

# Risk-Based Supervision of Pension Funds:

## A Review of International Experience and Preliminary Assessment of the First Outcomes

*Gregory Brunner*

*Richard Hinz*

*Roberto Rocha*

The World Bank  
Financial Systems Department  
Financial Policy Development Unit  
January 2008



## Abstract

This paper provides a review of the design and experience of risk-based pension fund supervision in several countries that have been leaders in the development of these methods. The utilization of risk-based methods originates primarily in the supervision of banks. In recent years it has increasingly been extended to other types of financial intermediaries including pension funds and insurers. The trend toward risk-based supervision of pensions is closely associated with movement toward the integration of pension supervision with that of banking and other financial services into a single national authority. Although similar in concept to the techniques

developed in banking, the application to pension funds has required modifications, particularly for defined contribution funds that transfer investment risk to fund members. The countries examined provide a range of experiences that illustrate both the diversity of pension systems and approaches to risk-based supervision, but also a commonality of the focus on sound risk management and effective supervisory outcomes. The paper provides a description of pension supervision in Australia, Denmark, Mexico and the Netherlands, and an initial evaluation of the results achieved in relation to the underlying objectives.

---

This paper—a product of the Financial Policy Development Unit in the Financial Systems Department (FPDFS)—is part of a larger project on risk-based supervision of pension funds managed by the department, in collaboration with the International Organization of Pension Supervisors (IOPS). Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at [rrocha@worldbank.org](mailto:rrocha@worldbank.org), [gbrunner@worldbank.org](mailto:gbrunner@worldbank.org), and [rhinz@worldbank.org](mailto:rhinz@worldbank.org).

*The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development/World Bank and its affiliated organizations, or those of the Executive Directors of the World Bank or the governments they represent.*

# **Risk-Based Supervision of Pension Funds:**

## **A Review of International Experience and Preliminary Assessment of the First Outcomes**

Gregory Brunner, Richard Hinz, and Roberto Rocha <sup>1</sup>

The World Bank, Washington DC

---

<sup>1</sup> This paper is part of a broader project on risk-based supervision coordinated jointly by the World Bank and the IOPS. The authors are grateful to Constantinos Stephanou, David Madero, Dirk Broeders, Dimitri Vittas, Heinz Rudolph, Laura Ard, Luiz Mario Hernandez Acevedo, and Peter Skjodt, for useful inputs and comments on an earlier draft.

## Contents

<b>I. Introduction</b>	<b>2</b>
<b>II. Conceptual Origins of Risk-Based Supervision - Basel II and Solvency II</b>	<b>3</b>
<b>III. Introduction of Risk-based Supervision for Pensions</b>	<b>5</b>
1. Overview of the Four Pension Systems	5
2. Factors Motivating the Adoption of Risk-Based Supervision in Pension Systems	7
<b>IV. The Main Elements of Risk-Based Supervision for Pensions</b>	<b>9</b>
1. Common Objectives and Elements of Design	9
2. Overview of the Main Components of Pension Supervision in the Four Countries	11
3. Regulatory Requirements for Risk Management Architecture	13
4. Risk-Based Solvency Standards	14
5. Supervisory Risk Scoring Systems	18
6. Market Based Discipline and Third Parties	21
7. Internal Structure of the Supervision Agency	22
<b>V. Preliminary Assessment of the Impact of RBS</b>	<b>23</b>
1. The Netherlands	23
2. Denmark	25
3. Australia	27
4. Mexico	29
<b>VI. Concluding Observations</b>	<b>31</b>

## Tables

Table 1: Main Characteristics of the Four Private Pension Systems, Dec. 2005	6
Table 2: Factors Motivating the Adoption of Risk-Based Supervision	8
Table 3: Main Components of Risk-Based Supervision in the Four Countries	12
Table 4: Regulatory Requirements on the Risk Management Architecture	14
Table 5: Risk-Based Solvency Requirements	16
Table 6: Risk Scoring Methods	20
Table 7: Role of Market Discipline, Third Parties, Disclosure	22
Table 8: Asset Allocation of Dutch Pension Funds 2001 – 2005 (in % of total)	24
Table 9: Changes in the Asset Allocation of Life Companies and Pension Funds	26
Table 10: Simulation Results of Change in Interest Rates	27
Table 11: Average Composition of the Aggressive Pension Portfolio in Mexico (Siefors 2)	30

## Figures

Figure 1: The Three Pillars of Basel II	4
Figure 2	10
Figure 3: Distribution of the Duration of Dutch Pension Fund Fixed Income Investments	25
Figure 4	26
Figure 5: Shifts in the Efficient Frontier and Actual Risk-Return Combinations	30
Figure 6: Maturity of the Public Debt Stock and Government Securities in the Riskier Portfolio	31
Figure 7: Basic and Aggressive Portfolios: VaR Limits and Actual VaRs, 2005-2006	31

## I. INTRODUCTION

Over the past several decades privately managed pensions have evolved from their origins as a supplemental form of deferred compensation to become an important, and in some cases central, element of social insurance systems. Their supervision has made a similar transition to meet the requirements of this new role, evolving from an initial emphasis on ensuring compliance with tax laws and labor contracts and relatively simple methods to limiting investment risk, towards a much more comprehensive approach designed to ensure proper management of all the risks associated with complex institutions relied on to provide secure sources of retirement income.

The wave of innovation and reforms in Latin America and Central and Eastern Europe beginning in the early 1980s transformed pension funds from primarily employer sponsored defined benefit (DB) arrangements into more diverse forms including most significantly the emergence of special purpose financial intermediaries operating on a defined contribution (DC) basis. This largely removed the capacity to rely on employers to guarantee outcomes placing financial risks squarely on the shoulders of members. This transition shifted the nexus of supervision from controlling agency risks to managing systemic financial and operational risks. Initially the new supervision regimes were based on simple portfolio limits with very pro-active compliance enforcement. Bounding downside risk over short periods through investment controls was the primary concern. The risk-return efficiency or effective capital allocation were very secondary considerations.

By the beginning of the new millennium several factors combined to accelerate these changes in supervision methods. Private pension funds in a number of countries accumulated asset levels exceeding those of more traditional financial institutions, in some cases more than 100% of GDP, leading to a commensurate increase in attention to their systemic importance. A “perfect storm” of rapidly declining interest rates coincident with collapsing equity prices exposed the fragility of the loose funding requirements for the remaining DB schemes. Concerns about the capacity of the new DC plans to produce adequate levels of retirement income also focused attention on the efficacy of their design and operation. This led a number of countries to begin to adopt supervision systems based on various risk-based approaches that established new standards for the operation of pension funds and guided the conduct of their oversight activities.

The objective of this paper is to review the experience in four of the pioneers in developing risk-based supervision for pension funds: Australia, Denmark, Mexico, and the Netherlands. These countries each have large well established pension systems that provide a useful initial review because they constitute a representative sample of the characteristics of pension systems worldwide, including occupational and open pension funds as well as both defined benefit and defined contribution arrangements. The paper draws on individual country studies that form part of a joint project of the World Bank and the International Organization of Pension Supervisors (IOPS), as well as discussions with pension supervisors and market participants in these countries. The reader is referred to the case studies for a more detailed analysis of individual countries.<sup>1</sup>

The paper is structured as follows. The second section reviews the origins of risk-based supervision in banking and insurance, and the progress that has been achieved in developing further the risk-based approach under the Basel II and Solvency II

agreements. The third section provides an overview of the pension systems of the four countries and the factors that have motivated the introduction of risk-based supervision in these countries. The fourth section – the core of the paper – provides a more in depth discussion of the main elements of risk-based supervision of pension funds in the four countries. This is followed by a very preliminary assessment of the impact of the new supervisory approach on the sectors, as well as some observations on the challenges that supervisors will face in the future. Finally, the sixth section concludes and draws some preliminary lessons for other countries.

## **II. CONCEPTUAL ORIGINS OF RISK-BASED SUPERVISION - BASEL II AND SOLVENCY II**

The movement towards risk-based supervisory approaches can be traced to the development of early warning systems for banks. The earliest of these systems was the CAMEL system for risk rating adopted by the United States in the 1980s. In 1988 the Basel Committee on Banking Supervision implemented the Capital Adequacy Accord (Basel I) which provided a risk-based framework for assessing the capital adequacy of banks to cover credit risks. The development of this framework was an important step in the path towards risk-based supervision. It sought to ensure an adequate level of capital in the banking system by applying weighting to credit exposures based on broad risk classifications.

During the 1990s a number of supervisors implemented risk assessment and early warning systems. In 1993 the Bank of Italy implemented an off-site monitoring system called PATROL; in 1997 the German Federal Supervisory Office introduced an early warning and monitoring system called BAKIS. In the same year the French Banking Commission introduced an off-site supervisory bank rating system called ORAP. In 1998 the Financial Service Authority in the United Kingdom introduced its RATE model, a comprehensive bank risk rating system, and the Dutch National Bank (DNB) implemented a comprehensive system called RAST which has evolved into the FIRM Model applied to all financial entities regulated by DNB today.

In 1999 the Basel Committee began the process of replacing the Basel I Accord with a more contemporary framework which requires banks to improve risk management and corporate governance in conjunction with improved supervision and transparency. The new framework known as Basel II is designed to encourage good risk management by tying regulatory capital requirements to the results of internal systems and processes, thus creating incentives for improvements in risk management. In addition to making the calculation of regulatory capital more risk sensitive and recognizing the quality of internal risk management systems, the framework added two pillars to the model – the supervisory review process and the market discipline. The three pillars of the new model are shown in Figure 1.

**Figure 1: The Three Pillars of Basel II**

Pillar 1	Pillar 2	Pillar 3
Minimum Capital Requirements	Supervisory Review Process	Market Discipline
Risk-based capital rule reflecting: <sup>1</sup> <ul style="list-style-type: none"> <li>• Market risk</li> <li>• Credit risk</li> <li>• Operational risk</li> </ul>	<ul style="list-style-type: none"> <li>• Regulatory compliance</li> <li>• Reporting obligations leading to more transparency and accountability</li> </ul>	<ul style="list-style-type: none"> <li>• Meaningful disclosure</li> </ul>

*Note:* 1) The interest rate risk on the banking book (loans, deposits) is not included in pillar 1 of Basel II, but in pillar 2. However, it is included in pillar 1 of Solvency II.

The Basel II framework provides banks with a choice between a standardized approach to calculating credit risk using specified risk factors and an internal ratings based approach which is subject to explicit approval by the bank supervisor which would allow banks to use their internal ratings systems for credit risk. It has been built through a process of extensive exploration by regulators of emerging industry practices in risk management and considerable testing and calibration.

The framework requires implementation of an effective and comprehensive risk management system. It is envisaged that banks will set up a proper organizational structure, policies, procedures and limits for credit, market and operational risk. Banks are also required to have an integrated approach to risk management that covers the risks in particular business segments as well as the bank as a whole.

The second pillar, supervisory review, allows supervisors to evaluate a banks' assessment of its own risks and assure themselves that the banks processes are robust. Supervisors will have the opportunity to assess whether a bank understands its risk profile and is sufficiently capitalized against its risks. This pillar will encourage adoption of risk focused internal audits, strengthened management information systems and the development of risk management units.

The third pillar – market discipline – ensures that the market is provided with sufficient information to allow it to undertake its own assessment of banks' risks. It is intended to strengthen incentives for improved risk management through greater transparency. This should allow market participants to better understand the risks inherent in each bank and to ultimately support well managed banks at the expense of poorly managed banks.

The movement towards greater risk focus is also being reflected in the insurance industry. The International Association of Insurance Supervisors (IAIS) is currently working to develop a common international framework for assessing the solvency of insurers. At a regional level work is underway in Europe on the Solvency II project which aims to adopt a risk-based approach to capital requirements for insurance companies; and introduce qualitative requirements for senior management, risk management, model validation and internal controls. There will also be recognition of internal modeling in collaboration with the actuarial profession. Solvency II will involve a three pillar approach similar to Basel II, introducing a supervisory review process and enhanced transparency.

The current solvency framework in Europe dating from the early 1970s defines capital requirements for insurers in terms of solvency margins typically based on simple rules applied to technical provisions or premiums. Under Solvency II the first pillar will

define the resources that a company needs to be considered solvent. It will define two thresholds for capital. The Solvency Capital Requirement will set a threshold for supervisory action and a Minimum Capital Requirement will provide a basis for stronger action or even withdrawal of the company's license to write new business. As with Basel II, the capital requirement can be calculated using either a simple standardized model or an internal model which has been approved by the supervisor. Pillar 2 will take into account qualitative measures of risk control focusing on risk management processes, individual risk capital assessment, and aspects of operational risk, including stress testing. Pillar 3 will address disclosure requirements incorporating more consistent international accounting standards. In many European countries which operate DB pension schemes or guarantee arrangements which involve technical reserving, the rules applying to insurance companies may also apply to pension entities.

Across the globe the trend is inexorably moving towards improved risk management based on the three key elements outlined in Figure 2. Firstly, institutions themselves are focusing on improving their own risk management. They are developing risk management strategies and they are measuring and assessing risk in a more comprehensive manner. In many institutions this involves the creation of dedicated risk management units. They are implementing controls to ensure that risk management policies are followed and are ensuring that risk management information is presented to management and board in a meaningful fashion.

Supervisors are responding to this by building up their ability to assess risk. The basic tools of on-site and off-site supervision are taking on a risk focus, and specialist risk units are being created with expertise to tackle complex issues. Many regulators are encouraging improved risk management by implementing regulatory standards and providing guidance. Finally, more external parties are being encouraged to take a role in the risk assessment process, either through broadening the role of some traditional players like auditors and actuaries, or through encouragement of greater scrutiny by outside parties through greater transparency of reporting.

### **III. INTRODUCTION OF RISK-BASED SUPERVISION FOR PENSIONS**

#### **1. Overview of the Four Pension Systems**

This section provides an overview of the private pension systems of the four countries examined to provide an understanding of the factors that motivated the introduction of risk-based supervision. Further background information on the pension systems of these countries is provided in the individual country papers.<sup>2</sup>

As shown in Table 1, all of the countries have mandatory or quasi-mandatory private pension systems. In Australia and Mexico, contributions to private pension plans are imposed by legislation. In the Netherlands and Denmark, contributions take place in the context of collective labor agreements. These are classified as quasi-mandatory, because most workers are covered by these agreements. The mandatory or quasi-mandatory nature of contributions results in high coverage rates except for Mexico. The lower coverage ratio in Mexico, despite the legal obligation to contribute, is explained by the large share of the labor force in the informal sector and the lower number of active contributors relative to the total universe of pension fund members.<sup>3</sup>

The pension systems in these countries are very large, with assets exceeding 100 percent of GDP in all cases, except for Mexico. The relatively small size of assets relative to GDP in the Mexican case is due to the lower coverage ratio and the fact that the Mexican system is much younger, having started operations only in 1998. However, the mandatory nature of contributions to individual accounts implies that that private pension system will continue growing at fast rates and increase its share in the financial sector.

Three countries have a large number of funds, ranging from 111 in Denmark to 1,000 in Australia and these funds may operate more than one pension plan. Many of these are occupational funds structured as non-profit trusts or foundations that were originally created on a voluntary basis and have been operating for several decades. They include single funds and larger multi-employer or industry-wide funds. Australia and Denmark also have several for-profit commercial institutions managing pension funds – including life insurance companies in the Danish case.

**Table 1: Main Characteristics of the Four Private Pension Systems, Dec. 2005**

	Mandate	Coverage (% of labor force)	Assets (% GDP)	Number of Funds	Legal structure of pension funds	Type of Plan
Netherlands	Quasi- mandatory	90	120	700	Occupational	Mostly DB
Denmark	Quasi- mandatory	80	124	111	Occupational and open <sup>1</sup>	Mostly DC with absolute return guarantee (DB-like)
Australia	Mandatory	90	104	1,004	Occupational and open <sup>2</sup>	DC
Mexico	Mandatory	29	8	18	Open	DC with ceiling on downside risk (VaR)

*Notes:* 1) Denmark: 44 corporate funds, 30 industry-wide funds, 37 life insurance companies;

2) Australia: 681 corporate funds, 86 industry-wide funds, 194 retail funds, 43 public sector funds. The figures do not include small funds.

*Sources:* Hinz and Van Dam (2006), Andersen and Van Dam (2006), Thompson (2006), Bernstein and Chumacero (2007), Rofman and Luchetti (2006)

Mexico has only 18 funds currently licensed. The difference in the number of funds is a result of the different origins and characteristics of the Mexican system. The Australian, Danish and Dutch systems have their roots in voluntary arrangements with employers. Most funds were initially established with liberal licensing/authorization rules designed to encourage participation and coverage. By contrast, the Mexican system was established as a mandatory system of open funds subject to a strict regulatory framework, including much stricter licensing rules.<sup>4</sup>

Dutch pension funds manage primarily DB plans – the Netherlands has been one the few countries that has successfully resisted the move towards DC plans. The Danish system is a DC system that offers benefit guarantees and operates on a risk-sharing (or profit-sharing) basis. The guarantees introduce a core liability and the risk of insolvency of the provider. Therefore, the Danish system exhibits some of the characteristics of a defined-benefit system, although it operates with more flexible rules than pure defined-

benefit systems and seems to be moving in the direction of DC plans with fewer guarantees.<sup>5</sup>

Australian pension funds manage primarily traditional DC plans with no formal guarantees. There are still some DB plans, but these are mostly restricted to public sector funds, and account for a small share of total assets. Australia best represents a pure defined contribution system.

Mexican funds, by contrast, manage their DC plans under a new regulatory framework that includes a limit on downside risk defined by a ceiling on the daily absolute Value at Risk (VaR). This is a significant departure from the setup introduced in Chile and other countries in Latin America and Central Europe that relied on quantitative portfolio restrictions to manage risks. Most of these countries have introduced minimum relative return guarantees that intensify herding behavior and lead pension funds to base their investment strategies on tracking errors or relative VaRs vis-à-vis the benchmark portfolio. Pension fund managers in these countries are more concerned with relative risk (the risk of deviating from the benchmark and facing a capital call to honor the relative return guarantee) than absolute risk. The Mexican experiment is both innovative and controversial, and is being followed with interest in other countries.

## **2. Factors Motivating the Adoption of Risk-Based Supervision in Pension Systems**

Some of the factors that have motivated the introduction of risk-based supervision of pension funds are common to all the four countries, while others seem to be country-specific. Table 2 summarizes the motivating factors that have been identified in the individual country studies.

Preventing under-funding of DB plans was a strong factor motivating the adoption of risk-based supervision in the Netherlands. Dutch funds enjoyed the equity boom in the 1990s and started taking contribution holidays when funding ratios reached levels considered as high. However, these funding ratios proved insufficient to absorb the adverse price movements in the early 2000s – the crash of the equity market combined with the drop in interest rates led several funds to become under-funded or only marginally funded. Regulators interpreted the outcome as indicating a weakness in the supervisory approach that was perceived as lacking sufficient foresight and concern for the risks facing the institutions.

The introduction of a more risk-based approach to supervision in Denmark was also motivated by a concern with the solvency of pension providers, but the surrounding conditions were different from those in the Netherlands. First, the new Danish “traffic light” system (explained in more detail below) preceded the equity crash in the early 2000s. By the time equity prices collapsed and interest rates declined, the new system was already in place. Second, the new system was introduced as a *quid pro quo* for a more liberal investment regime in which the ceiling on equity investments was raised to 70%. Danish funds were allowed to make riskier investments provided that they held sufficient capital to absorb the risk. Third, the Danish system operates on a risk-sharing basis, which means that the system has buffers that can absorb at least part of the adverse price movements. These differences imply that the first motivating factor was more important in the Netherlands than in Denmark. However, there was still concern with provider solvency in Denmark, justifying the inclusion of this factor.

Concern with adverse price movements was also one of the motivating factors in Mexico, although the Mexican system is a DC system where the investment risk is shifted to the individual and there is little risk of provider insolvency. The policy concern in Mexico was not the risk of provider insolvency, but the exposure of retiring workers to extreme downside losses and the extreme volatility of benefits across cohorts.<sup>6</sup> It is also interesting to note that, as in the Danish case, the adoption of a VaR ceiling in Mexico and the introduction of strict risk management rules were a *quid pro quo* for the introduction of a more liberal investment regime that allowed pension fund managers to make riskier investments and use derivatives.

**Table 2: Factors Motivating the Adoption of Risk-Based Supervision**

	Policy of reducing the risk of under-funding, insolvency of DB plans (or DC plans with guarantees) due to sudden and adverse price movements	Policy of limiting maximum loss to members of DC plans due to adverse movements in asset prices	Search for efficiency gains, especially from improvements in risk/return trade-off	Increasing complexity of financial instruments and markets	Effort to allocate efficiently scarce supervisory resources	Spillover from bank/insurance supervision; Change in approach after integration of agency
Netherlands	X			X	X	X
Denmark	X		X	X	X	X
Australia				X	X	X
Mexico		X	X	X	x	

The search for efficiency gains was also one of the main motivating factors in Denmark and Mexico. In both cases, the investment regime was liberalized and pension funds allowed to invest more in equity and other assets perceived as risky. In Mexico, pension funds were allowed to use derivatives, subject to certification by the supervisor. The relaxation of the investment regime was motivated by the perception that pension funds were constrained below the efficient investment frontier and that there was scope for longer term improvements in the risk-return trade-off. The relaxation of investment rules was accompanied by other rules designed to strengthen risk management and constrain excessive risk-taking.

The need to establish rules that enabled pension funds to take advantage of the increasing sophistication and complexity of financial instruments and markets was a motivating factor in all the four countries. This reflects a more general recognition by financial supervisors worldwide that it is no longer feasible to monitor all of the operations of financial institutions, and that a more effective approach entails ensuring that these institutions have sound risk management practices and internal controls.

In the Netherlands, Denmark, and Australia, the adoption of risk-based supervision was also driven by the need to allocate scarce supervisory resources efficiently. Especially in Australia and the Netherlands, supervisors need to monitor a large number of institutions. A traditional, compliance-based supervision would be either too costly or ineffective in these cases. The risk-based approach allows supervisors to focus their

scarce resources in the institutions exposed to greater risks and/or with weaker risk management capacity. This factor was less important in Mexico, where only 18 funds are allowed to operate.<sup>7</sup>

The integration of financial supervisory functions in one entity also seems to have been a motivating factor in the Netherlands, Denmark, and Australia. The adoption of risk-based supervision in pensions seems to have been accelerated in the countries that integrated their agencies and adopted the same basic supervision approach to all financial institutions. There was in these cases an accelerated transfer of supervisory “know-how” from banking and/or insurance supervision to pension supervision. Mexico was again the exception, as the supervisory agency (Comision Nacional del Sistema de Ahorro para el Retiro – Consar) was a single entity when the new approach was adopted and has remained a single entity since then.

#### **IV. THE MAIN ELEMENTS OF RISK-BASED SUPERVISION FOR PENSIONS**

##### **1. Common Objectives and Elements of Design**

As discussed in section II, one of the main objectives of risk-based supervision in banking and insurance is to ensure that institutions adopt sound risk management procedures and hold appropriate levels of capital. Regulators and policy-makers are aware that many leading institutions have already adopted good risk management practices and some companies would already be able to meet the more demanding requirements of Basel II and Solvency II. These financial institutions recognize that sound risk management practices are in the interest of stakeholders and are rewarded by the market, as indicated by the growing consideration of the quality of internal risk management by rating companies.<sup>8</sup>

Pension supervisors face challenges that are in many aspects similar to those faced by bank and insurance supervisors. They recognize the need to evolve to an approach that emphasizes sound risk management by the supervised institutions, in order to strengthen financial stability and ensure more efficient outcomes for pensioners. They are also aware that several pension funds in their countries have already started adopting good risk management practices. The challenge that pension supervisors face is to ensure that all licensed institutions comply with minimum standards of risk management and hold appropriate levels of capital (in the systems where this is relevant).

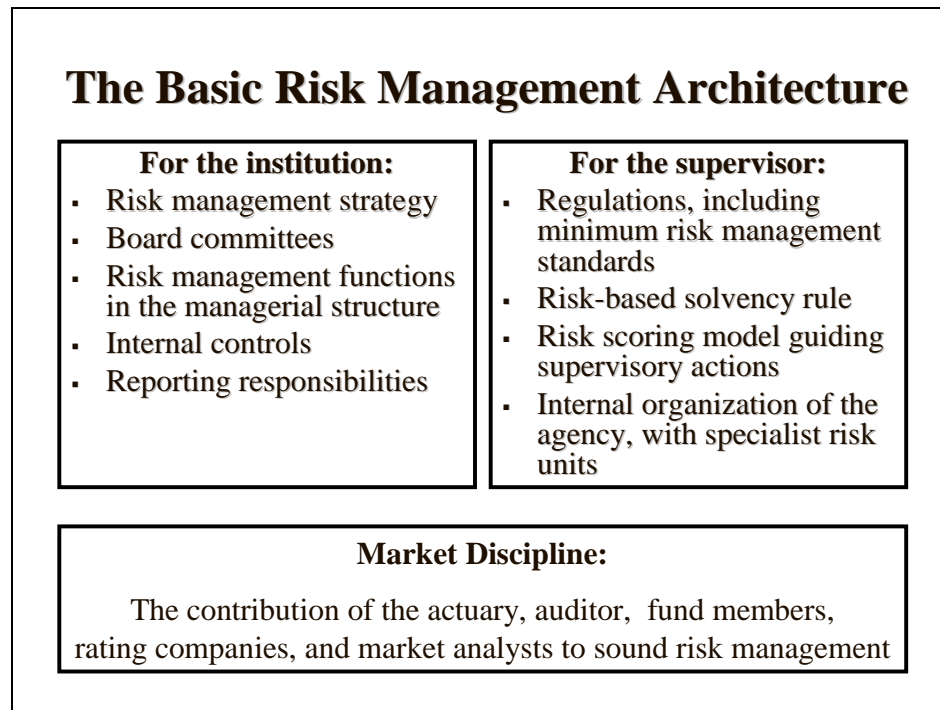
In order to examine the way pension supervisors have addressed this challenge, it is useful to consider Figure 2 that identifies the three main groups of players involved in the overall architecture of risk management. The first group consists of the supervised institutions. The second group is the supervisory agency, and the third consists of other market participants that may have the capacity to influence the decisions and actions of pension funds. These include auditors, actuaries, fund members, rating companies, and market analysts.

One of the main objectives of risk-based supervision is to ensure sound risk management at the institutional level. As indicated in the left box of Figure 2, the capacity of the institution to identify, measure, and manage all the relevant risks, would be reflected in the presence of a sound internal architecture of risk management that includes a reasonable risk management strategy, evidence of Board involvement in risk

management, the existence of risk management functions performed by competent, independent, and accountable professionals, and proper internal controls.

The question is what tools supervisors have to ensure these outcomes. As indicated in the right box of Figure 2, the broad elements of the supervisory toolkit include the regulations issued by the supervisor, including direct regulations focused on the risk management architecture and risk management procedures, a risk-based capital rule (in the environments where this is relevant), and a risk-scoring model that guides supervisory strategies and procedures. In addition, the supervisory agency will organize itself consistent with the requirements of these elements by establishing some units focused on managing the relationships with the supervised entities and other technical units more specialized in the measurement and analysis of different type of risks.

**Figure 2**



Finally, the third group of relevant players includes those market participants which may contribute to market discipline and the adoption of sound risk management practices by the institutions. The role of some of these players depends on regulations issued by the supervisor as well. For example, the role of the auditor may be enhanced by expanding the scope of the audits to include an assessment of the effectiveness of risk management systems and internal controls, and imposing whistle-blowing obligations. The influence of fund members, rating companies, and other market analysts may be strengthened by good accounting, auditing and disclosure rules issued by the supervisor.

It is possible to relate the main components identified in Figure 2 with the three pillars in the Basel II/Solvency II framework. The risk-based solvency rule constitutes the first pillar and is relevant in DB systems or DC systems which offer benefit guarantees. The second pillar represents the supervisory process. Figure 2 emphasizes risk scoring models, because these models have become essential tools around which pension supervisors organize their off-site and on-site supervisory actions. The third pillar, market discipline, is directly represented by the third block in Figure 2. This pillar

is expected to play an essential role in the Basel II and Solvency II frameworks, but its relevance for pension supervision depends more closely on the particular type of system, as discussed below.

## **2. Overview of the Main Components of Pension Supervision in the Four Countries**

As illustrated in Table 3, pension supervisors in the four countries have developed these tools to varying degrees, reflecting the different environments. In The Netherlands, Denmark, and Australia, the institutions must comply with corporate governance rules that emphasize the role and responsibilities of the Board and must also have a risk management plan or risk management guidelines, but do not have to adopt a specific architecture of risk management. By contrast, all Mexican pension funds have to adopt a very specific and detailed risk management architecture laid out in a specific regulation issued by the supervisor.

The different approach followed in Mexico reflects the particular characteristics of the Mexican system, including the much smaller number of relatively homogeneous institutions. It is possible to implement this type of regulation in a system with only 18 pension funds. It would be very difficult – and also questionable – to implement this type of regulation in a system with 1,000 pension funds, including large and small funds with very different capacities. Supervisors could generate severe inefficiencies by imposing a one-size-fits-all type of regulation. Of course, the build up of risk management capacity in the institutions is a supervisory objective in Australia, Denmark, and the Netherlands, but supervisors try to achieve this objective through other means, such as the incentive effects associated with their risk scoring model or by imposing sanctions on institutions with weak capacity to manage risks.

Risk-based solvency rules are relevant in the Netherlands and Denmark, because of the nature of their systems. Dutch supervisors have recently implemented a detailed and formal risk-based solvency rule that addresses longevity, market, credit, currency, and interest rate risks and that penalizes asset-liability mismatches. Denmark has adopted a model that can be classified as hybrid. The formal solvency rule is not risk-based, but is complemented by a standard stress test called the “traffic light system” that entails a test of the resiliency of the institution to fluctuations in interest rates and asset prices. The Danish traffic light system shares some common elements with the new Dutch solvency rule but also has some important differences. It is not a formal solvency rule, as already noted, and is applied in the context of a risk-sharing system, which implies a lower risk of insolvency. Risk-based solvency rules are not relevant in DC systems such as Australia and Mexico, but Mexican regulators have adopted a ceiling on daily VaR that limits the exposure of DC fund members to downside risk.

Australia and the Netherlands have made substantial progress in building comprehensive risk scoring models that are applied to all financial institutions, with adaptations depending on the type of institution. In the Netherlands, solvency indicators are considered as inputs to the risk scoring model, providing a link between the risk-based capital position and the risk scores. It is also interesting to note that the Australian risk scoring model takes into consideration the institution’s exposure to financial risks (and the capacity to manage these risks) in the risk scores, even though it is applied to DC plans where financial risks are shifted to the individual members. The Australian Prudential Regulatory Authority (APRA) examines the adequacy of investment

management processes, including the investment strategies, asset allocation, diversification, liquidity needs and performance measurement, monitoring and benchmarking. It looks not only for compliance with the broad investment rules but also to how risk management compares to good industry practices. Denmark and Mexico have made only partial progress in this area. Both countries have developed elements of a risk scoring model to guide their supervisory actions, but have not yet developed full models.

**Table 3: Main Components of Risk-Based Supervision in the Four Countries**

	<b>Requirements for the Internal Risk Management Architecture</b>	<b>Risk-Based Solvency Rule</b>	<b>Risk Scoring Model</b>	<b>Role of Market Discipline/Disclosure</b>	<b>Organization of Supervision Agency</b>
Netherlands	Internal review of Board's management of long term risks. Risk management plan in fund's business plan (Abtn)	Fully developed risk-based solvency rule	Fully developed and unified framework, considering quantitative and qualitative aspects; Applied to all financial institutions with relevant adaptations	Low; Possibly higher in some cases through single employer balance sheet	Integrated agency; Specialized pension units and specialized ALM and Legal units.
Denmark	Board of Directors required to issue risk management guidelines	Hybrid rule: solvency margin + risk-based traffic light system	Partially developed	High	Integrated agency; Specialized pension units and specialized risk units
Australia	Risk management strategy and plan required for licensing	No formal solvency rules for DC plans <sup>1</sup>	Fully developed and unified framework considering quantitative and qualitative aspects; Applied to all financial institutions with relevant adaptations	Medium	Integrated Agency. Lead supervisors and risk/technical specialists
Mexico	Very specific and detailed architecture laid out in a regulation issued by the supervisor	No formal solvency rules for DC plans; However, VaR ceilings to limit downside risk	Partially developed: Elements of risk scoring for operational risk and financial risk	Medium/High	Single-purpose entity, with specialized operational and financial risk units

*Notes:* 1/ Australia imposes basic technical solvency requirements for the remaining DB funds. The size of solvency buffer is assessed as part of PAIRS

Market discipline does not seem to play a very important role in the Netherlands, although the disclosure of the fund's solvency position and its implications for the sponsor may impose an element of discipline in single employer funds. Market discipline plays a more important role in Mexico and Denmark, where there is more scope for individuals or sponsors to change the provider, and supervisors in both countries ensure a high level of disclosure to facilitate comparisons and well-informed decisions.

Finally, all the supervisory agencies have reorganized themselves to conduct a type of supervision that requires more specialized skills. In Australia, Denmark, and the Netherlands there are units focused on the relationship with the institutions and specialized units providing expert/technical support on different types of risks. The Mexican supervisory agency has a particular setup that mirrors the internal risk management architecture imposed by regulation.

### **3. Regulatory Requirements for Risk Management Architecture**

Table 4 provides more detail on the regulatory requirements for the internal risk management architecture. Australia, Denmark, and the Netherlands impose some requirements on risk management as part of licensing or initial registration procedures. This includes the elaboration of a risk management plan or risk management guidelines. These requirements are not very detailed, with the supervisors allowing for differences depending on the size of the institution. These countries do not seem to impose specific regulatory requirements on the internal risk management architecture, although Dutch funds must have an internal body reviewing long term risk management, as well as independent risk management functions.

As mentioned before, Mexican supervisors have followed a different approach, issuing a direct regulation that specifies in detail all the elements of the internal risk management architecture. All pension funds must have two Board committees dedicated to risk management, one focused on operational risk and the other on financial risk. Each committee must have at least five members, of which are three Board members. At least one of the Board members must be independent. The other members are the Chief Executive Officer (CEO) and the Chief Risk Officer (CRO). The CRO heads an independent and central risk management unit (UAIR), addressing both operational and financial risks, and must report to the Board, the CEO and the supervisor. The regulation specifies in detail the duties and obligations of the CRO, including the interactions with other key executives such as the Chief Investment Officer. The regulation also requires the presence of a compliance officer ensuring observance of all the regulations.

It is difficult to make a comparison of the effectiveness of these two approaches, because Australian, Danish, and Dutch supervisors may also induce institutions to adopt sound risk management practices through their risk scoring models. As explained in more detail below, risk scoring models measure the exposure of institutions to risk and their capacity to manage these risks. This capacity is assessed in some detail, entailing the assessment of the quality of very specific elements of risk management, procedures, and control. Institutions which receive low scores are typically subject to more intensive supervision and are pressed to remedy their deficiencies.

The Australian Prudential Regulatory Authority (APRA) introduced a guidance note on risk management to further explain the risk management requirements inserted into the legislation in the context of a comprehensive re-licensing program that has resulted in a sharp reduction in the number of institutions. Its supervisors report that several institutions could not demonstrate their capacity to prepare or implement a coherent risk management plan during the re-licensing process.

The Australian experience suggests that pension supervisors probably need to consider a combination of tools to ensure the introduction of sound risk management

practices in all institutions, while also providing the necessary flexibility for institutions of different sizes. The Mexican approach can only be implemented in systems with fewer and larger pension funds. The Mexican approach merits consideration by countries with similar systems, although its effectiveness would need to be assessed in the coming years. One of the issues that would need to be examined is whether the approach works well across different institutions, including institutions which are part of financial conglomerates owned by parent companies abroad – a very common situation in systems like the Chilean and the Mexican.

**Table 4: Regulatory Requirements on the Risk Management Architecture**

	Risk Management Plan/Strategy	Board Committees for Risk Management	Minimum participation in Board Committees	Centralized Risk Management Function	Reporting Obligations of Chief Risk Officer (CRO)	Relationship of CRO with Other Functions	Compliance Officer
Netherlands	Required to be included in the business plan submitted at time of licensing	Accountability body that <i>inter alia</i> reviews long term risk management	No specific requirements	Must be independent of all other departments in the pension fund	No specific requirements	No specific requirements	No specific requirements
Denmark	Board of Directors required to issue risk management guidelines	No specific requirements	No specific requirements	No specific requirements	No specific requirements	No specific requirements	No specific requirements
Australia	Required for Licensing; Complexity and detail depend on fund's size	No specific requirements	No specific requirements	No specific requirements	No specific requirements	No specific requirements	No specific requirements
Mexico	Written policies and procedures for addressing operational and financial risk	Two Board committees for operational and financial risks	Board committees must have at least 5 members: three Board members, of which one independent, the CEO, and the CRO	Central risk management unit (UAIR) dealing with operational and financial risks and headed by Chief Risk Officer (CRO)	To CEO, Board, and Supervisor	Specified in detail	Compliance Officer required

#### 4. Risk-Based Solvency Standards

The main elements of the solvency requirements for the four countries are summarized in Table 5. The Netherlands has developed the most structured and formal of these solvency regimes. This system originated with a set of solvency standards first developed in 1997 that were subsequently refined and introduced with the new Pensions

Act, effective on January 1, 2007. The Dutch system includes a minimum solvency margin and solvency buffers designed to minimize the risk of under-funding due to longevity improvements or fluctuations in interest rates and asset prices.

Liabilities (technical provisions) are measured with a mortality table that reflects predicted longevity improvements and a buffer to deal with unforeseen improvements. The discount rate used is the market yield curve measured by the Euro swap curve. The interest rates used for discounting are only slightly higher than those in government bonds of equivalent duration, due to the high credit standing of banks operating in the market and the high market liquidity. All pension funds must comply with a minimum solvency requirement equivalent to 5% of technical provisions. However, funds must also build additional solvency buffers whose magnitude depends on the degree of asset-liability mismatches, and that are designed to reduce the probability of under-funding to only 2.5% within a one year horizon. For example, funds that invest more in equity, or fixed income assets with shorter duration than the duration of liabilities, or foreign currency assets, must maintain stronger buffers.

In line with the approach followed in Basel II, pension funds may opt to comply with a standardized model or build their own internal models to compute their solvency requirements, although these models need to be approved by the supervisor. In the standardized model, the solvency buffers are calculated through a stress test based on six broad risk factors and a formula for aggregate risk that takes partially into account correlations across asset classes. The methodology implies that the typical Dutch fund will need to maintain a sizable buffer amounting to 30% of technical provisions. To reduce the buffer, the fund will need to reduce the mismatch by, for example, shifting from equity to bonds or increasing the duration of the bond portfolio.

The Dutch approach provides an incentive for pension funds to build their own internal models, because a more refined methodology and more accurate parameters will probably reduce the size of the required solvency buffer. However, if pension funds decide to build their own models this may prove challenging to the supervisor, which will have to assess each of these models.<sup>9</sup>

Although pension funds may be able to reduce their solvency requirements by building their own models, the Dutch risk-based solvency rule has still been criticized for being too costly and not taking into consideration the possibility that long-run risks are lower due to lower correlations of asset classes over time or mean reversion of equity returns.<sup>10</sup> Dutch regulators clearly preferred to adopt a conservative view, while introducing an element of flexibility by allowing a relatively long period of 15 years for compliance.

The Danish solvency requirements are slightly less specified but grounded on the same principles. As with the Netherlands, there is a minimum solvency margin based on the current valuation of liabilities that is supplemented by a stress test based on the composition of assets. The stress test places each fund into one of three “traffic light” zones that indicate the current solvency position. It is distinguished from the Dutch approach because it does not explicitly link remedial measures to the status of the funds but rather seeks to maintain funds within a solvency corridor through signaling devices and market pressures. A solvency status is calculated for every institution twice a year and places each institution in one of three categories: A green light for those deemed within acceptable solvency status, a yellow light for those determined to be in danger of

facing solvency problems and a red light for the institutions that face severe and immediate problems.

**Table 5: Risk-Based Solvency Requirements**

Country	Measurement of Liabilities (TPs) <sup>1</sup>		Minimum Solvency Requirements	Solvency Buffers
	Treatment of Longevity Risk	Discount Factors		
<b>Netherlands</b>	Group specific mortality table adjusted for predicted longevity improvements, plus buffer to address uncertainty in predicted values	Market yield curve measured by Euro swap curve	5% of Technical Provisions (from EU IORP Directive)  Measured once per year using current market values  Maximum period for correction of deviations: 3 years	Maximum probability of underfunding within one year measured with stress test: 2.5% Solvency buffers determined by risk factors specific to each asset class. Example of risk factors include yearly decline in: Equity: 25-35% (depends on type) Currency: 20% Real Estate: 15%  Maximum period for correction of deviations: 15 years
<b>Denmark</b>	Fund-specific mortality table approved by actuary and supervisor  Traffic light stress test includes assessment of the impact of a 5% improvement in longevity	Market yield curve measured by Euro swap curve	Solvency margin defined by EU Life Directive: 4% of Technical Provision plus 0.3 % of risk bearing investments  Measured every six months using current market values  Period of correction from minimum required standards: One year	Traffic light system is a stress test rather than part of the formal solvency rule, but results are taken into consideration in the supervisory assessment. Test defines three zones: green, yellow, and red Final outcome depends on whether entity remains solvent after test. Example (yearly variations) : Listed equity: Red 12%, Yellow 30% Interest rate (medium duration) Red +/- 0.85%; Yellow +/- 1.2%
<b>Australia</b>	No formal liabilities in DC plans	No formal liabilities in DC plans	No solvency requirements for DC plans	No solvency requirements for DC plans
<b>Mexico</b>	No formal liabilities in DC plans	No formal liabilities in DC plans	No formal solvency requirements, but Value at Risk (VaR) limit designed to limit downside risk for DC members Historic VaR calculated with rolling 550 day sample at 5% significance with different limits imposed on the two portfolios. Price vector provided by 2 independent vendors Higher risk portfolio: 1% maximum daily loss Standard risk portfolio: 0.6% maximum daily loss	

Notes: 1/ TP = Technical Provisions

Rather than impose a single potential scenario of adverse market conditions the Danish approach establishes two sets of parameters for each risk factor, which effectively imply a mild and a strong stress test. If a fund is put into theoretical insolvency by the mild test it is deemed to be in the red zone. In other words, funds in the red zone cannot

withstand even a moderate adverse shift in asset prices. Those which remain theoretically solvent under the mild test but not the strong test are placed in the yellow zone. For example, a decline in equities of 12% is posited for the red test and 30% for the yellow. The factors are 8% and 12% respectively for real estate. Factors are also stipulated for varying duration of fixed income instruments, credit risk and others. Funds which remain theoretically solvent after the strong test are put in the green zone.

Failure to meet the yellow scenario is treated as an early warning indicator. An institution that receives a yellow light is placed under intensified supervision. The primary goal of intensified supervision is to increase the risk awareness of the management of the pension institution. When an institution receives a red light, it may be subjected to more drastic intervention. The supervisor may order the institution concerned to take the measures necessary within a specified time limit if its financial position has deteriorated to such a degree that it puts the interests of policy holders and other affected parties at risk.

A red light does not necessarily imply that the institution will immediately be subject to crisis management. The supervisor will normally require monthly reporting from the institution as well as a commitment that it will not increase its overall risk exposure. If the institution remains in a red light situation for a prolonged period a reduction in risk will be required although measures to reduce risks and/or risk exposures are not specified in detail. However, action plans prepared by the institution concerned must be submitted to the supervisor. The Danish Financial Supervisory Authority (DFSA) decides the maximum period for the restoration of the financial position, depending on the size of the shortfall and anticipated market developments. The DFSA is expected to monitor the performance of the operating plan and demand changes in the plan if the financial position of the institution suffers further deterioration. If the base capital of the pension institution is less than one-third of the solvency requirement or is less than the minimum capital requirement, the period for restoration of capital will be stated in months and will not normally exceed one year.

Australia, which has rapidly transitioned to nearly an entirely DC based system over the past decade, does not incorporate explicit solvency requirements on the risks of DC fund portfolios. However, the exposure to financial risks is captured in the risk scoring model, and the supervisor will check if the institution has the capacity to manage these risks. If the institution proves to be unable to manage the risks associated with a more aggressive or complex portfolio it becomes subject to more intensive supervision.

Mexico has taken an entirely different approach to volatility risk. Within their DC system the relevant characteristic is the volatility of the value of member's accounts rather than asset-liability balance. While not strictly speaking a solvency measure in the traditional meaning, the parameters that Mexico requires their pension funds to remain within serve a similar purpose, to ensure the adequacy of the asset base and retain its fluctuations within a prescribed level. This may be viewed as implicitly assuming a liability (or minimum return) for the pension system.

The Mexican limitations are established in the form of a maximum permissible "value at risk" or VaR which the funds are permitted to have. Mexico now permits two types of portfolios (Siefors) within each of the pension companies (Afores). The standard portfolio established at the outset of the systems design is limited to a composition that is estimated through the methodology outlined below to be associated

with a maximum loss in a day of less than 0.6% of its value. The higher risk/return portfolio that was recently introduced into the system must maintain a VaR of less than 1.0%.

The VaR is calculated by the supervisor on a daily basis, based on a rolling 500 day sample of the prices of all of the permissible assets. The price vector is provided by two independent price vendors, to ensure a common valuation methodology and comparability. The VaR is historic and calculated with a 5% level of significance for each portfolio (the individual portfolios are reported to the supervisor through automated systems). If any of the funds drifts outside of the permissible limits the supervisor is able to intervene and provide specific instructions regarding the reallocation required to move back within the prescribed standard. This has not occurred yet, as the actual VaRs remain well below the ceilings, as shown in Figure 7 in the following Part V of this paper.

## **5. Supervisory Risk Scoring Systems**

All supervisors gain an understanding of the risk profile of pension funds through their normal supervision activities. Any basic supervision framework involves the collection of data from pension funds. This can be as basic as the collection of annual accounts but more typically will involve collection of data through a set of standard forms designed by the supervisor and submitted by the pension funds on a regular basis. Through the analysis of collected data supervisors will have a picture of the financial strength of the funds. This can be supplemented by the collection of additional information from on-site inspections and the market. This information can be combined for the computation of overall risk scores for each institution. The various risk scoring systems from the four countries reviewed are shown in Table 6.

Australia was the first of the four countries to introduce a fully developed scoring system with the development in 2002 of a structured framework for risk assessment in pension funds known as the Probability and Impact Rating System (PAIRS). The results of this structured methodology for ranking pension funds according to the relative threat of failure are then mapped into a supervisory response framework (SOARS). The model makes a distinction between larger funds which are subject to detailed assessment and smaller funds which are subject to a streamlined and more automated assessment. Additional focus is also given to funds which are DB.

APRA applies the same broad supervisory model to superannuation funds as to banks and insurance companies. The analyst is asked to assess the significance of the risks and mitigating factors and to assess the extent to which each contributes to (for the inherent risk factors) or reduce (for the management and control areas) the overall risks of the fund. Weighted numerical assessments are combined into an overall score. This score is converted to a risk rating using a non-linear function to ensure that higher risk funds are given greater attention. After taking into account an impact rating based on fund size, the scores are converted into a supervisory attention index which maps into a 'supervisory stance' and action plan. In this way the rating directly defines how the supervisor will manage their relationship with the pension fund. Funds in the 'normal' category are subject to regular supervision activities. Those in 'oversight' category receive more intense monitoring and more frequent contact. Funds rated for 'mandated improvement' are expected to develop and implement plans for improvement, while

those rated 'restructure' require strong enforcement action. The framework imposes a stronger analytical discipline to a still largely judgmental process and provides an audit trail to analyze and explain supervisory decisions and actions. It allows APRA to allocate more resources to institutions whose failure would have a greater impact on the financial system.

In the Netherlands in 2005, the Dutch National Bank (DNB) introduced an integrated method for analyzing risk for all financial institutions known as the Financial Institutions Risk analysis Method (FIRM) which replaced the earlier pension and insurance specific system known as MARS. Like Australia, supervision in the Netherlands is based on the ongoing process of information collection, consultations with the supervised entities and a structured approach to the assessment of risk and the manner in which those risks are managed. Under the FIRM model, the DNB takes into account the assessment of solvency outlined earlier and combines this with an evaluation of the pension entity, the risks to which it is exposed and the quality of the risk management procedures in place. Like Australia, the results of the risk assessment become the basis for decisions regarding the nature and intensity of supervisory action.

The FIRM model adopts a four-stage approach to building the risk assessment. In the first step a detailed profile of the pension fund is constructed. The second step identifies relevant management units and functions and assigns weights to these. Using this functional breakdown the third step evaluates gross risks and assigns a score to this assessment. In contrast to Australia, the Dutch system combines probability and impact into a single score within the system rather than assessing these separately, based on the view that the two elements are so closely related they should not be independently considered. The various types of risks identified in Australia and the Netherlands are very similar. The additional focus in the Netherlands on technical insurance and mismatch risks reflects the primarily DB nature of the pension system.

The fourth step in the Netherlands seeks to obtain an insight into the quality of risk controls for each risk category to derive a final value that represent the net risks of the pension fund. The aggregation of risks is based on a mathematical algorithm which puts emphasis on high risks and poor controls. The reports which form part of the FIRM model form a basis for the planning of supervision activities. The frequency of on-site inspections is determined largely by the risk profile of the fund. During an on-site inspection data are collected which allow the FIRM model to be updated and high risk areas which have been identified are examined closely.

Concurrent with the introduction of the VaR standards in 2002, the Mexican supervisory authority Consar has developed elements of a risk scoring model, in the form of early warning indicators for assessing operational and financial risks. The current methodology entails three risk factors – low, medium and high – and gives emphasis to irregularities detected during supervision activity. Reflecting the fact that Mexico operates a DC system it is not surprising that the main weaknesses identified relate to internal controls and the collection of contributions. Supervision strategies are focused on the most critical areas identified by the early warning system. However, Consar is in the process of incorporating other elements of risk into the VaR, such as credit risk, and assessing how it can make greater use of the VaR results for risk scoring.

Denmark has also developed elements of a risk scoring model, in the form of an internal rating system with three internal quality scores covering organization, procedures

and internal controls, as well as ratings on insurance risks which mainly cover longevity risk exposure of the different institutions. The DFSA combines these internal score or early warning indicators with the traffic light results, to guide the intensity and scope of supervisory activity.

**Table 6: Risk Scoring Methods**

	<b>Type of Risk Scoring System</b>	<b>Aims of the Model</b>	<b>Main Elements of Risk Scoring System</b>	<b>Special features for pensions</b>	<b>Supervisory response framework</b>
<b>Netherlands (FIRM)</b>	Comprehensive risk scoring model applied to all types of institutions covered by integrated supervision authority	Identify and measure all major risks and the capacity of the entity to manage them; Determine supervisory response; Induce build-up of internal risk management capacity	Definition of gross or inherent risks, as well as mitigating factors through risk controls. Use of default scores and templates. Combined probability and impact. Single net risk score built up from common elements	Risk-based solvency standards (FTK) applied to pensions and insurance provides major inputs to the risk scoring model and is a supervisory tool on its own	Used for planning supervisory cycle, frequency and nature of interventions.
<b>Denmark</b>	Set of early warning indicators, including the results of the traffic light stress test	Identify areas and institutions exposed to greater risks; Determine supervisory response; Induce build-up of internal risk management capacity	Risk scoring model is partly developed. Relies relatively more on the results of the traffic light stress test.	Traffic light is a stress test that complements the EU solvency margin requirements.	Used for planning supervisory cycle, frequency and nature of interventions.  Yellow light triggers more intensified supervision. Red light likely to trigger remedial action
<b>Australia (PAIRS)</b>	Comprehensive risk scoring model applied to all types of institutions covered by integrated supervision authority	Identify and measure all major risks and the capacity of the entity to manage them; Determine supervisory response; Induce build-up of internal risk management capacity	Definition of gross or inherent risks, as well as mitigating factors through risk controls. Use of default scores and templates. Combined probability and impact. Single net risk score built up from common elements	Capital strength component excluded for DC funds	Risk scoring maps directly to supervisory response (SOARS)
<b>Mexico</b>	Set of early warning indicators; Developing a risk scoring model		Under development; Actual VaRs will be input to the model	VaR limit computed daily.	If breach of VaR results in a loss, compensation must be paid.

## 6. Market Based Discipline and Third Parties

The importance of market discipline in risk-based supervision depends fundamentally on the type of pension system, and the extent to which supervisors ensure disclosure and enhance the roles of third parties such as the external auditor. In general, the market discipline pillar is more relevant in open pension systems that allow selection of the provider. Even in these cases, however, the supervisor must ensure proper accounting, auditing, and disclosure rules ensuring the access of fund members and market analysis to relevant and accurate information.

As shown in Table 7, all the four countries have adopted market valuation of balance sheets. While this is a standard feature of DC systems, such as the Australian and the Mexican, it has only recently been introduced in the Netherlands and Denmark. In all the countries external auditors need to verify the accuracy of financial statements. In Australia and Mexico, their role is expanded to include an assessment of the quality of risk management systems. In all four countries external auditors have “whistle-blowing” obligations, i.e. they are required to report material problems to the supervisor.

Mexico imposes extensive disclosure requirements, including monthly disclosure of individual portfolios, returns, fees, and VaRs. Denmark discloses annually a large number of performance and solvency indicators of individual providers, allowing for direct comparisons of performance. The Australian Securities and Investments Commission has detailed product disclosure requirements for funds which allow members to direct their investment strategies. However, disclosure requirements on fund performance remain comparatively less extensive in Australia, a somewhat surprising result considering that members have been recently allowed to switch across pension funds. The less demanding disclosure requirements in the Netherlands are expected, reflecting the closed nature of the Dutch system.

Overall, the market discipline pillar seems to play a more important role in Mexico and Denmark, followed by Australia and the Netherlands. Mexico would seem to meet all the requirements for a strong third pillar, although the benefit guarantee extended to older workers probably weakens market discipline (Bernstein and Chumacero (2007)). The Danish system also assigns an important role for the third pillar, as indicated by the comprehensive disclosure requirements.

Australia has recently extended the scope of external audits to include an assessment of the quality of risk management systems. The extent to which external auditors can perform this task effectively is open to question, but the fact that regulations include this obligation reveals the intention to increase the importance of third party monitoring. Moreover, the recent decision to allow members to switch funds may increase pressure for more disclosure in the future. In the Netherlands, disclosure requirements are less extensive, although the obligation for single sponsors to reflect the situation of their funds in their balance sheets may introduce an important element of market discipline.

**Table 7: Role of Market Discipline, Third Parties, Disclosure**

	Accounting Rules	Selected Auditing Rules		Disclosure Requirements
		Scope of Audit	Accountability	
<b>Netherlands</b>	Fair valuation of assets and liabilities	Financial Statements	Whistle blowing obligations	Single employer funds included on balance sheet of sponsor
<b>Denmark</b>	Fair valuation of assets and liabilities	Financial Statements	Whistle blowing obligations to supervisor authority for “material” issues	Extensive disclosure of individual indicators of efficiency and solvency – key performance indicators – on supervisors website
<b>Australia</b>	Net market value for assets	Financial Statements and Assessment of Risk Management Systems	Whistle blowing obligations	Operating statement and statement of financial position for all funds
<b>Mexico</b>	Marked-to-market; Regulated price vendors ensuring consistent portfolio valuation and comparability	Financial Statements and Assessment of Risk Management Systems	Whistle blowing obligations	Extensive disclosure of individual investment policies, fees, returns, and VaRs

## 7. Internal Structure of the Supervision Agency

The supervisory agencies of the four countries include one which is responsible solely for supervising retirement savings (Mexico), two independent integrated supervisors (Australia and Denmark) and one where the central bank serves as an integrated financial supervisory authority (the Netherlands).

In Mexico, Consar was initially focused on collecting information and ensuring compliance with the rules and regulations, particularly the tight controls over investment. In the past few years it has undergone an internal reorganization to allow it to more effectively implement a risk-based approach to supervision. The main supervision activities have been separated into operational and financial areas under two separate vice-presidencies. Consar has been building up its technical capabilities to assess the impact of VaR models and enable assessment of the risk management practices within the pension fund managers.

The Danish FSA was established in its present form as an integrated financial sector regulator in 1988. Major segments of the financial industry are supervised in different divisions. The Life and Pensions Division is one of ten divisions responsible for supervision and regulatory techniques. Staff in this division takes part in off-site surveillance and on-site inspections. This Division was responsible for developing the traffic light stress test, in close collaboration with the Banking Division which had developed expertise in this area.

Within the Dutch National Bank, supervision is organized around several operating directorates aligned with particular types of institution such as conglomerates, banks,

insurance companies and pension funds. Each division is supported by a supervisory policy division with responsibilities across all types of institutions and by centers of expertise in specialist areas such as “Asset-Liability Management”. The development of FIRM has involved representatives from all supervisory divisions but is owned by a Division Director from one of the supervisory divisions. An expert team comprising representatives from all operational divisions is responsible for ensuring that the system is updated as required.

Within APRA, supervision follows a more integrated model in which staff can have responsibility for several types of financial institutions. In their supervisory and analytical work analysts responsible for routine supervision are supported by specialists in credit, market and operational risk and can draw on actuarial support. A separate group within the Policy and Research Division provides technical support for the PAIRS/SOARS model, and collects data on risk rating for regular reporting to management and the Executive Team within APRA.

## **V. PRELIMINARY ASSESSMENT OF THE IMPACT OF RBS**

This section provides some initial observations that can be gleaned from the limited information available about the changes that are associated with the adoption of risk-based supervision. It is important to stress that any assessment must be seen as preliminary, because these new supervisory systems have been introduced very recently and are designed to control pension systems whose outcomes in relation to the ability to deliver retirement benefits for a typical member extend across many decades.

### **1. The Netherlands**

The new Dutch supervisory paradigm is primarily directed to the resiliency of the solvency of DB pension plans. Although not formally imposed until very recently, both the FIRM scoring system and the solvency standards had similar antecedents in prior systems that were either announced or put into practice over the past four to five years, a period likely to be sufficient for underlying effects to begin to come to light. These risk-based approaches potentially impose significant costs, especially the new risk-based solvency rules. These new rules may induce funds to change their strategic asset allocation, increase contribution rates, reduce benefits, or implement a combination of all these solutions. They may also induce employers to stop sponsoring DB plans altogether and move towards less onerous DC plans.

Despite these increasing risks to plan sponsors, which in other countries such as the UK and US have resulted in a massive substitution of DC arrangements and some decline in coverage, neither of these can be observed in the Netherlands. The overall coverage rate remains above 90%, one of the highest in the world, and the total number of members has remained essentially unchanged since 2004. Virtually all of these remain DB plans, with DC plan coverage showing an increase from 2.3 to 3.6 percent of members between 2004 and 2006. This seeming resiliency of the DB system to regulatory encroachment must be considered in the context of a system founded in collectively bargained industry wide arrangements that, at a minimum, are likely to be insulated from changes in form over the short term. The only possible effect that can be observed in the aggregate data is a decline in the number of funds from over 1,000 in the late 1990s to 860 in 2004 and 798 in 2006. This reduction may reflect the higher costs

imposed by the new system that make small funds less viable, but it may reflect other causes as well. In any case, another five years may be required to conclusively observe any effects of the new rules on coverage, plan selection, and fund size.

What has happened more clearly in recent years are dramatic changes in the secondary aspects of pension scheme characteristics. While much of this is likely related to broader pressures of population aging to some extent they may be interpreted partially as a process of hedging risk exposure in response to the new more stringent solvency measures. The proportion of Dutch pension funds that provide benefits based on final pay has declined from 54% in 2002 just prior to the initial introduction of risk-based rules to about 10%. A less marked increase in the incidence of conditional indexing of promised benefits to price levels has occurred from 90% in 2002 to an almost universal 98% in 2006 although there was very little room for movement in this indicator.

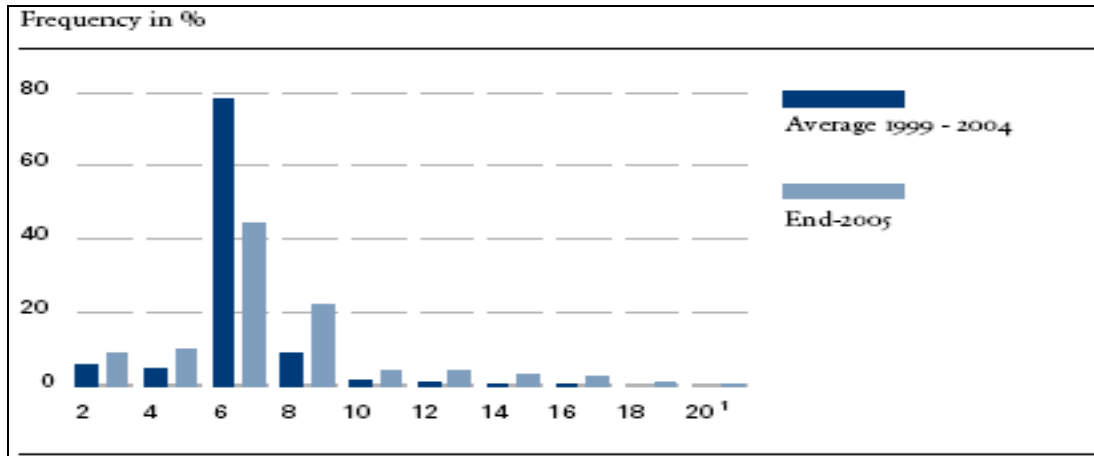
As mentioned before, another area to observe the impact of the new supervisory system is in the investment patterns of funds. Two effects were generally posited in response to rules that impose high costs for asset-liability mismatches. These are a movement away from equities to fixed income and increases in the duration of fixed income portfolios. As shown in Table 8, the aggregate balance sheet information on pension funds does not appear to support the first of these expectations. The available evidence does however seem to indicate the second expected impact – the lengthening of the duration of the fixed income portfolios to better manage the mismatch exposure that is exacerbated with the volatility of the new market based discount rate. As shown in Figure 3, from the end of 2003 to the end of 2005 average duration increased by a year to more than 6 years with some funds moving to much longer durations.

It is possible that pension portfolios will become more conservative in the future, as pension funds build their internal models and reassess in more detail the impact of the new rules on their solvency position. At the same time, the absence of more pronounced shifts in strategic asset allocation could also be due to the long period of compliance. As mentioned before, pension funds are allowed 15 years to address shortfalls in the required solvency buffers. This relatively long period of compliance introduces a necessary element of flexibility, especially in view of the uncertainty regarding mean reversion of equity returns.<sup>11</sup>

**Table 8: Asset Allocation of Dutch Pension Funds 2001 – 2005 (in % of total)**

	2001	2002	2003	2004	2005
Land and buildings	11%	11%	10%	10%	10%
Investments, non-consolidated	1%	1%	1%	1%	0%
Shares and other variable yield securities	42%	35%	40%	40%	42%
Bonds and other fixed yield securities	36%	41%	39%	40%	40%
Mortgage loans	3%	4%	3%	3%	2%
Private loans	5%	3%	2%	2%	1%
Deposits	0%	0%	0%	0%	1%
Other investments	2%	2%	3%	2%	3%
Liquid assets	1%	2%	2%	2%	2%
Total (Euro millions)	460,777	427,297	481,811	542,112	624,881

Source: DNB data and authors calculations

**Figure 3: Distribution of the Duration of Dutch Pension Fund Fixed Income Investments**

Source: Kakes and Broeders, "The sustainability of the Dutch pension system" DNB Occasional Studies, Vol. 4 No. 6, 2006 p 41

## 2. Denmark

The introduction of the risk-based approach to supervision occurred just prior to the decline of interest rates and the drop in equity prices in 2001-2002, making it difficult to distinguish the effects of the introduction of the new system from external factors. Immediately after the introduction of the more risk oriented rules, pension institutions suffered huge losses on their equity portfolios, while the present value of technical provisions increased dramatically. A very high proportion of contracts had been issued with guaranteed returns. Guaranteed rates were lowered by two-thirds in two stages over the 1990s, but pension institutions continued to be exposed to the residual high-rate contracts for both past and future contributions that could still be made under the terms of the previous contracts.

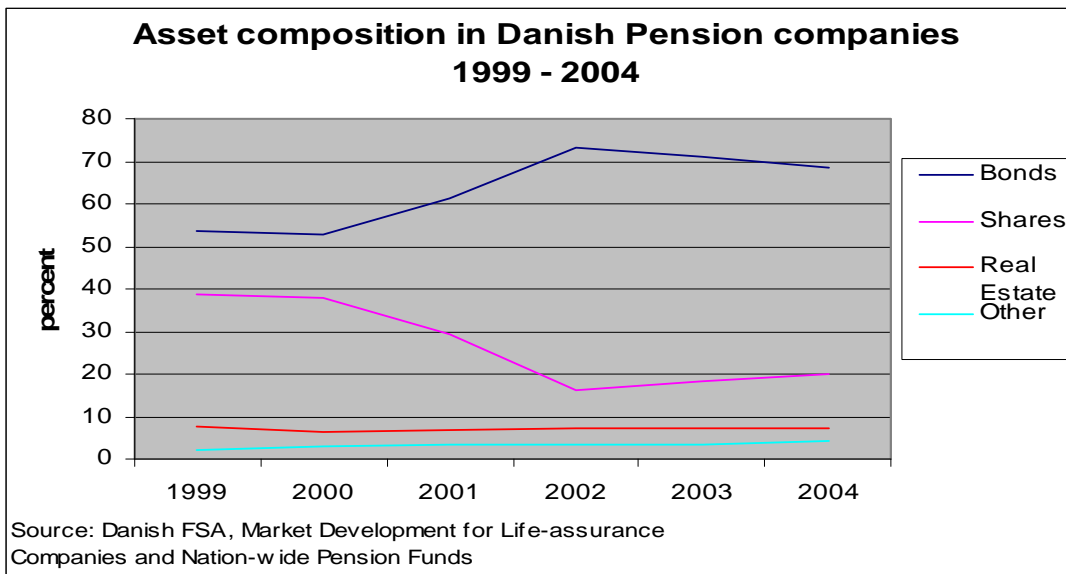
The mismatch between assets and liabilities was aggravated by the presence of large investments in mortgage bonds with embedded call options. As borrowers exercised their option to refinance their mortgages with lower interest rates, pension institutions did not experience an increase in the market value of their bond holdings. In this situation, a large number of institutions found themselves in the yellow light zone under the new traffic light system, while some were even in the red light zone. For a few companies the situation turned out to be so severe that they encountered real problems in fulfilling their solvency requirements and they were placed under special supervision by the authorities.

As shown in Table 9 and Figure 4, pension institutions reacted to the financial crisis and the new stress testing by reducing the proportion of equities following two years of substantially negative returns in 2001 and 2002. They also began to close the duration gap that had led to the deterioration of their solvency position by increasing investment in foreign bonds which offer longer durations. The institutions also began to engage in extensive hedging operations, mostly through the use of long-term interest rate swaps in the more liquid Euro market<sup>12</sup>. Although such policies ran the risk of "locking-in the losses", it was generally accepted that under the new solvency standards pension institutions could not afford to suffer additional losses and further endanger their position.

**Table 9: Changes in the Asset Allocation of Life Companies and Pension Funds**

	<b>Domestic Bonds</b>	<b>Foreign Bonds</b>	<b>Domestic Equities</b>	<b>Foreign Equities</b>	<b>Investment Trusts</b>	<b>Other Assets</b>
1998	54.4	1.3	13.4	12.3	1.9	16.7
1999	46.6	2.1	12.6	18.3	3.5	17.0
2000	44.7	4.8	11.3	18.5	4.6	16.1
2001	45.1	10.7	8.6	12.5	6.3	16.8
2002	53.0	13.6	4.6	6.9	6.2	15.7
2003	51.3	12.4	4.4	8.0	8.1	15.8
2004	43.2	14.6	4.6	8.3	12.3	17.1

Source: DFSA

**Figure 4**

The increased use of derivatives and the changes in strategic asset allocation significantly improved the position of pension funds in relation to unfavorable interest rate movements, as indicated in the simulations shown in Table 10. While in 2001 and 2002, an interest rate fall of 1 percentage point produced a net loss of more than DKK 15 billion, the new portfolio structure had transformed a negative 100 basis point decline into an estimated net gain of DKK 15 billion in 2003 and DKK 8 billion in 2004.

**Table 10: Simulation Results of Change in Interest Rates**

Year	Change	Liabilities DKK bn	Assets DKK bn	AL Gains DKK bn	Derivatives DKK bn	Net Gains DKK bn
2001	-1%	-65.0	49.4	-15.6		-15.6
2002	-1%	-66.6	26.7	-39.9	25.1	-14.8
2003	-1%	-52.0	40.2	-11.8	26.9	15.1
2004	-1%	-76.1	40.7	-35.4	43.8	8.4

Source: Ladekarl et al, 2006

In addition to these changes in asset allocation, there were also other important changes in the rules for profit distribution (the Danish system is dominated by risk-sharing or profit-sharing policies, as mentioned before). Until recently, most institutions set the rate of profit distribution to clients one year ahead. This rate was an important competitive parameter among pension institutions. However, after 2002, many institutions introduced a variable rate of profit distribution that depends on investment performance during the year. This more flexible approach made it easier for institutions to meet their obligations, but coupled with the substantial reduction in guaranteed rates of return it created considerable uncertainty in the eyes of policyholders.

Overall, the introduction of risk-based supervision in Denmark has led institutions to reduce their asset-liability mismatches through changes in asset allocation and greater use of derivatives. One important consequence of these adjustments has been the decline in the expected rate of return on the portfolio and the decreased enthusiasm of providers to offer benefit guarantees. The greater use of derivatives has apparently helped companies reduce asset-liability mismatches at a reasonable cost but does not seem to have been able to arrest a decline in the expected rate of return. Interestingly, new clients have been more willing to take more risk in exchange for a higher expected return, as indicated by the growth of unit-linked and other products that are offered without any guarantees or with reduced levels of guarantee. Therefore, the Danish system seems to be moving towards a more traditional DC system with fewer guarantees.

These trends seem to contradict the conclusion of other researchers, that the use of derivatives (especially long-term interest swaps) has allowed Danish companies to address the mismatches and also preserve returns.<sup>13</sup> On the contrary, the available evidence suggests that the new risk-based rules have induced pension funds to hold more conservative portfolios and lower guarantees, and that young members are favoring contracts that entail higher expected returns and more volatility. This is an area that should merit more research, as it would throw more light on the impact of risk-based supervision on portfolio strategies.

### 3. Australia

There are two main elements to changes in the risk-based supervisory framework in Australia which have had an impact on superannuation (pension) funds over the past few years. The first to be introduced was the PAIRS/SOARS framework. The second was the introduction of a comprehensive licensing framework for all superannuation funds.

The PAIRS/SOARS framework was intended to improve APRA's supervisory performance and not directly impact on the industry. APRA assesses the timeliness and

effectiveness of its intervention, by tracking the migration of institutions between the different supervisory stances. In the three years since the model was introduced the great majority of institutions in 'Mandated Improvement' or 'Restructure' at some point over this period have either improved or exited the industry, with no entity failures. Of the 168 institutions that have been in these two stances, 57 have improved, 16 remain in their SOARS category, one has been downgraded and 94 have exited<sup>14</sup>. APRA does not separately publish this data for superannuation funds but has confirmed that around 100 have been superannuation funds. These figures suggest that these tools have made APRA more effective, but they have mainly helped industry by removing or strengthening the weakest entities.

The second major change has been the introduction of superannuation licensing. At the beginning of the licensing transition period there were more than 1,700 trustees operating. By the end of the licensing transition period 307 trustee licenses had been issued (with about twice as many registered funds). This consolidation had begun many years before APRA introduced licensing, but this measure clearly hastened industry consolidation and generated a move towards corporate superannuation outsourcing. In order to be granted a license trustees had to demonstrate that they meet the required minimum standards of risk and were well placed to provide beneficiaries with greater levels of safety and security for their superannuation accounts. New operating standards concerning fitness and propriety, risk management, adequacy of resources and outsourcing proved challenging to meet and many trustees have left the industry.

One of the reasons for reform of superannuation was to create a more professional industry where risk management standards, particularly for operational risk, were substantially improved. In its most recent annual report APRA notes that a regulated superannuation fund (excluding small funds) now manages, on average, over seven times the level of assets it managed five years ago, a period in which total superannuation assets have less than doubled. Superannuation funds have grown in terms of size, complexity and growing sophistication of risk management and the industry more closely resembles the other industries which APRA regulates.

Among those trustees that have exited have been some generally smaller entities with problematic investments involving highly undiversified portfolios (sometimes dominated by a handful of illiquid assets) and related party and employer-linked transactions. However there has been little impact on broader investment strategies or any observable changes in the investment composition of the industry.

APRA suggests that the implementation of PAIRS/SOARS has resulted in more consistent supervisory outcomes by allowing for a better calibration of APRA's reaction to supervisory issues across a large number of institutions and supervisors. The primary source of information for a PAIRS assessment is based on the findings from supervision activities. Any requirements placed on superannuation funds and recommendations for changes in behavior or systems generally arise from these findings rather than from a particular PAIRS rating. However, while PAIRS does not mandate those changes on an institution per se it is very useful in calibrating the impact of these changes on the overall risk profile of a fund. Industry has indicated that improved consistency enhances its confidence in APRA's methods and procedures.

#### 4. Mexico

As mentioned before, the search for efficiency gains and the concern with extreme portfolio losses were two important factors that motivated the adoption of risk-based supervision in Mexico. The relaxation of portfolio restrictions (including the permission to use derivatives) combined with stricter risk management requirements was intended to lead to more efficient outcomes while the exposure of individuals to downside risk would be contained by the VaR limit.

The impact of the regulatory changes is assessed by examining the resulting shifts in the efficient frontier and the actual changes in portfolio strategies. Consar (2006) provides estimates of the efficient frontier for every year when the investment regime was liberalized. These estimates indicate that the frontier has been expanded quite substantially, especially in 2004, when there was another round of changes combined with the introduction of the VaR ceiling. Figure 5 illustrates the shift in the frontier resulting from the latest round of changes. The expansion of the frontier resulting from a relaxation of portfolio controls is expected and consistent with estimates for other countries, such as Chile.<sup>15</sup> However, whether the expansion of the frontier has led to more efficient outcomes is a more complex question.

It is clear that pension fund managers have made use of the greater freedom by moving away from very basic portfolios, and investing more in domestic and foreign equity, as well as foreign fixed income instruments. As shown in Table 11, the share of public sector bonds has declined from almost 100 percent to 75 percent, and the share of higher yield, privately-issued domestic and foreign assets, has increased commensurately. The average maturity and duration of the fixed income portfolio has also increased significantly, as shown in Figure 6. These portfolio shifts are reflected in risk-return combinations that are higher and to the right, as shown in Figure 5. The portfolio shifts are also reflected in the increasing VaRs, although VaRs remain well below the ceiling, as shown in Figure 7.

The outcomes are positive overall, as there has been a diversification away from a very basic and low return portfolio consisting primarily of government securities with short durations. However, there is no evidence of gains in the risk-return trade-off, strictly defined as a decrease in risk for the same return, or an increase in return for the same levels of risk. This is not surprising, as pension funds were basically investing in the risk-free portfolio. The right and upward movements in risk-return combinations and the increase in VaRs must be interpreted in this context. Even after these initial shifts, portfolios remain undiversified relative to pension funds in other countries and VaRs remain well below the ceiling. All in all, the conclusion is that the new approach has produced positive outcomes, but these cannot be interpreted as an efficiency gain in the strict sense. It is simply too early to make an assessment of whether the new approach is able to produce more efficient outcomes, relative to a regulatory regime that relies more heavily on portfolio controls, or relative to a regime like the Australian, that does not impose VaR ceilings, and that emphasizes sound risk management without imposing prescriptive regulations.

A critical question in Mexico is how portfolio managers will build their strategies once the actual VaRs approach the limits. Mexican supervisors have the power to increase the VaR limits if they conclude that the current ones excessively limit pension fund managers. However, a more fundamental question is whether VaR limits are the

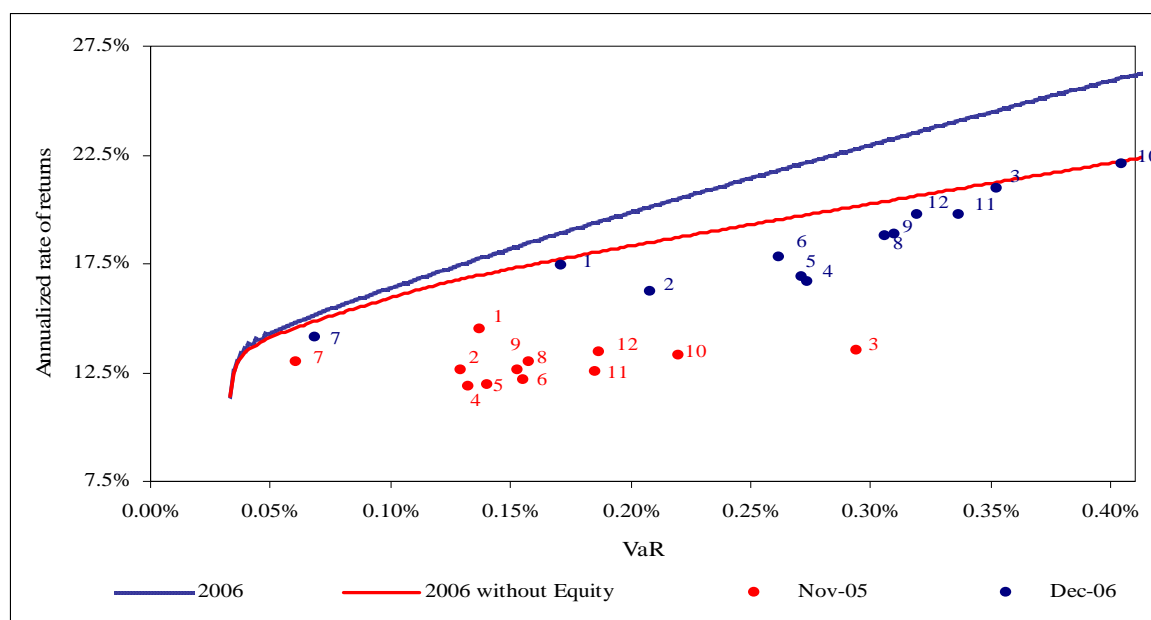
best approach for influencing the investment policies of DC pension funds and achieving efficient outcomes in the long-run. The application of VaRs for pension funds remains controversial, as there are well-known arguments against the adoption of a short run risk measure for institutional investors that should operate with a long time horizon.<sup>16</sup> Whereas the Mexican approach is innovative and attractive in many aspects, including the objective of containing downside risk, assessing its effectiveness will require a longer period and comparisons with the outcomes generated by other approaches to risk-based supervision of DC plans, such as the Australian.

**Table 11: Average Composition of the Aggressive Pension Portfolio in Mexico (Siefores 2)**

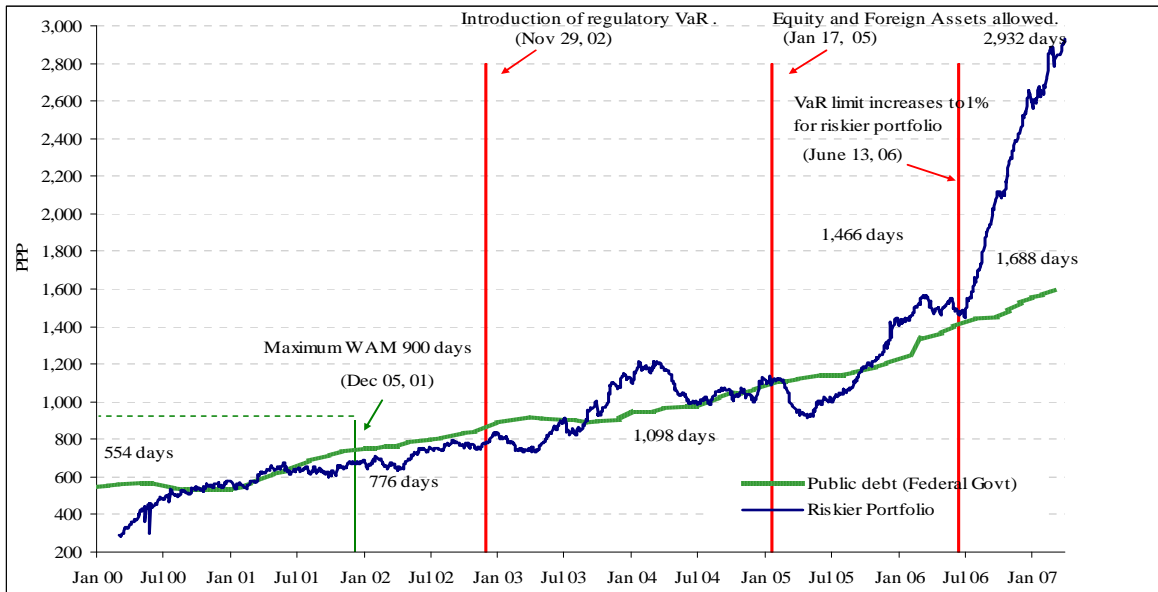
	2000	2001	2002	2003	2004	2005	2006
Government Bonds	92.6	89.8	85.5	84.5	85.5	86.1	76.5
Corporate Bonds	5.4	7.8	12.3	11.0	9.6	7.8	6.6
Financial Institutions Bonds	2.0	2.4	2.1	4.5	4.9	4.0	4.9
Domestic Equity						0.5	2.0
Foreign Assets						1.6	10.0
Fixed Income						0.6	4.2
Equity						1.0	5.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Consar

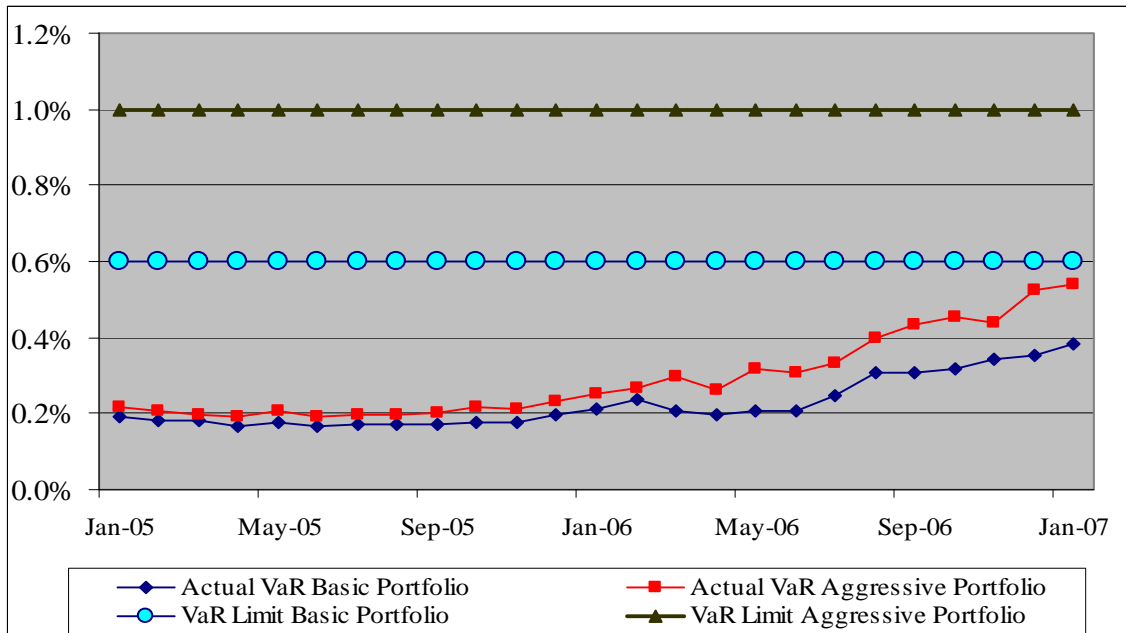
**Figure 5: Shifts in the Efficient Frontier and Actual Risk-Return Combinations**



**Figure 6: Maturity of the Public Debt Stock and Government Securities in the Riskier Portfolio**



**Figure 7: Basic and Aggressive Portfolios: VaR Limits and Actual VaRs, 2005-2006**



**VI. CONCLUDING OBSERVATIONS**

Review of the four early adopters of risk-based supervision for pension systems illustrates the potential for the application of these principles and methods across the full range of pension system designs. The nearly exclusively DB system operated by not-for-profit institutions in the Netherlands, the traditional DC employer sponsored funds in Australia, commercial pension institutions in Mexico and a hybrid system with

guarantees in Denmark have all made progress in introducing risk-based standards and procedures. The experience of these early adopters provides a number of observations and lessons that are useful to consider as other countries begin to move in this direction.

Risk-based supervision as it has emerged for banks and insurance companies is most readily transplanted to defined benefit pension systems such as that of the Netherlands. This is because the types of risk and associated methods that focus on solvency measurement and asset liability matching are quite similar. The presence of return guarantees such as in Denmark create some convergence of principles but require more adaptations.

Application to DC systems such as Mexico and Australia impose the greatest challenges. Transferring investment risk to members requires the formulation of alternative financial risk concepts. Mexico has been innovative in applying the concept of VAR as an attempt to contain downside losses. This remains controversial due to the limited linkages between such a short term measure and the longer horizon of pensions. This technique may involve trade-offs between security and optimizing long term returns. Australia has side stepped this challenge by simply incorporating process based investment standards into its broader risk scoring techniques. However, this is only a viable option in systems grounded in well established and supervised financial service providers. Development of income replacement targets for which a fund member might aim, and scenarios based on contributions and returns, perhaps offer potential future enhancements to both of these approaches.

The use of comprehensive risk scoring models appears to offer considerable promise for pension supervision. Moreover, there is a high potential for establishing generic models that are applicable to a number of financial institutions, which provide strong support for the integration of financial institution supervision. A consistent approach to the design of risk scoring systems has emerged among the various countries that will provide a useful template for others to follow. Scoring systems appear to offer considerable potential for inducing an improvement in the quality of internal risk management as well, although pension supervisors may still need to complement the use of risk scoring models with direct regulations on risk management. Scoring systems also offer the promise of establishing sophisticated metrics to guide the allocation of supervisory resources and through public disclosure a strong basis to leverage market discipline.

There has been only limited progress to date in utilizing enhanced disclosure and market competition to improve the efficiency and security of pension funds. Although very sophisticated risk scoring and evaluation techniques have been developed in three of the countries and are in the process of being implemented in Mexico, ratings are not disclosed to the market. Denmark remains at the vanguard of this process but limits this to summary solvency indicators rather than the underlying analysis. The Netherlands limit disclosure of their risk management scores to the pension funds. Australia does not even disclose to a fund its rating, although funds will notice the changes in supervisory stance which would accompany a rating change. This perhaps reflects a need for a continuing adaptation of the tools derived from banking to the different context of pensions. Indeed, whereas supervisors rarely release a bank's rating for fear of causing a "run" on weaker institutions, there may be scope for being more open in disclosing

ratings for pension funds in order to strengthen market discipline and promote sound risk management.<sup>17</sup>

Evidence of the impact of risk-based methods is preliminary at best and it remains far too early to draw any decisive conclusions. There is no indication of loss of pension coverage in any setting and other measurable effects have been largely at the margins. Funding ratios in the Netherlands and Denmark have improved, but this would probably have occurred in any event due to the recovery of the asset markets coincident with the adoption of the new methods. Portfolios in the Netherlands and Denmark have become more conservative and exhibit indications of better duration matching. In both countries pension funds seem to be looking for more flexibility in order to reduce their solvency requirements. Dutch funds seem to be making greater use of conditional indexation. Danish funds are offering a greater variety of products, and new entrants seem to favor unit-linked products with lower guarantees but offering prospects of higher returns. This can be interpreted as a movement away from pure defined benefit systems, which is much more pronounced in the Danish case, but there are no hard data to make a decisive conclusion.

Some observers remain confident that the use of derivatives will increasingly allow pension institutions in the Netherlands and Denmark to hedge their risks at a reasonable cost without unduly sacrificing returns. However, it is too early to conclude that the new risk-based methods are indeed resulting in lower returns and a move away from defined benefits system and/or guarantees. It is also too early to assess the extent to which derivatives will allow pension funds to hedge their risks without sacrificing returns. In the two countries, the movements in pension portfolios and their implication for long-run return performance will need to be carefully assessed in the next few years.

In Australia the introduction of the risk scoring model in conjunction with stronger licensing standards has accentuated the ongoing trend away from DB plans and has led to the consolidation of the industry, as smaller funds have increasingly been absorbed by larger entities. However, this is likely due to a broader set of factors with adoption of risk-based supervision hard to distinguish. In Mexico it is simply too early to draw any conclusions because the system remains in a formative stage. The early evidence provides promising indications of a more diversified portfolio associated with the relaxation of asset allocation requirements in favor of risk-based measures. However, the applicability of short term VaR measures remains controversial, and it is difficult to assess how investment policies will evolve in the longer run, as the actual VaRs approach their ceilings.

A variety of difficult challenges will need to be addressed as these risk-based systems evolve. Both the Dutch and Danish systems implicitly place little reliance on the possibility of mean reversion in equity markets by utilizing fixed parameters in their stress testing. It is possible that solvency buffers will prove excessive and costly. This issue is partially addressed through the 15 year adjustment period for compliance with solvency requirements and the ability of funds in the Netherlands to propose their own stress testing methodology. In Denmark, the fact that the traffic light system is not a formal solvency requirement also introduces an element of flexibility. It remains to be seen whether the two countries have achieved the right balance between solvency protection and flexibility in the system. Likewise, the capacity of the supervisor to

effectively evaluate individual internal solvency models will provide useful lessons for others contemplating similar elements to achieve efficient outcomes through flexibility.

There are related issues in the mechanics of the methods. For practical (and likely political reasons) the solvency standards that are in use are based on retrospective measures of asset class volatility. This can potentially create price distortions and unduly limit innovation and the emergence of new instruments and may not accurately reflect the nature of some potential investment categories. For practical purposes, the mark to market pricing requirements of these standards effectively limits pension funds to assets with observable prices. The tradeoff between gains from the transparency of market discipline arising from such standards will have to be very carefully considered in relation to the longer term constraint on risk return efficiency of overall portfolios. This limits pension funds capacity to pursue the illiquidity premiums available in some types of investments (e.g. private equity, private placements) that are often perceived as advantageous to pension funds due to their relatively minimal liquidity requirements.

Three more general challenges are also important in considering the utility of risk-based approaches. Most fundamental is the applicability of the risk standards to the inherent nature of pension funds. Thus far these have no direct linkage to a fully articulated concept of retirement income adequacy. There is no empirical basis for the 1% daily VaR in Mexico that considers how much return and volatility over the multiple decade investment time horizon of the typical participant is appropriate. The 97.5% probability standard in the Dutch FTK does not have any direct foundation in the capacity of pension funds to remain solvent over the long term, a criticism that was well voiced during the consultation period. Similarly, to the extent these are based on a perceived “average” member of the fund they may be poorly aligned with the diverse requirements of members with widely varying time horizons and or differing risk appetites. In this respect, risk parameters would have to be calibrated to multiple portfolios or the varying financial circumstances of funds sponsors which may so complicate matters that the transparency and capacity to administer the system is lost.

A second general problem is that the solvency standards are potentially pro-cyclical in nature. Funds holding more volatile assets will have incentives to sell these when faced with market fluctuations. If pension funds are sufficiently large these can become a potentially self reinforcing cycles that exacerbates instability and ultimately limit the potential diversification and therefore risk management capacity of the funds.

Finally, the political economy of the risk-based supervision of pension funds remains untested. By their very nature these approaches presume that some level of risk is appropriate for pension funds and seek to calibrate their parameters to this standard level. None have yet to weather the kind of “perfect storm” of nearly simultaneous asset meltdowns and interest rate collapse or contagion effects that were associated with their introduction. It remains to be seen whether politicians will be able to sustain reasonable risks when the real losses to member’s accounts are incurred or will retreat into the mode of absolute security at any cost when faced with angry pensioners marching on the streets. In principle, even an event with a probability as low as 2.5% will occur within the period in which an individual is involved with the pension system.

Despite these challenges, risk-based supervision methods are likely to continue to gain acceptance, as they offer the prospect of advantages relative to other approaches. They provide a forward looking paradigm around which to organize supervision that

offers the promise of reduced risk of insolvency of DB funds and potential efficiency gains in DC systems that impose investment restrictions. They potentially provide a common framework to assess the relative risks of DC funds that function in a “prudent person” investment regime. However, as in all such matters, there is likely to be no free lunch. Risk-based supervision systems may lead to more conservative portfolios in DB funds and constrain DC funds to a presumed average risk tolerance, depending on how they are designed. The ability to use derivatives may to some extent mitigate these outcomes but this is not applicable to all countries. Risk-based methods will enable supervisors to better allocate their scarce resources, although they will also impose new technical requirements and a higher level of sophistication from all parties. The further development of these systems will be closely monitored and undoubtedly will provide many more useful lessons as others consider how to proceed down this path.

## Notes

---

<sup>1</sup> Bernstein and Chumacero (2007), Hinz and Van Dam (2006), Andersen and Van Dam (2006), Thompson (2006).

<sup>2</sup> Andersen and Van Dam (2006), Bernstein and Chumacero (2007), Hinz and Van Dam (2006), and Thompson (2006). See also Black (2004) for a comparative analysis of risk-based supervision of banks.

<sup>3</sup> The total number of individual accounts amounts to 84 percent of the labor force, but a large share of pension fund members move in and out of informality and do not contribute on a regular basis. This phenomenon is common in Latin America and other emerging countries (Rofman and Luchetti (2006)).

<sup>4</sup> It is interesting to note, in this regard, that Australian regulators have recently implemented a comprehensive re-licensing program based on much stricter licensing criteria that has reduced significantly the number of funds.

<sup>5</sup> Dutch funds can opt for an unconditional or a conditional benefit indexation rule. The latter rule introduces an element of risk-sharing, but the Dutch system remains a traditional defined benefit system.

<sup>6</sup> It is possible that the introduction of the VaR ceiling was also motivated by the existence of Government guarantees, especially the guarantee that workers with accrued rights in the former PAYG system will not receive a pension lower than the one they would have received (Bernstein and Chumacero (2007)).

<sup>7</sup> Mexican supervisors also make use of early warning indicators to guide supervisory actions, but this motivating factor was clearly more important in the other countries, where a much larger number of funds are allowed to operate.

<sup>8</sup> Standard and Poors and Moody’s have developed their own methodologies for rating the quality of the internal risk management of insurance companies and take the results into consideration in the elaboration of the final ratings. See, for example, Ingram (2006).

<sup>9</sup> The implementation of Basel II will impose similar challenges for bank supervisors.

<sup>10</sup> Jorion (2003) provides a review of the debate on mean reversion and empirical tests. See also Bodie (1995), Campbell and Viceira (2002 and 2004), and Campbell, Chan, and Viceira (2003).

<sup>11</sup> Jorion (2003) provides a review of the debate on mean reversion. See also Campbell and Viceira (2002 and 2004), and Campbell, Chan, and Viceira (2004).

<sup>12</sup> The response of pension institutions to the financial turmoil and the growing use of derivatives are analyzed in some detail in Ladekarl et al (2006).

<sup>13</sup> Boeri et al (2006).

<sup>14</sup> APRA Annual Report 2006

<sup>15</sup> Bernstein and Chumacero (2006).

<sup>16</sup> Barberis (2000), Campbell, Chan and Viceira (2002), Campbell and Viceira (2002 and 2004) discuss optimal portfolio strategies with short and long time horizons. Dowd and Blake (2006) present a critical view of VaRs as a risk indicator.

<sup>17</sup> At the same time, the disclosure of score results should not lead pension funds to hold very conservative portfolios.

## References

- Andersen, E. and R. Van Dam (2006) "Risk-Based Supervision of Pension Funds in Denmark" Unpublished Manuscript, The World Bank, Washington DC.
- Australian Prudential Regulation Authority 2006. *APRA Annual Report 2006*. Sydney, Australia
- Barberis, Nicholas. 2000. "Investing for the Long Run When Returns are Predictable." *The Journal of Finance*, vol. LV No 1. February, 225-264.
- Benston, G.J. (1998), *Regulating Financial Markets: A Critique and Some Proposals*, Hobart Paper No. 135, London, Institute of Economic Affairs.
- Bernstein, S. and R. Chumacero (2006) "Quantifying the Costs of Investment Limits for Chilwan Pension Funds" *Fiscal Studies*, Vol. 27 Issue 1, pp.99-123
- Bernstein, S. and R. Chumacero (2007) "Risk-Based Supervision of Pension Funds in Mexico" Unpublished Manuscript, The World Bank, Washington DC.
- Black, J. (2004) "The Development of Risk Based Regulation in Financial Services: Canada, the UK, and Australia". Center for the Analysis of Risk and Regulation. London School of Economics. London, UK.
- Bodie, Z. (1995), 'On the Risk of Stocks in the Long Run', *Financial Analysts Journal*, 51 (3), pp. 18 – 22.
- Bodie, Zvi. 2001. "Retirement Investing: A New Approach." *Pension Research Council Working Paper* 2001-8.
- Bodie, Zvi. 2002. "An Analysis of Investment Advice to Retirement Plan Participants", *Pension Research Council Working Paper* 2002-15.
- Bodie, Zvi, Jerome Detemple, Sussanne Otruba and Stephan Walter. 2004. "Optimal Consumption-Portfolio Choices and Retirement Planning." *Journal of Economic Dynamics and Control*, 28, 1115-1148.
- Bodie, Zvi, Robert Merton and P. Samuelson. 1992. "Labor Supply Flexibility and Portfolio Choice in a Life Cycle Model." *Journal of Econometrics Dynamics and Control*, 16, 427-49.
- Boeri, T., L. Bovenberg, B. Coeuré, and A. Roberts (2006), *Dealing with the New Giants: Rethinking the Role of Pension Funds*. Geneva Reports on the World Economy No. 8. Centre for Economic Policy Research, London, UK.
- Booth, Philip, and Yakoub Yaboukov. 1998. "Investment Policy for Defined Contribution Pension Scheme Members Close to Retirement: An Analysis of the 'Lifestyle' Concept." *North American Actuarial Journal* 4(2).
- Campbell, John, and Luis Viceira. 2002. *Strategic Asset Allocation. Portfolio Choice for Long-Term Investors*. Oxford University Press, Oxford.

Campbell, John Y., Yeung Lewis Chan and Luis M. Viceira. 2003. "A Multivariate Model of Strategic Asset Allocation." *Journal of Financial Economics*, 67, 41-80.

Campbell, John and Luis Viceira, 2004. "*The Term Structure of the Risk Return Tradeoff*." Manuscript. Harvard University.

Crockett, Andrew. 2005. *Beyond Basel II: What Comes Next?* Presentation to GARP, 6th Annual Risk Management Convention and Exhibition. New York, February, 2005  
De Nederlandsche Bank Statistical Bulletin December 2005, "Pension funds anticipate Financial Assessment Framework in their investments.

De Nederlandsche Bank Statistical Bulletin December 2006 "Pension funds and life insurers in search of the right balance". Dutch National Bank, Amsterdam.

Davies, H. (1999), 'Financial Regulation: Why Bother?' Society of Business Economists lecture, January 1999, London, Financial Services Authority, *mimeo*.

Dowd, K. (1996), 'The Case for Financial *Laissez-Faire*', *Economic Journal*, 106(436), May, 679-87.

Dowd, K., and D. Blake (2006) "After VaR: The Theory, Estimation, and Insurance Applications of Quantile-Based Risk Measures", Discussion Paper PI-0603 (June), The Pensions Institute, London, UK.

Dugan, John C. 2007. *Bank Regulation and Risk Management*. Remarks before the Global Association of Risk Professionals (February), New York, N.Y.

Goodhart, C., Hartmann, P., Llewellyn, D., Rojas-Suarez, L. & Weisbrod, S. (1998), *Financial Regulation: Why, How and Where Now?*, London, Routledge.

Hinz, R, and R, Van Dam (2006) "Risk-Based Supervision of Pension Funds in the Netherlands" Unpublished manuscript, The World Bank, Washington DC.

Ingram, D. (2006) "Enterprise Risk Management: Insurance Ratings". Standard and Poors.

Jorion, P. (2003) "The Long-term Risks of Global Stock Markets" Financial Management Association.

Kane, E.J. (1997), 'Foundations of Financial Regulation', *mimeo*, Boston College, January.

Kakes, Jan and Broeders, Dirk (2006) "The sustainability of the Dutch Pension System" De Nederlandsche Bank Occasional papers

Ladepohl, J., Ladepohl, R., Andersen, E., Vittas, D. (2007). 'The Use of Derivatives to Hedge Imbedded Options: The Case of Pension Institutions in Denmark', World Bank Policy Research Paper 4159, March 2007. The World Bank, Washington, DC

Llewellyn, D. (1999) "The Economic Rationale for Financial Regulation" FSA Occasional Paper Series No. 1 (April)

Poterba, James, Joshua Rauh, Steven Venti and David Wise. 2006. "Lifecycle Asset Allocation Strategies and the Distribution of 401(K) Retirement Wealth." *NBER Working Paper Series* 11974. NBER. Cambridge, MA.

Rofman, R., and L. Luchetti (2006), 'Pension Systems in Latin America: Concepts and Measurements of Coverage', Social Protection Discussion Paper 0616, World Bank, Washington, DC

Sahajwala, Ranjana and Van den Bergh, Paul. 2000. *Supervisory Risk Assessment and Early Warning Systems*. Basel Committee on Banking Supervision Working Paper No. 4, December 2000. Bank for International Settlements, Basel, Switzerland

The Joint Forum. 2006. *Regulatory and market differences: issues and observations*. Basel Committee on Banking Supervision. International Organization of Securities Commissions, International Association of Insurance Supervisors. Bank for International Settlements, Basel, Switzerland

Thompson, G. (2006) "Risk- Based Supervision of Pension Funds in Australia" Unpublished manuscript, The World Bank, Washington DC.

Towers Perrin Tillinghast and the European Insurance Federation (CEA). 2006. *Solvency II Introductory Guide*.

Walker, Eduardo. 2003. "Portafolios Óptimos para los Nuevos Sistemas de Pensiones de Países Emergentes." Mimeo. Pontificia Universidad Católica de Chile. October.