japanese crises. Going in the other direction as suggested by the Report has also revealed its problems. The Report suggests that if banks were operating without a deposit guarantee, one of the responses to the decline in the value of their assets would be to raise more equity. Why? When the market value of the assets declines, the initial impact is to drive down the value of the banks' equity, which increases the level of risk for the banks' depositors. If the equity were not sufficient, the depositors would take losses. This provides an incentive for the banks to repair their equity position in order to reduce the apparent risk to their depositors.

The difficulty when there is a mechanism of deposit insurance is that the market value of the bank's equity depends in part on the value of the deposit guarantee. The lower the value of the loan portfolio, the greater the contribution of the deposit guarantee to the market value of the bank's equity. In that situation if more equity is raised, one will not raise the market value of the equity, but reduce the value of the guarantee. So banks, particularly in times of distress, have a strong incentive not to raise additional equity. In contrast, many other types of business

firms that do not have this guarantee structure behave exactly as the Report suggests banks would behave in the absence of a guarantee. This is the problem that should be addressed. Should deposit insurance be made variable? In normal times, the market value of the banks' assets behaves along with the general level of economic activity. Hence, banks get in trouble when the economy gets in trouble. In these times it does not seem very reasonable to add more to the burden of banks and give incentives to cut back on lending and risk taking by raising deposits insurance rates. The challenge here is to balance the inefficiencies and losses created by government support and the macroeconomic instability that might be regenerated by a more aggressive system designed to discipline banks.

Ernst-Ludwig von Thadden

*University of Lausanne and CEPR*

The Report is impressive not because of its novelty but because of its insistence on basic values and points. The authors emphasize three important points. First, corporate accounting even when done honestly and under GAAP rules does not provide a full picture of balance sheet riskiness. Second, government guarantees of bank debt or fixed claims such as firm-level defined benefit plans are more valuable when the firm in question experiences a negative shock. This type of phenomenon affects all types of guarantee whether they are implicit or explicit. Finally, aggregate shocks to balance sheets and government revenue are highly correlated. It may create problems such as those recently witnessed in Turkey or Argentina.

Focusing on macroeconomic risk diversification, why is so little actually contracted on? Why are those important markets missing is not well understood. The Report suggests that legal infrastructure matters, but another answer is possible. Once we have settled the issue of transparency and accountability, and once we have put mechanisms in place and enforced them firmly, then risk management is only an engineering issue. It does not take a rocket scientist (or a Bob Merton) to do the engineering, but it is extremely difficult and complex. We did not have the time to learn about these things up to now, as it took time to understand how financial markets functioned in the 1980's and 1990's. Experience could eventually allow for these systems to be put in place.

There is something missing in this system, however. The traditional asset pricing view sees financial intermediaries as collecting and repackaging financial claims. This is the view taken by the Report. If the problem is how to distribute and manage risk, then intermediaries are the solution and not the source of the problem. Intermediaries are to some extent the source of the problem, however. Banks sometimes fail not because of bad luck, but because of deep internal problems. The corporate finance view says that the main task of financial intermediaries is to deal with asymmetric information. Risk packaging is important, but understanding these risks and controlling them is at least as important. These institutions are also moral hazard-prone, they have to be controlled. In that case, we cannot repackage and reallocate risk independently of the sources of these risks.

Something is missing in the recommendations put forward by the Report. The accumulation of unintended or unanticipated risks is the source of most of the financial problems in the last few years. Much of that risk has been taken deliberately, for example in the Enron case. If the goal were to redistribute risks or to bail out institutions that have had bad luck, the Report's proposal would be perfect, but the dark side of risk is not treated. Active involvement and active monitoring of risk is needed to implement risk control, and to be effective, the controllers need to be able to reap some of the rewards. Transparency and good accountancy

will go a long way toward solving the problem, but we need to see better what fundamentally obstructs the markets for macroeconomic risk.

#### Authors' responses

Robert Merton

*Harvard Business School*

Robert Merton made clear that it was not the intention of the authors to deal with the insurance of risk-taking behaviour. He then focused on why such a proposal has not been put in place before. Currently a learning curve of two decades of financial markets is maturing. It takes time for contracts to be widely used once written. The contracts proposed in the Report may not be ideal, because there are still many technical problems. The issue of asymmetric information will always remain, however.

Answering Mussa, Merton noted that not being marked-to-market works effectively well except when there is a crisis. In 1991 Citibank was in deep trouble and its real estate portfolio had not been marked for years. This type of uncertainty does not bring about confidence during a crisis, when there is a clear need to know what things are really worth. If banks are allowed to behave like submarines, there will be an infusion of capital coming from the government. How transparent is this? The government can state that it is in the interest of public policy to insert equity at the right time and this would happen whether or not there is mark-to-market.

Answering to Kos, Merton noted that correlation should not only be thought by country but also by industries. One should look at what is under the hood of the country in terms of its exposures and concentrations, in terms of the benefits of diversification. He also dismissed the idea that these are complicated instruments. Finally, large-scale sales and corporate governance are not necessarily contradictory. The Report does not envision that the total of the entire country's specific assets would be sold. There is credit exposure but it is far less for both parties than standard equity or debt because the principal amounts are not exposed with swaps. If the country must pay out on the swap, it is because its industries have outperformed the rest of the world's, i.e. when it is in a relatively good position.

Francesco Giavazzi

*Bocconi University and CEPR*

Francesco Giavazzi singled out three points. First, the point raised by von Thadden about the incentive mechanism for regulation. Risk sharing should not only be on the downside. Second, even if correlations were important, *ex ante* diversification, that is diversification before the shocks, would reduce the correlations among countries when shocks occur. The correlation and contagion that we observe is one under the current degree of diversification, and it might be lower if diversification happened before the shocks materialize. Finally, the fact that governments might be reluctant to recognize the guarantees they offer is at the core of one of the important policy discussions about the Growth and Stability Pact in the Euro Area. One of the proposals studied looks at different shades of deficits according to the financial situation of the country. The idea is to move away from a crude measure of debt levels for Euro area countries to one that takes into account various exposures, what we call guarantees, that the governments are implicitly or explicitly offering and to try to evaluate what these implicit guarantees might amount to. Thus, not only should the government guarantees be acknowledged, but also the value of these guarantees should not be computed once and for all, but constantly adjusted.



Mario Draghi

*Goldman Sachs International*

Mario Draghi made three points. First, there is some confusion about what 'risk supervisors and managers participating into the upside' actually means. Does it refer to the supervisors such as the central bank sharing corporate profits, or the internal risk managers? To a certain extent, in securities houses where mark-to-market is used, this idea is implemented and the supervisors share and participate to the overall company's profits. Second, equity cannot be substituted for risk monitoring because the incentives are not adequate, especially with regards to taxation in the United States. Finally, increasing transparency is difficult but the point is that it should be possible to be more transparent. For instance, accountancy rules might become clearer.

### General discussion

Avinash Persaud agreed that swaps, especially a country's asset swaps or GDP swaps, are an appealing idea. Nevertheless, there are a number of reasons why they will remain limited. First, these swaps are going to be politically very difficult. The only way in which a country can have a swap of its assets today is by encouraging more immigration. Second, pricing the swap is an interesting issue as well. Exporters and importers of commodities are classic candidates for some kind of mutual asset swap. Yet attempts to smooth out the volatility of these prices broke down as no agreement on what was the right price to maintain over the long term could be reached. Another reason for their breakdown is also that those who have made the swap can influence the price later on. He next observed that equity swaps are a clever solution. What is the problem that arises with banks and concentration of risk? Is it that they are not able to diversify their risk and are thus forced into concentration? Or is it that they choose to be concentrated? Often the problem is neither that banks are unable to diversify nor that they do not have the right tools, but that they choose not to.

Mårten Ross illustrated the issue of the diversification of banks' portfolio to foreign assets with Estonia. In Estonia, ten years ago, there was no government debt. Hence, banks had to invest their liquidity portfolio fully in foreign assets. Some advisors encouraged the government to go into deficit and issue Treasury bills in order to bring liquidity to the banks. The common thinking is that it is risky because the exchange rate is floating. The only defense against such a policy is that in Estonia there is a currency board and hence no exchange rate risk. The question is thus the following: does the exchange rate policy explain the preference for banks to hold their liquidity position in domestic currency and assets?

Vitor Gaspar, while fully aware of the problems linked to disclosure and transparency, thought that the Report may be slightly naive, for example when it states that 'guarantees on the debt of financial institutions, whether explicit or implicit, should be openly recognized in the government's balance sheet'. Most governments do not have a balance sheet. The problem is not that governments do not have proper risk accounting, but that they do not have proper accounting at all.

Robert Merton emphasized the difference between swaps with non-speculative prices such as GDP swaps and those with speculative prices, which can be associated with indexes and traded securities. Some limitations should be set about contracts in which one party has control over the price. It is certainly true that games can be played over a six-month period with prices in the local market. The problem is that if they are kept down during these six months then in the next six months they would increase even more. Thus, it is difficult to manipulate long-term prices. Luckily, it should be noted that the main beneficiaries would be

smaller countries, which have little impact on the world indices.

Francesco Giavazzi, responding to Gaspar about governments' balance sheets, said that the danger is not doing anything because governments do not have balance sheets. There is something that can be done, measuring the debt level and recognizing that debt includes guarantees. Even if the asset side of the balance sheet cannot be measured, measuring the liabilities properly is important.

Mario Draghi answered the question on exchange rate policy. Unless there is complete dollarization, the currency mismatch will always exist. If policy is run correctly, however, it may never show up. Of course, if domestic banks bought only foreign bonds then there will be an exchange rate risk, as Märten Ross pointed out. The suggestion that banks buy foreign bonds does not address foreign exchange risk, but credit risk. The ultimate guarantee of the government is correlated with the value of the domestic bonds issued by the government. When the economy does poorly the loan book of the banks is expected to do poorly as well.

Summarizing, Stephen Freedman concluded that the Report makes the strong point that a common element in many episodes of financial instability has been the accumulation of unintended and unanticipated risks. Two examples illustrate this point. First, US accounting practices currently allow corporations to report their defined-benefit pension plans by booking only the difference between the plan's assets and liabilities in their corporate accounts, thereby concealing the plan's underlying asset risk. Second, implicit government guarantees are extended to the banking system in numerous countries.

The Report's option-theoretic approach to incorporating implicit guarantees when measuring country risk highlights the need for greater risk disclosure, in particular the need to identify and measure government guarantees, and the fact that fiscal policy must adapt to economic conditions. Firms and governments would be well advised to diversify macro risk, and an effective way to do so is through an increased use of swap instruments.

Freedman noted that the discussants focused on the implementation difficulties that would be involved with swaps and on the limits of such a strategy. First, it was noted that government intervention in financial markets raised a set of issues that would have to be sorted out. It was also suggested that the benefits from the proposed diversification might be overstated if one considers that the correlations may increase after such swap transactions become widespread. In particular, international contagion effects arising from tighter financial integration may reduce the gains from diversification. Next, it was observed that there might be good reasons why such markets for macro risk have not emerged so far. Specifically, one must recognise that the information asymmetries inherent in financial contracting set limits on the extent to which financial claims can be repackaged and reallocated. Finally, it was also suggested that government guarantees, deposit insurance in particular, while being associated with a number of microeconomic inefficiencies – such as providing incentives for excessive risk-taking – can have a stabilising function at the macroeconomic level.

## **2 First Panel Discussion: What is the problem? What can be done about it?**

Vitor Gaspar  
*European Central Bank*

It remains very difficult to determine what the problem is and as a consequence, to recommend what can be done about it. On monetary policy and asset prices,

starting from the position expressed by Bernanke and Gertler (1999) and Issing (1998), monetary policy should focus on price stability. In fact, all central banks focus on price stability or have well-specified consumer price inflation targets. The reason seems to be that consumers care about their consumption stream over time.

There is a debate on the question of whether asset prices should be included in the price index used in the definition of price stability. Alchian and Klein (1973) argue that asset prices should be a good approximation for future spot prices. Therefore, if one considers intertemporal consumption, the correct approach to price stability should involve a role for asset prices. This is not a good idea because asset prices are not a good approximation for future consumer prices. Should then the European Central Bank take financial asset prices into account? Only to the extent that asset prices reveal risks to consumer price stability, and there are a number of reasons why this can be the case. First, asset prices may be a useful indicator of expectations from market participants, including inflation expectations. Second, changes in asset prices may generate consumers' wealth effects, which influence economic developments. Three important caveats must be kept in mind, however. First, the link between asset prices and fundamentals is difficult, if not impossible, to evaluate. Second, the attribution of a significant weight to asset prices in the monetary policy reaction function may add undesired volatility. Third, asset prices also affect the allocation of risk. Controlling for asset prices might create distortions in risk allocation.

Clearly, efficient financial markets are desirable. There is strong empirical evidence that financial intermediaries (banks and financial markets) promote growth and risk sharing, see e.g. Beck and Levine (2002). Moreover, financial markets and financial intermediaries are very important for risk sharing. Townsend (1994) uses data from villages of southern India and finds that local financial markets are sharing risk very efficiently (mainly through credit transactions). Are more sophisticated financial markets necessarily more efficient? On the one hand, sophistication of financial markets creates more opportunities for an optimal allocation of risk. On the other hand, financial innovations that improve the asset structure but do not complete markets, are not always welfare enhancing.

In the end, financial market imperfections remain. Abrupt shifts in asset prices can be rationalized as properties of efficient financial markets. For example, it may be that the correction back to fundamentals is abrupt while the building up of departures is gradual. In that case, financial markets can amplify shocks, notably through balance sheet effects of financial asset prices, in particular when assets are used as collateral.

In conclusion, monetary policy should take asset prices into account only to the extent that they reveal risks to consumer price stability. In other words, asset prices should not enter directly into the central bank's objective function. Moreover, the development of efficient financial markets should be favoured to promote efficient resource allocation. In this context, the single market for financial services should be fully implemented in Europe.

Mark Hendriks

*Société Générale*

The question invites negativity, especially given the current pessimistic state of the financial industry. Stepping back, however, one must recognize that the financial system in the last 25 years has evolved successfully and this is a notable achievement. In fact, the financial system should encourage economic development, be secure, and punish abuses of our confidence.

Why are financial markets unstable? Economic policy is probably the biggest

cause of financial market instability. Indeed, large volatility is obtained in those countries whose macroeconomic policies appear to provide an opportunity for a large movement in asset prices, or abnormal profits. Institutional arrangements also play a role. On the buy side (the institutional management industry in its broadest acceptance), there is a herd instinct whereby every asset manager is afraid of underperforming their peer group. The technology bubble is a good example of that phenomenon. The use of benchmarks may enhance instability. Moreover, the fact that many assets are managed in relationship with benchmarks prevents economic adjustment from occurring. The hedge fund community's activity is to create high investment returns relative to the norm. High returns imply high risk, which may stem from little diversification or a great focus on perceived weaknesses in either a macroeconomic situation or an arbitrage situation. This can be related to the transparency problem due to the fact that hedge funds, unlike other institutions, are not required to publish their positions on a quarterly basis.

On the sell side, research is not independent of investment banking activities. There are clear conflicts of interest and these should be dealt with by regulatory authorities. Moreover, there is a risk of a mispricing of the transactions that are done internally within a financial conglomerate. Outsiders do not know what is transferred internally.

Regarding governance, declaration of interests remains very important. Cross-shareholding and cross-interests of directors on each other's board give rise again to a problem of transparency. Moreover, there is a current lack of international agreement on codes and standards.

Finally, financial market instability can be reduced in a number of other ways: sensible macroeconomic management, maybe coordination; recognition and resource transfers to genuinely poor countries; an agreement on an international code of practice for financial participants; an effective enforcement of this code of practice; a full disclosure of post transaction positions; and the separation of research from investment banking.

Giles Keating

*Crédit Suisse First Boston*

Looking back at a number of memorable episodes of turbulence, securities markets can often appear to be creating shocks, when in reality they are absorbing shocks from somewhere else. Those shocks often are monetary and fiscal policy errors. If this is right, then what can be done is to try to refine the way in which macroeconomic policy is made, rather than altering securities markets.

The Nasdaq bubble is a recent episode of financial turbulence in the forefront of people's minds. Attaching the word 'bubble' to that incident suggests that this was a shock creating episode, in other words that it was due to a process of destabilising expectations working within the market. It is important to note that the most extreme phase of the price surge, from a relatively modest 2500 up towards 5000, coincided with the two or three months before, and immediately after, the Y2K date of 1st January 2000. Everywhere central bank policy was subordinated to Y2K. Interest rate increases were effectively ruled out and excess high-powered money was injected into the system. Keating did not suggest a direct causal link but an expectations effect. Investors were aware that policy could not be tightened and that financial shortfalls would be readily met. So the market was especially prone to an internal destabilising process, until the Y2K scare finished around the end of January 2000. The extreme valuations in the market were exacerbated, perhaps even caused by, an external event rather than merely coming from destabilising internal expectations.

A second and somewhat different example relates to the 1987 stock market crash. Immediately before the crash, valuations were conditioned on the assumption that international policy cooperation between the United States and Germany would continue, thereby keeping the world economy on a Pareto superior collaborative path. The underlying cause of the crash was a breakdown of collaboration. The official US government report, perhaps unsurprisingly, chose instead to blame market practices. Moving from stock to bond markets, the 1994 Treasury bond market decline was virtually a crash, albeit spread over several months. The likely cause was the Federal Reserve's decision to delay tightening from late 1993 into early 1994. That decision looks wrong using the data that are available with hindsight, showing strength at the end of 1993. The delay contributed to the bond market's overheating and consequent decline.

These examples suggest how securities markets may sometimes be inappropriately blamed. They are not always the innocent absorbers of shocks created elsewhere. A good counter-example is the contagion among emerging market bond markets in the 1990's. Countries with healthy fundamentals were affected by problems elsewhere. This effect was at least in part due to the flood of non-specialist money that bought emerging market bonds in the 1990's. These investors pulled their money indiscriminately, creating positive correlations. Such investors have now largely left the market, which is one of the reasons why the current Argentina crisis has not caused the same kind of contagion. Indeed, fixed pools of specialist money that must stay in the sector can even create the opposite effect of excessively negative correlation.

Turning to the banking system, the Merton model is an excellent tool to evaluate changes in bank capital, as described in the Report. While there are some practical problems in making this operational, the CSFB's CUSP model implements the Merton model on a large scale, for companies with traded bonds and equity. There are, however, a different set of implementation issues for loans to companies without traded liabilities.

Evaluating the capital deterioration is one thing, but funding it quite another. The Report discusses voluntary shareholder top-ups, suggesting the use of subordinated debt rather than equity. This is not going to solve the more fundamental problem of why shareholders would want to add capital of any kind to a troubled bank. In general, there is no practical reason why the NPV of net revenues from such a bank should offer a market return on the capital needed to bring ratios back above BIS levels. So to restore the ratios, the government seems the only possibility, with all the implications for public sector balance sheets that the Report emphasises. The BIS ratios should not be fixed over the economic cycle but much higher at the peak of the economic cycle and much lower at the trough. The ratios should not be altered for an individual bank, for obvious moral hazard reasons, but for the banking system as a whole. There could either be some preset formula related to general macroeconomic variables and default experience, or the ratios could be adjusted by an independent authority analogous to central banks. Merton-type modelling could be used as one of the inputs to the decision. The idea is to force shareholders who wish to participate in the oligopoly profits of the banking system, to inject 'excess' capital during a cyclical upswing when they are likely to be willing and able to do so, and then to allow that excess capital to be run down in provisioning and actual defaults in the downswing. Instead of the current fixed 8% total ratio, the ratio at the cycle could peak at 15-20%, and be reduced to as low as 2-3%. This would not completely eliminate the need for a government guarantee, but it should greatly reduce its implicit cost. Moreover, it should facilitate a market-led restructuring of the banking system during a downswing. Well-run banks, experiencing better loan performance than the laggards,

would find themselves with an increasing amount of free capital as the BIS limit fell, something they do not get with fixed ratios and they could use to take over and recapitulate the weaker institutions.

Richard Portes

*London Business School and CEPR*

The problem is country risk, financial fragility and the occurrence of crises. The real focus of the Report is on crisis prevention. These crises will always occur, no matter financial engineering, standards and codes and proposals. Crises may even have positive effects. Some of the measures to limit the occurrence of crises or to mitigate their effects have their own costs. Equity swaps could have unfortunate effects on corporate governance. It can also be argued that derivatives create opacity. Moreover, some of the measures proposed in the Report may have adverse effects on the development of local financial markets, mainly on trading volume and the development of local equity markets as a potential source for economic growth. Opening up to foreign market participants is beneficial since it allows for a reduction in the cost of capital. Therefore, we should not ignore the costs of trying to cure the problem.

Regarding the question of banks hedging through investment into foreign assets, does it help a country to deal with crises if foreigners hold part of the domestic debt directly or indirectly? In fact, selling the domestic debt to the foreigners will not help if the initial problem is a domestic fiscal problem. Moreover, choosing the GDP as the asset underlying sovereign debt is not appropriate. One must recognize that there is no underlying asset that corresponds to the sovereign debt, thereby complicating the process of resolving crises.

Turning to the resolution of crises, a first point is that collateralised bonds are not enforceable internationally. One example is the overwriting of the priority of Brady bond holders in the Ecuador default and debt restructuring. Another issue is the question why the relevant institutional changes do not happen. Looking at a common bankruptcy law, it was so chaotic that the markets could not come up with an appropriate structure in terms of the development of case law. Hence, bankruptcy codes were developed as an alternative that was more appropriate than the Anglo-Saxon system. This is analogous to the current discussion of dealing with sovereign debt restructuring mechanisms, notably the so-called Krueger proposal. Whenever the markets do not want new codes and standards, these will have to be imposed.

There is also a need for limits on the size of bailouts by the authorities, notably from the International Monetary Fund. These limits and the criteria to determine their appropriate level should be credible. There must be a mechanism for standstills as well as corresponding criteria. Financing should also be given in the course of crises resolution. Finally, there is a need for institutional structures to organize the resolution of crises. The International Monetary Fund is a *parti pris* and its role should be very limited.

Ian Woolford

*Reserve Bank of New Zealand*

Although the unintended accumulation of risk is present, because of poor risk management techniques, inattention or lack of understanding about the complexity of opaque derivative contracts, most people would agree that banks have improved dramatically in their ability to think about and manage risk. In fact, banks' risk management around the 'central' events has probably improved. It is the 'tail' events that, by their nature, remain problematic. What is the problem? Is it the elimination of financial distress? Is it the elimination of contagion

within and between financial systems? Is it the minimization of systemic disruption when a bank does fail? Is it the protection of small depositors? Or is it a combination of all of the above? It is remarkable that in these times of turbulence for individual institutions and economies as a whole, there is a tendency to look for specific changes. One example is the massive quantity of literature on the reform of the international financial architecture.

It seems that most banking crises have arisen from a combination of poor microeconomic management, e.g. poor credit risk management, and excessive exposure concentration, as well as unhelpful macroeconomic factors, such as asset price bubbles and sharp swings in real interest rates and exchange rates. Banks should be encouraged to manage their risks prudently, governments must ensure that macroeconomic policies are sound and sustainable, and microeconomic policies must be set such that relative prices can move freely and are not unduly distorted, so as to reduce the risk of banks lending on the basis of false economic signals. So, how can regulators induce banks to manage their risk prudently? Bankers appropriately always want to take more risk than regulators would like them to take. It is not possible to close this gap, but one can reduce it, encouraging bankers to be less focused on short-term maximisation of market shares and profits. The approach of the Reserve Bank of New Zealand emphasises that supervision is a poor substitute for sound corporate governance. Moreover, regulation should really provide directors with the right incentives to identify, monitor and control their risks.

There are three main strands: promoting self-discipline by banks in the management of their risks, fostering effective market discipline in the banking system, and supervising banks for the purpose of promoting financial stability. Focusing on the issue of banks' self-discipline, one of the key mechanisms is quarterly public disclosure statements, including comprehensive financial statements, credit rating information, detailed information on capital adequacy, asset quality and various risk exposures, and information on the bank's exposure to market risk. This is very transparent and is used by the public, financial analysts and competitors.

Another mechanism is director attestations. Directors face potentially severe criminal penalties and civil liability where a disclosure statement is held to be false or misleading. The directors have to attest to:

- whether the bank is compliant with prudential requirements;
- whether the bank has systems in place to adequately monitor and control its banking risks and whether those systems are being properly applied;
- whether the bank's exposure to connected parties is contrary to the interests of the bank;
- whether the disclosure statement contains all the required disclosures and is not false or misleading.

Anecdotal evidence on the attitudinal and behavioural change in the directors' approach to this aspect of their accountability has been very encouraging. In fact, the most common complaint from directors is that they have to spend far too much time scrutinising the statements.

### *General discussion*

Walter Engert mentioned that policy-makers must manage the explicit and implicit guarantees. In fact, these may be a cause behind the higher frequency of

crises. Ian Woolford answered that in New Zealand the approach is to remove guarantees as much as possible. There is, for example, no deposit insurance. Richard Portes emphasised that a major problem in recent years has been the moral hazard generated by large-scale bailouts. Hence, there is a clear argument for limits and alternative credibility creating mechanisms must be designed. Ulrich Kohli added that before setting limits, one should have a way to dealing with crises.

Charles Wyplosz mentioned that the Report shows that banks currently carry too much risk because of a lack of diversification and proposes a number of ways through which all sorts of risk could be diversified. Then, why doesn't it happen spontaneously? The question should rather be what could be done to trigger the process of using swaps on a widespread scale, thereby reducing the overall amount of risk borne by depositors and taxpayers. José Resano connected the diversification issue with risk arising from benchmarking. There has been a revival of hedge funds recently and these may be a way to circumvent the problem of insufficient diversification. Christian Pfister commented that banking activity is cyclical itself. Banks should be able to anticipate the downturns. William White emphasised price misalignments and the potential large effects of readjustments on financial markets. Mark Hendriks talked about the scarce use of derivative instruments. One of the impediments is that pension funds account for a large size of investable assets, whereas their liabilities are in a single country. Diversification outside their own currency is not allowed. On benchmarking and hedge funds, Hendriks argued that transparency should be much greater and that positions should be reported.

Robert Merton said that innovation usually occurs when there is a clear need for a regulatory change. Therefore, it is only when the appropriate parties will think that the problem is large enough that changes will be implemented. Vitor Gaspar defined the stability of the financial system as its ability to withstand shocks and argued that the consequences of catastrophic events depend on what causes the readjustment and in which circumstances this adjustment takes place.

Ulrich Kohli concluded by saying that financial markets have been able to resist large shocks in the last decade. The role of banks has decreased, which may be a good thing, but difficulties have occurred unexpectedly in other sectors, as in the Enron case. Therefore, the answer may not be more regulation but a better enforcement of the existing regulation. Moreover, macroeconomic policy should be managed appropriately. Finally, corporate governance is very important. The concealing of risks is a serious problem and it requires more disclosure and transparency.

### **3 Second Panel Discussion: Risk assessment in balance sheets: Basel and other approaches**

Svein Gjedrem

*Bank of Norway*

The Norwegian banking crisis – as well as the Swedish and Finnish crises – was largely the result of macroeconomic shocks. A boom in the early 1980's fuelled in part by strong credit growth, was followed by a deep recession at the end of that decade. Oil prices fell sharply in 1985. The Norwegian kroner was devalued, and fiscal and monetary policies were tightened in response. Today in Norway, banks are better capitalized, balance sheets of companies and households are in a much better shape and the macroeconomic policies are less pro-cyclical. Still, banks remain vulnerable to the business cycle, so the question remains of how the



macroeconomic risk can be removed from the economy. Macroeconomic policies should do three things: 1) improve the stabilization of the economy; 2) transfer the macro risk to others by increasing foreign ownership in local businesses and banks; 3) hedge some of this risk by investing the revenue of the Petroleum Fund (which will amount to more than a 100% of GDP in four or five years) abroad. The Fund now exposes Norway more to international capital market risk than to oil price risk. According to the Report, Norway should perhaps have diversified even more. Forward markets are either thin or non-existing for large quantities of oil, however. Thus, even if many of the proposals in the Report are interesting, in practice they are not so easy to implement.

To adapt to the remaining risk a capital cushion should be built in banks and financial institutions, by means of a cyclical capital adequacy ratio. The problem then becomes how to measure the time dimension of risk, or relative versus absolute risk, as well as the build up of true economic risk over the cycle when the exact position on the economic cycle is unknown. It is quite difficult to find the right risk estimate and thus the corresponding buffer. The Basel II proposal is a step towards improving the measure of risk, even though it is not currently possible to measure it precisely. The new accord gives financial institutions better incentives to measure their risk exposure, leads to better risk management practices, and gives banks better information about their risk exposure. It thus enables them to improve the calibration of their risk models and hedge against specific risks.

There are, however, limitations to how well risk can be measured. Predicting future loan losses based on historical data is quite a complex issue and subject to the limitations against any stable econometric relation. Predicting the macro risk is even more difficult given the divergent views about the business cycle. These uncertainties make the third pillar of the new accord all the more important. Timely and correct information enables the market to give a 'second opinion' on the bank's risk exposure for both bank customers and the regulators. Some may argue that market prices are inherently biased; they vary too much and cannot be trusted. They are nonetheless the only price someone is willing to trade on and as such they are useful benchmarks.

Increased transparency and more emphasis on market judgment may increase volatility and banks may appear to be more risky, but which is better; not knowing the situation of banks or being well informed about the banks' actual exposure? Being ignorant of the true risk might be pleasant in the short run, but in the long run more information should enable us to make better decisions and ultimately to prevent future crises.

The importance of increased transparency was evident during the resolution of the Norwegian banking crisis. It does not mean that the whole banking book should be continuously marked-to-market. Particular strong arguments are needed, however, if decisions on value estimates should deviate from market values. This is all the more true in times of financial crises.

Troubled banks are then managed by new outside managers with no thorough knowledge of the quality of the bank's assets. This is exactly the time at which market information is mostly needed. The decision of whether to provide new capital to the banks is also critically dependent on judgment of asset quality. The successful solutions to the banking crises in Norway was due to the willingness of seeing 'reality in the eyes' by using marked-to-market valuation of assets.

In conclusion, some macro risk may be removed by improving macroeconomic policies and by using new hedging techniques. Moreover, macro risk may be decreased, but will not disappear. The new Basel Accord does not

eliminate this vulnerability. This accord is a step in the right direction, however. It will improve risk management practices in the financial sector, and it will thereby improve financial stability.

David Mayes  
*Bank of Finland*

Four ideas need to be put together in order to get a proper approach to the subject of risk: 1) a better understanding of risk and how it can be managed by banks, investors, external assessors and supervisory authorities such as by macro-prudential oversight and financial stability reviews; 2) a better measurement of the time varying component of risk; 3) counter cyclical supervision rules such as the Hong Kong Monetary Authority limits to the loan to valuation ratios or the Finish Supervisory Authority warnings; 4) support from monetary policy in the form of liquidity or information about how asset prices are incorporated in the monetary policy rule.

The Report raises the two issues of pro-cyclicality and limiting some risks. It proposes to solve them with the adoption of three sets of measures. First, better measurement and information will improve risk assessment and management, simultaneously reducing cyclicality and improving reactions to it. Second, there is a danger in the Basel proposal in expecting too much from regulators and supervisors and not enough from market participants. Finally, volatility is a problem only for those who cannot adjust to it flexibly and costlessly.

Moving on to the Basel approach, the problem is to get a proper balance among the pillars of the accord. What should be done is first to avoid the worst anomalies of pillar I. Second, it should avoid placing emphasis on discretion and opaque rulings of the supervisory authority under pillar II. Finally the accord should place more emphasis on pillar III by providing information on banks in a timely manner (i.e. quarterly). The third pillar looks at bi-annual data only and this is a bit disappointing. Comparability is also important, as are relevant accounting standards, auditing independence and reputation. The accord should also encourage early market-driven action and enable rapid resolution of crises.

As for measuring risk, there is no correct or perfect answer. Therefore, we should not pursue a single approach. The methods need to be clear, bearing in mind the extent of their accuracy and properties. It is however more important to know how well the measures are being applied than it is to know what the methods are. The penalties that exist in New Zealand are food for thought here. The ultimate goal should be to enable comparisons across banks.

One of the key issues is that we need a large market element in the system of internal ratings. The further ones goes into that direction, however, the more volatile the ratings become. At the same time other forms of ratings such as external ratings will tend to lag rather than be forward looking. In other words, the wedge should be between volatility in the assessment and required capital, not between actual risk and the assessment.

As for the time dimension element, dynamic provisioning should be encouraged. The Spanish example, which takes into account that there is variation over the course of the cycle, is relevant here. They suggest that there is 'latent risk' of 0-1.5% which is constant over the cycle. In good times there should be a statistical provision, which accounts for the difference between the specific provisioning and that latent risk. This can be built up to a maximum of three times the annual latent risk while the lower limit is zero. In the trough of the cycle, that fund can be drawn on. This approach is not without problems however. The tax authorities must allow making provisions in that way. The remark goes for accounting standards.

Another possibility, which has been advocated, is an official statement of the 'cyclical' position of the economy, along the lines of the Johansson Commission proposals in Sweden. A balanced committee of technical experts assesses the cyclical position of the economy relative to its trend. The aim is to use that as a means of managing fiscal policy in the context of the Growth and Stability Pact. It could also be used by the financial authorities in deciding whether one should be provisioning more or less than currently, or whether extreme measures are necessary.

In conclusion, there are a series of ingredients that can be added for improving the Basel Accord. Ten are listed here; greater clarity about credit risk and its management; improved 'macro-prudential' information; an improved risk measurement that incorporates a larger element of market valuation and a fuller time horizon; more prudence by banks and markets that would be self-damping; a regulatory structure encouraging banks to improve risk management; regulation limiting the banks' ability to move to extreme positions; regulation with an automatic counter-cyclical element to it; complementary stabilizing structures by other authorities, e.g. tax regime and macroeconomic policy; greater market pressure on banks; and improved arrangements for handling international liquidity and solvency problems.

Avinash Persaud  
*State Street Corporation*

The new Basel agreement has many good intentions for a systematic approach, therefore allowing for many exceptions, special interests and hence stretching over more than 500 pages. In addition, the points of regulatory intervention are misaligned with the points of market failure. It should be possible, however, to write an accord that would fit on a single page with brevity and parsimony bringing some operating benefits. An alternative proposal would have to deal with three issues:

1) Speed, since bank failures have a big potential for contagion bringing significant economic and social externalities. Regulation is thus needed to avoid frequent large bank failures but does not remove market pressures for efficiency and good risk management practices.

2) Banking is by definition an information industry. Banks make money by matching borrowers and lenders. They play as such a significant role for economic growth. This is all the more true when additional channels of finance are not available as is the case for small and medium enterprises or in emerging market economies. It is therefore very important that a regulation of banks does not penalize a well managed bank with an informational advantage over the nature of its loan portfolio. It should not be prevented from lending to a borrower that the market, the credit rating agencies, or the average lender thought was too risky. Arbitrating between different assessments of risk is what good bankers who know their customers should be all about. Consequently steps towards a risk weighted capital adequacy and internal risk assessment are in fact generally good. However, the accord takes one step back by qualifying and limiting this approach with a host of restrictions, of imposed assumptions and correlations and imposed caution. The main market failure is not that banks systematically underestimate risk, which would require constant multipliers and constant caution.

3) The market failure that should be addressed is that bank failures are predominantly pro-cyclical. They underestimate risk in good times and overestimate it in recessions. When averaged across the cycle, it is by no means clear that the

banks systematically underestimate the risk of traditionally risky assets. Indeed there is evidence, not proof, of the opposite given the continued long run excess returns available in lending to emerging companies and countries.

The procyclicality of lending and risk assessment is an empirical observation grounded in much theory. Whatever is the source of it, a constant multiplier to internal risk assessments will not solve it. Insofar as internal risk ratings are cyclical, multipliers amplify the cyclicity.

Given these issues, a new capital accord should be based around three tranches of required capital:

1) The first tranche of capital should be based on the bank's self-assessment of risk in its balance sheet. This is risk weighted; it does not penalize banks with good risk management and credit skills. The banks' ability to make these assessments should be transparent to the market and the regulator through the adoption of a broad and common framework of risk buckets and predictions of natural losses published regularly.

2) A second tranche of required capital should be based on the banks' record of self-assessment. A bank that invests in a risky asset but has a good record at credit assessment could end up requiring less capital than a bank that invests in safer assets but has poor credit skills and many negative surprises. It preserves incentives for both the risk taking and risk management. If banks did not suffer from pro-cyclicality this would be sufficient.

3) A third tranche of required capital is needed to deal with this market failure and needs to be directly counter-cyclical. Measuring the cycle is not easy to do, but it is not impossible. Many leading indicators series have been developed (such as by the OECD) which predict the course of the cycle quite well.

In conclusion, if the new capital accord had been enforced during previous crises, required capital would have followed crises quite perversely. Too little capital would have been required just prior to the crisis as banks invariably underestimated their risks and too much capital would be required afterwards with banks overestimating their risks.

A better alignment of market failure with intervention leads to three simple regulatory charges on banks:

1) A risk weighted charge linked to the banks' internal risk assessment, which have to be approved and inspected by the regulators.

2) A charge related to the record of self-assessment, to ensure that the risks are not avoided but are taken by those who are best able to do so.

3) A counter-cyclical capital charge to deal with the markets inability to differentiate well between cyclical booms and structural shifts. The authorities will levy this charge not based on a forecast of the cycle but the actual progression of the cycle.

Alexander Swoboda

*Graduate Institute of International Studies*

Capital asset ratios and other such prudential measures really aim at the stability and safety of individual banks and not at the stability of the system. The pro-cyclicality is due to two reasons: first, the riskiness of the asset moves counter-cyclically; and second, during a recessionary macroeconomic shock the capital of banks will decrease since some of the capital will be lost in absorbing the bad loans.

The question remains of how to deal with financial instability and assessing what, if any, is the role of capital adequacy ratios. Historically the traditional means to deal with financial crises have been deposit insurance, standstills in crises, lender of last resort provisions and explicit/implicit government guarantees. Capital asset ratios are thus relatively recent newcomers in the safety of the banking system literature. They are an invention of the 1980's.

Why do we have capital adequacy ratios? They are a *quid pro quo* for the earlier guarantees, and there is greater regulation or supervision in order to avoid that the guaranteed will abuse the guarantee. The goal is to limit the moral hazard and the cost of the guarantee to the government or the taxpayer.

Do their shortcomings mean that we want to do away with capital asset ratios? Probably not, because they are one way of reducing the probability that the bank run chain starts. They make the individual institutions safer, decreasing the probability that a micro shock will become a macro shock. It is thus not possible to do away with capital adequacy ratios, but what is necessary is to do away with their cyclical tendencies.

Indeed, the proposals of the Report will not resolve the problem but might help to ameliorate the trade-off. Transparency, better risk sharing and better pricing of the risk and awareness of the cost of the guarantee would help. Hence, to reduce the pro-cyclicality for the banking system, three aspects are important: first, the desirable fiscal behaviour of governments in the sovereign credit context; second, capital asset ratios should be made more variable and counter rather than pro-cyclical; finally, it is important that forbearance be counter-cyclical rather than pro-cyclical.

### *General discussion*

Jean-Pierre Landau thought that the future of the banking system is going to be determined by the interaction of three things: Basel, mark-to-market and the rating system. Turning to the Basel Accord, Landau argued that the problem is with reference to which state of nature risk is assessed. To assess the risk of a bank's portfolio three options are available:

- 1) Basel I: it assesses the risk at the moment the loans are made according to a very crude approach.
- 2) A second possibility would be to assess the risk at the moment at which the loan is made, but according to an appreciation of the different states of nature which are likely to occur during the lifetime of the loan. That would involve some kind of provisioning as well as some capital asset ratio.
- 3) One could also assess the risk of the portfolio according to the state of nature at the moment of the assessment of the loan. This is the approach of Basel II with the consequence that the risk of previous decisions is

reassessed and these reassessments are allowed to influence decisions about future loans.

Indeed, this is the essence of pro-cyclicality. In addition, Basel II only allows for risk assessment for a state of nature for the next year, which introduces an additional element of volatility. Finally, the issue remains of whether absolute risk in this system is going to be better assessed, whether it is going to be increased or diminished.

On the whole, the Basel Committee has said that the reform would not change the overall capital charge of the banking system. The overall risk of the system will not change, there will only be a redistribution of risk between institutions. Landau thought that this is an optimistic assessment and that due to pro-cyclicality, the overall risk in the system will increase and the system might find itself more vulnerable than before the reform.

Mark-to-market is the ultimate step for allowing to permanently reassess the risk of the portfolio. Thus, if the entire portfolio is marked to market, it makes all the internal risk assessment redundant. This is of course a limit situation.

Do we want the banks to react to shocks exactly like any financial intermediary? The case had been made by Alan Greenspan a few years ago. It is a good thing to have the banks when other segments of the market are not working very well. If we want to have different channels of financial intermediation, then we should allow them to react differently to shocks in the financial market.

In conclusion, Landau made a few remarks about ratings. Ratings will play a big role in Basel II through the so-called standardized approach. Indeed they will determine the risk-weighted ratios, which will calibrate the system. There are two things to be said about ratings. First, rating is a discontinuous process. When wondering whether the financial system is a shock creator or shock absorber, these discontinuities have to be taken into account. Second, the rating sector is characterized by very few players, no real competition, and a system of remuneration which raises questions about the incentives for real transparency.

Jean-Jacques Rey outlined two points. First, the Basel accord defines only minimum capital requirements, leaving it to banks to sort out their profiles through the cycle so that these minimum capital requirements are always met. If market participants complain about the pro-cyclicality of fixed ratios it is probably because they have transformed the minimum requirements into normative requirements.

Then, Rey stressed one element of the solution which has been mentioned briefly, namely the need for improving governance in financial markets and among users of the financial system. Governance is about transparency and disclosure, risk awareness in the management but also about inserting proper checks and balances in the internal relationship between the board and management. It is also about promoting a culture of integrity into the system. Its absence leads not only to financial instability but also to discrediting the system. Governance is also about putting some checks on the exclusive pursuit of shareholder value and enhancing awareness of stakeholders' interests, and stakeholders are aplenty in the financial system. Rey was not sure whether governance is a matter for self-regulation or public oversight.

Walter Engert commented further on the notion of pro-cyclicality. A procyclical regime needs a bottom line, which, if crossed, would mean the closure or merger of the bank. Thus, over the cycle, it can be expected that banks would put a lot more capital on their books than they currently do. On the downside there would be much more demanding conditions about closure and termination with much less discretion for regulators. Is the macro efficiency gain worth the micro

efficiency cost?

Michael Mussa found the discussion over the Basel accord misplaced. Government regulation should protect against the big mistakes and little marginal mistakes do not matter very much. Basel I standards did not prevent the Japanese banking crisis. If a country is not willing to enforce the standards, then standards are not useful.

Robert Dugger said that the reason why the discussion is misplaced is that it does not really deal with what is at work in the pro-cyclical process. The Report is very similar to the option value dynamic research that led to the deposit insurance reform in the United States in the early nineties. Over time, however, it has been realized that ultimately vested interested will determine where risk evolves.

David Mayes argued that mark-to-market is the greater market influence but not the whole of it, and certainly subordinated debt is part of the issue. There are two problems with subordinated debt. First, the issuer is not necessarily the risk taking institution. Second, there is a difference between the responses of the institutions to changes in the price of the subordinated debt. Although the market may be expressing a view, there is considerable data from the United States that suggest that institutions do not really take much notice of this view.

Turning to the other corporate governance issues that have been raised, Mayes addressed the problem of meeting a bottom line. Here, Denmark behaved in an exemplary way. There were two aspects. First, the proportion of non-performing loans to GDP was biggest in the Nordic countries but none of the banks failed. Second, the legislation in place at the time required that if a bank was 25% below what its required minimum capital was, it had to produce a plan, which would result in the repairing of that capital in a certain time period. The Danish industry then behaved more prudently than in the other Nordic countries.

To conclude, Mayes emphasized two problems with Persaud's second tranche. First, the development of a track record might increase pro-cyclicality if evaluated after too short a period of time. The second problem is associated with the new entrants.

Avinash Persaud mentioned that a solution to the problem of new entrants is to make sure that they face the average. It is important to distinguish between pro-cyclicality of ratios and the pro-cyclicality of the market assessment of risk. It is not mark-to-market itself which causes the problem but mark-to-market combined with risk limits. If the market is going down by 10%, we see a big loss, and because of risk limits, the response is to sell as well. This increases rather than minimizes risk.

Answering to Rey, Alexander Swoboda said that an 8% requirement is a minimum and banks should be able to manage that over the cycle. The problem is that on the one hand there are competitive pressures that prevent them from deviating too much from that minimum. On the other hand, they pay a tax for the guarantee and will not maximize the amount of the tax.

---

## Bibliography

- Alchian, A. and Klein, B. (1973), 'On a correct measure of inflation', *Journal of Money, Credit and Banking* 5, pp. 173-191
- Beck, T. and Levine, R. (2002), 'Stock markets, banks and growth: correlation or causality', mimeo, University of Minnesota
- Bernanke, B. and Gertler, M. (1999), 'Monetary policy and asset price volatility', *Federal Reserve Bank of Kansas City Economic Review*, 4th quarter, pp. 17-51
- Black, F. and Scholes, M. (1973), 'The Pricing of Options and Corporate Liabilities', *Journal of Political Economy*, 81 (May-June), pp. 637-59.
- Blejer, M. and Schumacher, L. (2000), 'Central Banks' Use of Derivatives and other Contingent Liabilities: Analytical Issues and Policy Implications', Working Paper 00/66. Washington, IMF.
- Bodie, Z. and Merton, R. C. (1993), 'Deposit Insurance Reform: A Functional Approach', in A. Meltzer and C. Plosser (eds.), *Carnegie-Rochester Conference Series on Public Policy*, 38, North Holland, pp. 1-34.
- Bodie, Z. and Merton, R. C. (2002), 'International Pension Swaps', *Journal of Pension Economics and Finance*, 1 (January), pp. 77-83.
- Bodie, Z., Mitsui, A. and Tufano, P. (2002), 'Corporate Pension Policy: Bethlehem Steel 2001', Harvard Business School, N-9-202-088.
- Borio, C., Furfine, C. and Lowe, P. (2001), 'Procyclicality of the Financial System and Financial Stability: Issues and Policy Options', mimeo, BIS.
- Burnside, C., Eichenbaum, M. and Rebelo, S. (2002), 'Government Guarantees and Self-fulfilling Speculative Attacks', mimeo, Northwestern University.
- Caballero, R. J. (2003), 'The Future of the IMF', forthcoming in *American Economic Review, Papers and Proceedings*, May 2003.
- Caballero, R. J. and Krishnamurthy, A. (2000), 'Dollarization of Liabilities: Underinsurance and Domestic Financial Underdevelopment', NBER Working Paper No. 7792, July.
- Caballero, R. J. and Panageas, S. (2003), 'Hedging Sudden Stops and Precautionary Recessions: A Quantitative Approach', mimeo, MIT, January.
- Calvo, G. 'Explaining Sudden Stops, Growth Collapses and BOP Crises', Mundell-Fleming Lecture, IMF, November, forthcoming, IMF Staff Papers.
- Cox, J. C. and Ross, S. (1976), 'The Valuation of Options for Alternative Stochastic Processes', *Journal of Financial Economics*, 3 (January-March), pp. 145-66.
- Credit Suisse (1997), *CreditRisk+: A Credit Risk Management Framework*, Credit Suisse Financial Products.
- Crouhy, M., Galai, D. and Mark, R. (2001), *Risk Management*, New York, McGraw Hill.
- Dornbusch, R. (1998), 'After Asia: New Directions for the International Financial System', mimeo, MIT.



- Dornbusch, R. (2002), 'A Primer on Emerging Market Crises', in S. Edwards and J. A. Frankel (eds.), *Preventing Currency Crises in Emerging Markets*, Chicago, The University of Chicago Press, pp. 743-54.
- Feldstein, M. (ed.) (2003), *Economic and Financial Crises in Emerging Market Economies*, Chicago, The University of Chicago Press.
- Fischer, S. (2002), 'Financial Crises and Reform of the International Financial System', NBER Working Paper No. 9297, October.
- Garber, P. (1999), 'Derivatives in International Capital Flows', in M. Feldstein (ed.), *International Capital Flows*, Chicago, The University of Chicago Press, pp. 386-407.
- Gray, D. F. (2001), 'Macro Financial Risk Country Report: Thailand', mimeo, MFRisk, Inc.
- Gray, D. F. (2002), 'Macro Finance: The Bigger Picture', *Risk*, June.
- Gray, D. F., Merton, R. C. and Bodie, Z. (2002), 'A New Framework for Analyzing and Managing Macrofinancial Risk', Conference on Finance and the Macroeconomy, New York University, New York, October.
- Hancock, P. and R. Mendoza (2002), 'Risk and Transparency in Pensions', *Financial Times*, 20 March 2002, p.21.
- Hull, J. C. (2000), *Options, Futures and other Derivatives*, 6th edition New York, Prentice Hall.
- IMF (International Monetary Fund) (2002), *World Economic Outlook*, April.
- ISDA (International Swaps and Derivatives Association) (2002), 'Enron: Corporate Failure, Market Success', available at [www.fenews.com/fen26/enron1.html](http://www.fenews.com/fen26/enron1.html)
- Issing, O. (1998), 'Asset prices and monetary policy: four views', Panel Discussion BIS/CEPR, CEPR publication
- Jeanne, O. and Zettelmeyer, J. (2002), '"Original Sin", Balance Sheet Crises and the Role of International Lending', mimeo, IMF Research Department, November.
- Kealhofer, S. (2003), 'Quantifying Credit Risk I: Default Prediction', *Financial Analysts Journal*, 59(1) (January/February).
- Merton, R. C. (1973), 'The Theory of Rational Option Pricing', *Bell Journal of Economics and Management Science*, 4 (Spring), pp. 141-83 (Chapter 8 in Merton ((1992)) *Continuous-Time Finance*).
- Merton, R. C. (1974), 'On the Pricing of Corporate Debt: The Risk Structure of Interest Rates', *Journal of Finance*, May, pp. 449-70 (Chapter 12 in Merton (1992) *Continuous-Time Finance*).
- Merton, R. C. (1977), 'An Analytical Derivation of the Cost of Loan Guarantees and Deposit Insurance: An Application of Modern Option Pricing Theory', *Journal of Banking and Finance*, June (Chapter 19 in Merton (1992) *Continuous-Time Finance*).
- Merton, R. C. (1990), 'The Financial System and Economic Performance', *Journal of Financial Services Research*, 4 (December), pp. 263-300.
- Merton, R. C. (1992), *Continuous-Time Finance*, revised edition, Oxford, Blackwell Publishers.
- Merton, R. C. (1999), 'Commentary: Finance Theory and the Shift to Integration', *Risk*, July, p. 50.
- Merton, R. C. (2002), 'Future Possibilities in Finance Theory and Finance Practice', in H. Geman, D. Madan, S. Pliska and T. Vorst (eds.), *Mathematical Finance: Bachelier Congress 2000*, Springer.
- Merton, R. C. and Z. Bodie (1992), 'On the management of financial guarantees', *Financial Management*, Winter, pp. 87-109.
- Merton, R. K. (1936), 'The Unanticipated Consequences of Purposive Social

- Action', *American Sociological Review*, I, pp. 894-904.
- Merton, R. K. (1989), 'Unanticipated Consequences and Kindred Sociological Ideas: A Personal Gloss', in C. Mongiardini and S. Tabboni (eds.), *L'Opera di Robert K. Merton e la sociologia contemporanea*, Genova, ECIG, pp. 307-29.
- Persaud, A. (2000), 'Sending the Herd off the Cliff Edge: The Disturbing Intercation between Herding and Market-sensitive Risk Management Practices', ERisk.
- Reisen, H. (2001), 'Will Basel II Contribute to Convergence in International Capital Flows?', mimeo, OECD Development Center.
- Shinasi, G. J., Craig, R. S., Dreed, B. and Kramer, C. (2000), 'Modern Banking and OTC Derivatives Markets', Occasional Paper No. 203. Washington, IMF.
- Tirole, J. (2002) *Financial Crises, Liquidity, and the International Monetary System*, Princeton, Princeton University Press.
- Townsend, R. M. (1994), 'Risk and insurance in Village India', *Econometrica* 62(3), pp. 539-591