

Amzallag, Adrien; Kapp, Daniel; Kok, Christoffer

Research Report

The impact of regulating occupational pensions in Europe on investment and financial stability

ECB Occasional Paper, No. 154

Provided in Cooperation with:

European Central Bank (ECB)

Suggested Citation: Amzallag, Adrien; Kapp, Daniel; Kok, Christoffer (2014) : The impact of regulating occupational pensions in Europe on investment and financial stability, ECB Occasional Paper, No. 154, European Central Bank (ECB), Frankfurt a. M.

This Version is available at:

<https://hdl.handle.net/10419/154607>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



EUROPEAN CENTRAL BANK

EUROSYSTEM

OCCASIONAL PAPER SERIES

NO 154 / JULY 2014

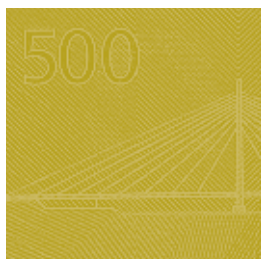
**THE IMPACT OF REGULATING
OCCUPATIONAL PENSIONS
IN EUROPE ON INVESTMENT
AND FINANCIAL STABILITY**

by Adrien Amzallag, Daniel Kapp
and Christoffer Kok



EUROPEAN CENTRAL BANK

EUROSYSTEM



OCCASIONAL PAPER SERIES

NO 154 / JULY 2014

THE IMPACT OF REGULATING OCCUPATIONAL PENSIONS IN EUROPE ON INVESTMENT AND FINANCIAL STABILITY

By Adrien Amzallag, Daniel Kapp and Christoffer Kok



In 2014 all ECB publications feature a motif taken from the €20 banknote.



NOTE: This Occasional Paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

Acknowledgements

The authors thank Giuseppe Loiacono and Cedric Mercken for providing excellent research assistance. The authors would also like to thank Ignazio Angeloni, Andreas Baumann, Marco Gross, Jerome Henry, Christoph Krischanitz, Reiner Martin, Katri Mikkonen, Raphael Quevedo, Philip Shier and Falco Valkenburg for their helpful comments and suggestions.

Adrien Amzallag,

European Central Bank, Adrien.Amzallag@ecb.int.

Daniel Kapp,

European Central Bank, Daniel.Kapp@ecb.int.

Christoffer Kok,

European Central Bank, Christoffer.Kok@ecb.int.

© European Central Bank, 2013

Address	Kaiserstrasse 29, 60311 Frankfurt am Main, Germany
Postal address	Postfach 16 03 19, 60066 Frankfurt am Main, Germany
Telephone	+49 69 1344 0
Internet	http://www.ecb.europa.eu
Fax	+49 69 1344 6000

All rights reserved.

ISSN	1725-6534 (online)
EU catalogue No	QB-02-14-002-EN-N (online)

Any reproduction, publication and reprint in the form of a different publication, whether printed or produced electronically, in whole or in part, is permitted only with the explicit written authorisation of the ECB or the authors.

This paper can be downloaded without charge from <http://www.ecb.europa.eu> or from the Social Science Research Network electronic library at http://ssrn.com/abstract_id=2464558.

Information on all of the papers published in the ECB Occasional Paper Series can be found on the ECB's website,

<http://www.ecb.europa.eu/pub/scientific/ops/date/html/index.en.html>

CONTENTS

CONTENTS

ABSTRACT	4
NON-TECHNICAL SUMMARY	5
1 INTRODUCTION	7
2 PENSIONS IN EUROPE	9
2.1 The three-pillar system	9
2.2 The occupational pension fund subsector	12
2.2.1 Recent trends and developments in occupational pension fund structures	14
2.2.2 Asset allocation structure	15
3 THE PROPOSALS FOR REVISING THE 2003 IORP DIRECTIVE	17
4 LONG-TERM INVESTMENT IMPACT OF THE EUROPEAN COMMISSION'S 2011 CALL FOR ADVICE FOR A REVISED IORP DIRECTIVE	21
5 EMPIRICAL ANALYSIS	24
5.1 Approach 1: OLS panel estimation	28
5.2 Approach 2: Difference in differences estimation	35
6 POTENTIAL IMPACT ON FINANCIAL STABILITY	38
6.1 The role of IORPs in the financial system	38
6.2 Potential impact of a revised IORP directive on pro-cyclicality	40
7 CONCLUSIONS	42
REFERENCES	43
APPENDICES	47
A Econometric results for Section 5	47
B Data sources	57

ABSTRACT

This study examines the European Commission's 2011 call for advice to the European Insurance and Occupational Pensions Authority (EIOPA) on the improvement of the Institutions for Occupational Retirement Provision (IORP) Directive (the "IORP Directive"). Specifically, it uses both the EIOPA final advice to the Commission and its quantitative impact study as a basis for answering the following questions: first, what would be the likely impact of the changes proposed to the IORP Directive, in particular minimum solvency requirements, the introduction of risk-based solvency capital requirements, on IORP investment strategies in the short and long term? Second, what would be the impact, if any, of these proposals on financial stability, in particular as regards possible pro-cyclical IORP investment behaviour?

The main findings of the study are that the proposed solvency capital requirement framework could lead to IORPs shifting their investment allocations towards a greater proportion of "low-risk" asset classes. However, the impact is likely to vary extensively across EU countries, in line with national pension legislation, demographic profiles, the macro-financial situation and cultural preferences. Nevertheless, the study finds some empirical support to suggest that even the announcement of the proposed revisions, which have in the meantime been deferred, may already have led to some de-risking of some IORPs. Furthermore, some pro-cyclicality of IORPs' investment strategies could be expected should these proposals be adopted, although the exact outcomes will depend on their precise calibration, especially regarding counter-cyclical adjustments.

JEL codes: G11, G18, G28, G23, C13, C23.

Keywords: Financial regulation, financial stability, Institutions for Occupational Retirement Provision

NON-TECHNICAL SUMMARY

This study examines the potential financial stability implications of the European Commission's 2011 call for advice to the European Insurance and Occupational Pensions Authority (EIOPA) on the improvement of the IORP Directive, including the introduction of risk-based minimum solvency capital requirements. It is assumed that EIOPA's final advice to the Commission¹ and its technical specifications for the quantitative impact study², both of which laid out the major changes to come concerning IORP risk-based regulation, would have formed the actual framework implemented by the Commission. The proposals related to solvency requirements for occupational pension funds have since been deferred by the European Commission and are currently subject to technical work by EIOPA.

On 27 March 2014 the European Commission put forward a legal proposal for a revision of the IORP Directive (2014/0091 (COD)). Compared with the 2012 EIOPA advice, it mainly further refines issues concerning qualitative requirements, risk management and disclosure to public authorities. Key elements, such as the holistic balance sheet and sponsor support, were mentioned in July 2010 when the European Commission issued a Green Paper that discussed the role of solvency risk among European pension funds. Nevertheless, the proposals related to solvency requirements have, since May 2013, been deferred by the European Commission and are currently subject to further technical work by EIOPA.³ At the same time, this discussion has generated substantial discussion among pension fund stakeholders and, since the main principles of the revised IORP Directive had already been laid out in the 2010 Green Paper, it is worthwhile exploring whether IORPs have already begun to adjust their investment with the aim of smoothing the transition to a risk-based capital regime.

In fact, the majority of the discussion was triggered by two major proposals: solvency capital requirements and the holistic balance sheet. The latter approach would allow IORPs to include in their balance sheets security and benefit adjustment mechanisms, such as sponsor support and pension protection schemes on the asset side, as well as various types of pension obligations, such as discretionary benefits and possible benefit reductions on the liability side.

Given its backward-looking nature, this study refers to the "revised IORP Directive", largely on the basis of information from 2010 to the end of 2012, and thus leaves out the Commission's legal proposals of 27 March 2014. To this end, the study first provides an overview of the EU pension funds sector and of the salient aspects of the Directives. Against this background, an assessment of the revised IORP Directive's long-term impact on IORPs' investment behaviour is provided, including an econometric analysis aimed at gauging whether the discussion of the Directive's review may already have affected IORPs' asset allocation decisions. Finally, the study considers potential financial stability considerations from the envisaged implications of the revised Directive on IORPs' long-term investment behaviour.

This study's findings suggest that the Commission's proposals for calculating minimum EU IORP solvency requirements are likely to impact on the asset allocation strategies of these institutions

1 EIOPA delivered its final advice to the European Commission on 15 February 2012, which can be found at https://eiopa.europa.eu/fileadmin/tx_dam/files/consultations/consultationpapers/CP06-11/EIOPA-BOS-12-015_EIOPA_s_Advice_to_the_European_Commission_on_the_review_of_the_IORP_Directive.pdf

2 The technical specifications quantitative impact study (QIS) on Institutions for Occupational Retirement Provision (IORPs) were published on 16 October 2012 and can be found at <https://eiopa.europa.eu/consultations/qis/occupational-pensions/quantitative-impact-study/technical-specifications/index.html>

3 See "Revision of the Occupational Pension Funds Directive – frequently asked questions", European Commission – MEMO/14/239, dated 27 March 2014.

over the medium term by inducing them to hold a greater proportion of their investments in “low-risk” assets (in other words, those assets carrying lower capital requirements). Indeed, there is some empirical support to suggest that this shift may have already begun as a result of the announcement of the proposals. However, the findings are not always easy to disentangle from the wider context of the past few years. Notably, IORPs have also shown a tendency to de-risk their investment portfolios in response to the global financial and euro area sovereign debt crises. Moreover, it cannot be ignored that the relative importance of IORPs in national pension systems differs markedly across the EU, and that there are many demographic, cultural and macro-financial differences that also play a role in the investment decisions of individual IORPs. This wide-ranging heterogeneity implies that the revised IORP Directive is in turn likely to have different impacts across EU countries.

Furthermore, the analysis also suggests that the Commission’s proposals may have some pro-cyclical implications for the IORPs’ investment strategies. However, the exact outcomes will depend on any final calibrations of the regulatory requirements, including potential counter-cyclical adjustments.

It should be emphasised that any quantitative estimates and qualitative statements about the revised IORP Directive at this still-early stage are surrounded by major uncertainty, especially as the horizon for the actual implementation of the solvency proposals related to the revised Directive remains somewhat unclear, as they have been deferred pending further analysis by EIOPA.

I INTRODUCTION

The European Commission in 2011 issued a call for advice from the European Insurance and Occupational Pensions Authority (EIOPA), on the revision of the 2003 Institutions for Occupational Retirement Provision (IORP) Directive (the “IORP Directive”). The call for advice noted an aim of creating an internal market for occupational retirement provision on a European scale and, in doing so, of the need for risk-based supervision of occupational pension funds. The call for advice included the subject of risk-based minimum solvency requirements, of which further technical details were set out in EIOPA’s response to the Commission. The proposals related to solvency requirements for occupational pension funds have since been deferred by the European Commission and are currently subject to further technical work by EIOPA.¹

On 27 March 2014 the European Commission put forward a legal proposal for revision of the IORP Directive (2014/0091 (COD)). Compared with the 2011 specifications, it mainly further refines issues concerning qualitative requirements, risk management and disclosure to public authorities. Key elements, such as the holistic balance sheet and sponsor support, were mentioned in July 2010 when the European Commission issued a Green Paper that discussed the role of solvency risk among European pension funds. At the same time, this discussion has generated substantial discussion among pension fund stakeholders and, since the main principles of the revised IORP Directive had already been laid out in the 2010 Green Paper, it is worthwhile exploring whether IORPs have already begun to adjust their investment with the aim of smoothing the transition to a risk-based capital regime.

In fact, the majority of the discussion was triggered by two major proposals: solvency capital requirements and the holistic balance sheet. The latter approach would allow IORPs to include in their balance sheets security and benefit adjustment mechanisms, such as sponsor support and pension protection schemes on the asset side, as well as various types of pension obligations, such as discretionary benefits and possible benefit reductions on the liability side (see Section 3). In the autumn of 2014 EIOPA will launch a second round of consultations for revisions on the asset side, in particular on how to refine valuation of sponsor support and benefit reductions, as well as on the construction/valuation of the recovery period. The goal is to have concrete input from EIOPA for the European Commission by 2015.

Specifically, this study investigates two research questions arising from the proposed solvency rules embedded in the two above-mentioned EIOPA documents published in 2012: first, what is the likely impact of the solvency rules proposed in the context of the review of the IORP Directive on IORP investment strategies in the short and long term? Second, what is the likely impact, if any, of these proposals on financial stability as regards the pro-cyclicality of IORPs’ investment behaviour?

This paper attempts to address these questions using a variety of methods. The study begins with an overview of the EU pension funds sector (Section 1) from an investment perspective, and continues with a discussion of the salient aspects of the review of the IORP Directive in Section 2. Section 3 provides a preliminary qualitative assessment of the long-term impact on occupational pension funds’ investment behaviour of the review of the IORP Directive. Section 4 presents an econometric analysis to gauge whether the announcement of the review of the Directive may

¹ See “Revision of the Occupational Pension Funds Directive – frequently asked questions”, European Commission – MEMO/14/239, dated 27 March 2014.

already have impacted on asset allocation decisions. Section 5 subsequently discusses financial stability considerations, using a mixture of empirical, theoretical and qualitative information, while Section 6 concludes.

The main findings of the analysis presented in this report suggest that moving in the direction of a more risk-sensitive regulatory approach to calculating minimum solvency requirements for IORPs in the EU, as stipulated in the context of the review of the IORP Directive, could impact on the asset allocation strategies of these institutions over the medium term by a greater proportion of their investments being allocated to low-risk asset classes. Although subject to many caveats, this report provides some tentative empirical evidence that the announcement of the review of the IORP Directive may already have had a certain attenuating (or de-risking) impact on the risk profiles of at least some IORPs.

Furthermore, it is conceivable that the introduction of more risk-sensitive solvency requirements for IORPs may have some pro-cyclical implications for the IORPs' investment strategies, although the exact outcomes will depend on the final calibrations of the regulatory requirements, including potential counter-cyclical instruments.

More generally, it should be emphasised that any quantitative estimates and qualitative statements about the review of the IORP Directive at this still-early stage are surrounded by major uncertainty, especially as the horizon for the actual implementation of any changes to the solvency requirements, as well as the precise nature of those requirements, remain unclear. Moreover, it has to be borne in mind that mapping the size and importance of the IORP sector in the EU is hampered by a lack of harmonised and comprehensive data.² As a consequence, this study relies on a wide range of different data sources that may not always be entirely consistent.

2 The ECB and the European System of Central Banks (ESCB) are currently publishing quarterly euro area aggregates for balance sheets of insurance corporations and pension funds based on available national data. As the quality, coverage, breakdowns and type of data published are insufficient to fulfil user needs, they have engaged in a "steady-state approach" for insurance corporations (and possibly also pension funds in the future), whereby user needs would be met by harmonised statistics based on an ECB Regulation.

2 PENSIONS IN EUROPE

2.1 THE THREE-PILLAR SYSTEM

The pension system is divided into three pillars: publicly-provided pensions, occupational pensions typically linked to an employer-employee relationship and private savings plans. Though all three pillars are present in most EU Member States, their relative size and technical features differ widely across countries owing to heterogeneous legal, regulatory and cultural practices.³

The first pillar is part of the public social security system and is usually based on a pay-as-you-go principle, in which contributions and taxes of current employees finance the pensions and other expenses of current retirees.⁴ This pillar generally serves two purposes: firstly, to redistribute income to prevent and reduce old-age poverty and, secondly, to smooth living standards between employment and retirement.⁵ Public retirement systems rely to a large extent on defined benefit (or similar) schemes, financed on a pay-as-you-go basis, with pensions depending on the years of service and individual earnings.⁶ In some EU countries, such as Sweden and Denmark, pension liabilities have been partially transferred to privately funded individual accounts.

The second pillar is composed of occupational pension arrangements, both voluntary and mandatory, provided by employers (sponsors) for the benefit of their employees. This pillar complements first pillar pensions and was the main focus of the first IORP Directive. Occupational pension arrangements consist of either defined benefit (DB) schemes or defined contribution (DC) schemes (or hybrids combining features of both), and are generally provided on a voluntary basis.⁷ Privately managed mandatory occupational DB plans also exist and are projected to increase in importance in some countries, such as Estonia, Latvia, Poland and Romania (European Commission, 2012a). In Sweden and Denmark, quasi-mandatory occupational DB arrangements are agreed upon between trade unions and employers, while in other countries there are mixed systems between mandatory and voluntary contributions.

The third pillar is in general defined as personal pension provisions consisting of individual, privately managed and fully funded DB accounts; contributions into these are often incentivised by favourable tax rules. In some countries, tax-favoured pension schemes have traditionally been restricted to workers in specific sectors, which has led to life insurance emerging as a popular alternative private saving vehicle to non-covered sectors.

Estimating the respective shares of these pillars across EU countries is not straightforward as a result of the above-mentioned heterogeneities in data collection. In addition, cross-country and cross-pillar analyses are often incomplete owing to the compiling institution focusing on one particular thing and to differences in the statistical treatment of individual submissions.⁸ Nevertheless, a recent analysis by Towers Watson, the consulting firm, suggests that second and third pillar arrangements

3 Table 2.2 in European Commission (2012a) provides a helpful overview of the main features of EU Member States' pension arrangements; see also Le Blanc (2011).

4 See European Parliament (2011).

5 For a discussion and further background information, see Le Blanc (2011) and European Commission (2012a).

6 Pensions are typically based either on the final salary at the time of retirement or on the average salary over a number of years.

7 DB schemes can broadly be defined as pension arrangements where the pay-out is pre-defined, whereas DC schemes refer to arrangements where the pension contributions are fixed but the payouts by and large depend on the scheme's investment returns.

8 For example, guidance from Eurostat does not appear to distinguish fully between those institutions that provide pensions on behalf of an employer, but are legally ringfenced (IORPs) – generally referred to as Pillar 2 – and those institutions providing additional “top-up” pensions on a voluntary basis (generally referred to as Pillar 3) – see European Parliament (2011) and European Commission/Eurostat (2004). In contrast, the OECD makes a clear distinction between private occupational private plans and “personal” pension plans that do not have to be linked to an employment relationship – see OECD (2005).

Table 1 Relative shares of pension assets

(percentage shares; 2010)

Country	Pillar 1	Pillar 2	Pillar 3
Belgium	54	46	
Czech Republic	8		92
Finland	48	52	
France	90	10	
Germany	18	82	
Ireland	85	15	
Luxembourg	94	6	
Netherlands	34	66	
Poland	87	13	
Slovenia	59	41	
Spain	43	21	36
Sweden	88	12	
United Kingdom	12	88	
EA17	71	27	2
EU27	73	24	3

Source: Towers Watson, EIOPA, EFRP, European Commission, OECD, ECB calculations.

Note: Countries included where data for at least two pillars could be retrieved. Pillar 1 data are from European Commissions “public pension assets as a share of GDP”, Pillar 2 and 3 data respectively are from OECD “occupational and personal autonomous pension fund assets as a share of GDP”. Data from the Netherlands and the United Kingdom are from Towers Watson’s “share of private pension assets” measure; based on Towers Watson’s methodology, “private” is assumed to refer to Pillar 2 only. Comparisons across countries should be made with caution, as differences in classification among data sources may be present.

far outweigh first pillar pensions in the UK and the Netherlands (Towers Watson, 2013). Table 1 (below) attempts to bring together disparate data sources; albeit still reasonably comparable. The results suggest that UK first pillar pension schemes accounted for only 12% of total pension fund assets in 2010, and similarly low shares were reported in the Czech Republic (8%) and Germany (18%). First pillar pension plans are also relatively small in the Netherlands (34%), Finland (48%) and Spain (43%). By contrast, countries such as France and Luxembourg appear to be continuing to rely largely on public sector-provided pension arrangements (or other products such as life insurance). On aggregate, it appears that, overall, Pillar 1 pension arrangements outweigh the other pillars in the EU.

While it is difficult to compare pension systems across EU countries, one way of comparing the relative importance of pension pillars is in terms of their respective pension outlays (such as minimum guaranteed and survivor pensions). From this perspective, Pillar 1 pension-based expenditure is generally substantially larger than that related to Pillars 2 and 3 (see Table 2), although data on Pillar 3 in particular are difficult to come by. For example, when compared with Table 1, a future rebalancing in the relative size of pillars (away from Pillar 1 pensions and towards Pillar 2 pension arrangements) is likely in countries like Spain and the United Kingdom as a greater number of active employees commence retirement. In addition, while shares across pillars in terms of expenditure and assets are similar in Sweden and Ireland, the share of pension expenditure in Pillar 1 pension arrangements is marginally greater than that of assets in the Netherlands, as well as on average in the euro area and in the EU as a whole.⁹

Regardless of their classification (Pillar 1, 2, or 3), pension funds in general face a number of short and longer-term challenges. For example, the fall in the long-term bond yields of many highly rated European sovereigns increased the present value of DB liabilities (where these are valued to market) and, as a result, the funding ratios of many pension funds have decreased.

⁹ Low response rates across countries mean these comparisons should be treated with caution. For a discussion of recent Pillar 1 pension reforms, see European Commission (2012a).

Table 2 Relative shares of pension expenditure

(percentage shares; 2010)

Country	Pillar 1	Pillar 2	Pillar 3
Denmark	70	30	
Estonia	99		1
Ireland	81	19	
Netherlands	58	42	
Portugal	96	4	
Spain	94	4	2
Sweden	86	13	0.4
United Kingdom	79	21	
EU27	85	14	1
EA17	85	13	2

Sources: European Commission, ECB calculations.

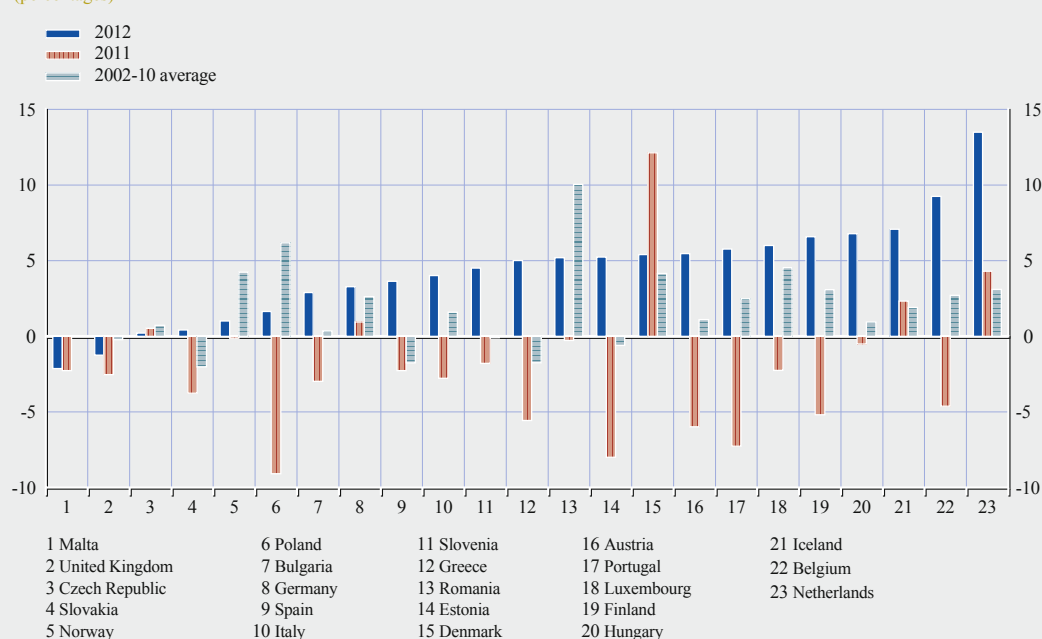
Note: Countries included where data for at least two pillars could be retrieved. Low response rates mean that estimates provided for the EU and euro area should be treated with caution.

This pressure has been matched on the asset side, where the economic downturn reduced contributions as well as net cash flows (EIOPA, 2012a). Cash flows were especially affected by historically low asset returns in 2011 (see Chart 1) as a result of high market volatility, low yields and widespread uncertainty. The poor 2011 asset returns were, however, partially offset by more favourable returns in 2012.

On the basis of a survey of national supervisory authorities, EIOPA in 2013 identified substantial regulatory and tax changes – including the removal of certain tax concessions, adjustments to the types of pension schemes on offer from employers and adjustments to discount rate calculations –

Chart 1 Real investment returns, 2012 and 2011 vs. 2002-10 average

(percentages)



Source: OECD Pension Markets in Focus (2012).

as the main short-term adjustment facing non-public pension funds. Longer-term challenges include an increase in life expectancy, adverse demographic developments as a result of low fertility rates, and a declining number of years in employment (see EIOPA, 2012a). Consequently, over the long term, public and private pension expenditures as a share of GDP are expected to increase in nearly all EU Member States, according to the European Commission (2012a).

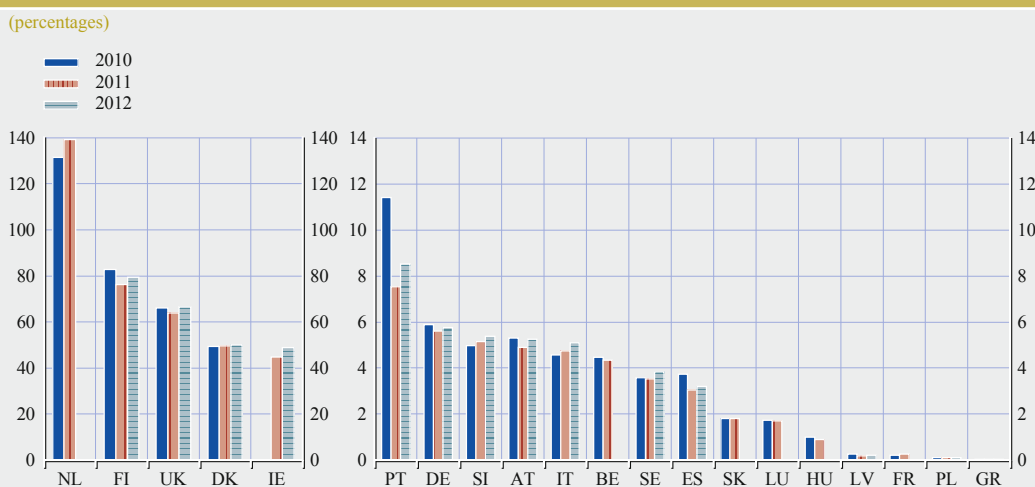
2.2 THE OCCUPATIONAL PENSION FUND SUBSECTOR

SIZE AND STRUCTURE

With about EUR 2.6 trillion in total assets at the end of 2012, occupational pension scheme assets are sizeable, albeit with non-negligible heterogeneity across countries (see EIOPA, 2013). The sector is most developed in the Netherlands, Finland, the United Kingdom, Denmark and Ireland. In the latter group of countries, assets in such pension scheme arrangements exceeded 40% of GDP in 2012 and approached 140% of GDP in the Netherlands (see Chart 2). Occupational pension fund assets in other reporting EU Member States are far lower, generally ranging from 3% to 8% of GDP or having little presence. The relative importance of the occupational pension fund sector in national jurisdictions in general seems to be related to the size of Pillar 1 schemes (see also Section 2.1). In most countries, the size of the occupational pension funds relative to GDP have increased slightly in recent years, with one notable exception being Portugal owing to the large-scale transfer of privately held pension assets to the sovereign in 2011.

Regular contributions into occupational pension schemes as a share of national GDP were below 2% on average in the EU countries in 2012, but were more sizeable in the Netherlands and Finland (see Chart 3). In the Netherlands, contributions are large, since occupational plans are “quasi-mandatory”, whereas occupational plans in general have historically dominated the UK pension funds sector.¹⁰ In Finland, the dominance of the compulsory occupational pension scheme (in addition to the

Chart 2 Occupational pension funds' assets as a percentage of GDP



Sources: EIOPA, OECD and ECB calculations.
Note: data are not available for all EU countries.

¹⁰ For further details, see OECD (2011).

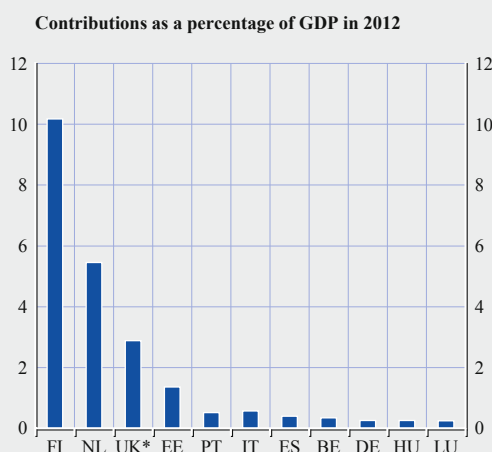
compulsory Pillar 1 arrangement) is also driving the large contribution rates.¹¹

Overall, these features suggest that, whereas the occupational pension fund sector plays an important role in the financial systems of some EU countries, the role played by occupational pension funds is largely negligible in others (where Pillar 1 schemes are predominant, for example). This heterogeneity in turn implies that the potential implications of the review of the IORP Directive are likely to vary extensively across countries in the EU.

For the sake of clarity, it should be recalled that the 2003 IORP Directive (and therefore the detailed analysis later in this paper) does not cover all occupational pension schemes (Pillar 2), but only “institutions, irrespective of their legal form, operating on a funded basis, established separately from any sponsoring undertaking or trade, for the purpose of providing retirement benefits in the context of an occupational activity” on the basis of a legally binding agreement between employers and employees.¹² In other words, the pension scheme is ring-fenced from the balance sheet of the employer (sponsor). Chart 4 displays the relative share of IORPs in the wider occupational pensions sector. The share is small in some countries, such as Finland, France and Germany owing to the presence of other substitute arrangements, such as life

Chart 3 Occupational pension funds' contributions as percentage of GDP

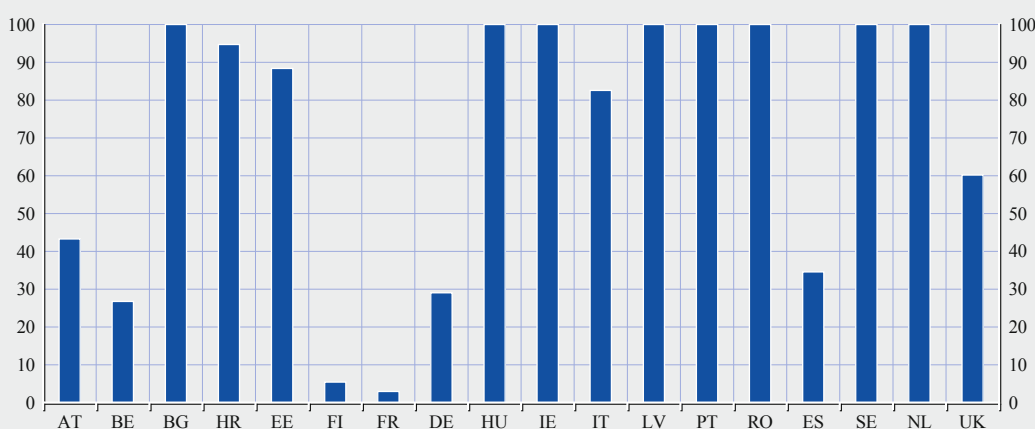
(percentages; 2012)



Source: OECD.
Note: Data for the United Kingdom correspond to the year 2011.

Chart 4 Share of IORP assets within the occupational pensions sector (2011)

(percentages)



Source: EFRP.

11 For further information, see the country profile for Finland at Pension Funds Online: <http://www.pensionfundsonline.co.uk/content/country-profiles/finland/118>

12 See Article 6 (a) of European Union (2003).

insurance providers, pay-as-you-go and book reserve schemes (where pension provision is not legally ring-fenced from the wider employer's balance sheet).¹³

2.2.1 RECENT TRENDS AND DEVELOPMENTS IN OCCUPATIONAL PENSION FUND STRUCTURES

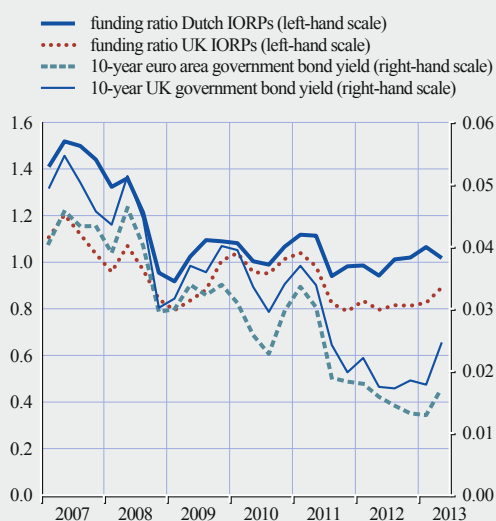
Another important development is the steady shift from DB to DC occupational pension schemes that has been observed in many countries (notably Denmark, Italy, Luxembourg, the Netherlands, Portugal and the United Kingdom).¹⁴

This transition has historically come largely in response to improvements in labour mobility, in turn driven by the evolution of industrial structures and labour force composition. DB plans and their relatively complicated funding requirements were often not portable across employers, which led to a rise in the number of DC plans as an alternative offer to newly recruited staff.¹⁵ More recently, as workforces have aged in many EU Member States and improvements in life expectancy have exceeded expectations, the costs of funding DB plans have risen for employers and stimulated further growth in DC arrangements.¹⁶ The prolonged period of low interest rates in the past few years has exacerbated these longer-term pressures, pushing up the present value of liabilities while reducing the expected asset returns on fixed income investments (see Chart 5).

At first glance, DC arrangements contain several unappealing features for employees when compared with DB schemes. Employees are exposed to inflation, market and longevity risks that were formerly borne by DB sponsors, as well as facing difficult decisions about when to enter/exit certain investment assets that they may not always be sufficiently sophisticated or willing to handle (Broadbent et al., 2006).

Chart 5 Pension funding ratios and long-term bond yields

(ratio as a percentage, left-hand side; yield as a percentage, right-hand side)



Sources: The UK Pension Protection Fund, De Nederlandsche Bank, Reuters and ECB calculations.

13 In France, more than 90% of the occupational pension fund assets are insurance-based and thus outside the IORP Directive's scope. In Germany, IORPs are also largely outweighed by book reserves (54% of all assets, according to AEGON, 2010) and insurance products. Insurance-based occupational retirement provision is also relatively large in Finland, Sweden and Belgium (EFRP 2010). As regards Finland, public and private occupational pension funds are highly linked, blurring the distinction between Pillar 1 and Pillar 2. Occupational pension arrangements lying outside the scope of the 2003 IORP Directive are regulated at a European level by the Solvency II Directive (non-life pension insurance products) and the Life Insurance Directive.

14 See, for example, OECD Global Pension Statistics and Towers Watson (2013).

15 See Broadbent et al. (2006). However, on 20 June 2013 the European Council adopted the pension portability directive (COM/2007/0603 final - COD 2005/0214) which requires Member States to implement minimum requirements for the acquisition and preservation of pension rights for people who go to work in another EU country. Member States remain responsible for the conditions under which people change jobs within the same country, but the European Commission expects them to apply the standards laid down by the portability directive to within-country mobility as well. Once implemented, the portability directive, will ensure people can work in another Member State without losing their occupational pension benefits.

16 Some countries have attempted to legally adjust certain parameters in order to give greater flexibility to occupational pension fund arrangements and thus reduce the need for wholesale shifts of pensions (from DB to DC). For example, the United Kingdom recently increased the minimum retirement age and abolished the statutory retirement age for all pension arrangements, including occupational pension schemes. The Netherlands has also increased its eligibility age and linked this with life expectancy developments.

Nevertheless, DC plans also offer employees several advantages relative to DB arrangements. First, DC schemes facilitate labour market mobility because they decrease so-called “accrual risk” (Broadbent et al., 2006).¹⁷ Second, employees are largely freed from employer insolvency risk, given that contribution rates can be set *ex ante* without any anticipated dependence on future sponsor support (though, in practice, this might make them higher, all else being equal). Third, employees are provided with more control on how to manage their retirement savings and assets over their lifetime, which may suit workers shifting between different employers at different stages of their career.¹⁸

Given these differences, DC schemes may well pursue investment strategies different from DB or hybrid arrangements. For example, greater risk-bearing exposure on the part of members, coupled with a precautionary savings motive, would be expected to move pension funds toward less risky allocations at the expense of smaller expected pensions in the future. In addition, the fact that members bear investment risk more directly is likely to lead to greater choices in investment strategies, in contrast to a single strategy imposed by the sponsor in a DB plan.¹⁹ As noted in the European Commission’s 2011 Call for Advice (annex)²⁰, these particularities of DC schemes may require specific investment strategy regulation, for example setting quantitative investment ceilings.

2.2.2 ASSET ALLOCATION STRUCTURE

Chart 6 illustrates the heterogeneity with respect to aggregate occupational pension sector investment across many EU countries (where data are available). Occupational pension funds in the United Kingdom, Belgium, Finland, Estonia, the Netherlands and Poland have collectively invested more than one third of their assets in shares, in contrast to far more conservative behaviour in central and eastern European countries (such as Slovenia, Slovakia, Latvia and the Czech Republic). At the same time, investments in government and corporate debt securities generally account for the bulk of invested assets, reflecting the longer duration of these assets (thereby more closely matching the duration of liabilities) and their lower expected risk.²¹ Furthermore, there is also wide dispersion of asset holdings across cash and “other” asset classes, which include items such as loans, mutual fund shares and real estate investments. For instance, IORPs in countries such as Greece, Malta and Latvia hold at least one quarter of their assets in low-yielding cash and deposits, while German, Italian, Portuguese and Maltese occupational pension funds have significant investments in broader asset classes.

The share of fixed-income instruments has increased on average across this sample group, rising from about 38% of assets in 2003 to 56% of assets in 2012.²² On average, IORPs have split their remaining investments across cash and “other” asset classes. As greater evidence of risk reductions in the past few years, the share of cash has also risen to an average holding of 13%, compared with about 5% in 2003, although equity holdings also rose from 14% to 18% over the same period on average.

17 Accrual risk refers to the fact that pension benefits in DB plans tend to be backloaded, which means that accumulation of benefits is slow at the beginning of a career and increases over time, so workers who change employers can lose a great portion of the expected benefits if these are not transferable from one employer to another.

18 See, for example, Agnew et al. (2003) for a discussion in the context of US defined contribution (401-k) accounts.

19 A single strategy can be set by the DB plan sponsor (or trustees), leaving little choice to individual members. The rationale for doing so is that the sponsor, often being the first line of defence as regards making up any funding shortfall, accepts this risk in exchange for greater control of the investment strategy.

20 Available at http://eiopa.europa.eu/fileadmin/tx_dam/files/requestsforadvice/20110409-CfA-IORPII-final.pdf

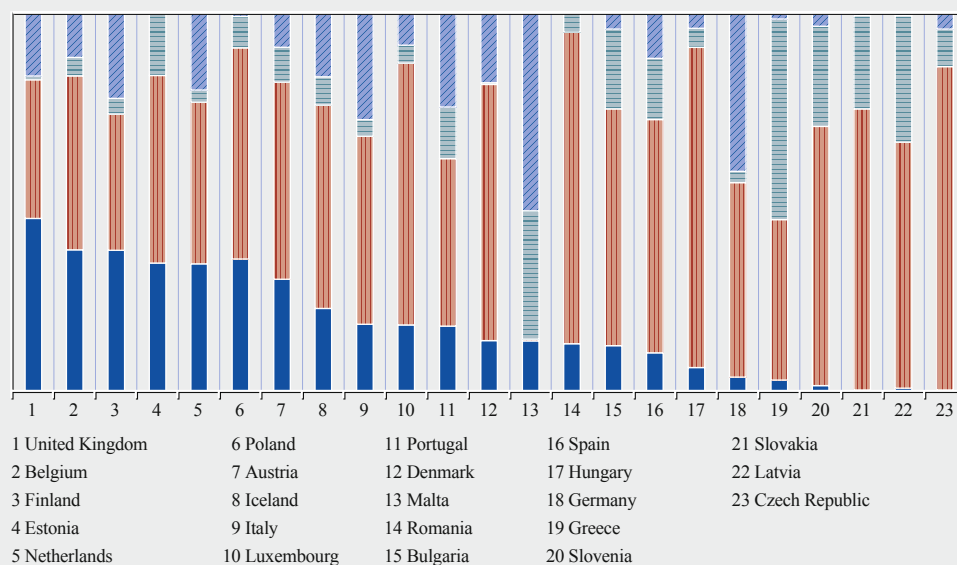
21 See also EIOPA (2013) for further details and discussion.

22 Comparing data provided in the 2005 edition of the OECD’s “Pension Markets in Focus”, where available, with the 2012 sample shown in Chart 6. All averages are unweighted.

Chart 6 Occupational pension sector investment (2012)

(percentages)

■ shares
■ bills and bonds
■ cash and deposit
▨ other



Sources: The OECD's "Pension Markets in Focus" (2012); Towers Watson (2013).

Note: The "Other" category includes loans, land and buildings, unallocated insurance contracts, hedge funds, private equity funds, structured products, other mutual funds (i.e. not invested in cash, bills and bonds, shares or land and buildings) and other investments.

3 THE PROPOSALS FOR REVISING THE 2003 IORP DIRECTIVE

The 2003 IORP Directive (European Union, 2003) aimed to allow IORPs to benefit from the internal market principles of free movement of capital and free provision of services. More precisely, it encourages pension funds to manage occupational pension schemes for companies established in another Member State and enables pan-European companies to operate only one pension fund for all their subsidiaries. In addition, the Directive seeks to establish minimum prudential standards in order to ensure proper protection of fund members and beneficiaries. The Directive was implemented by all Member States in 2007.

In March 2014 the European Commission issued a legal proposal for a revision of the Directive.²³

In the run-up to the proposal issued in March 2014 a review of the Directive (2003/41/EC) took place, with the aim of creating a new risk-based EU-wide legislative framework for IORPs and facilitating cross-border activity. In the course of this, the European Commission released both a Green Paper in July 2010, setting the guidelines for the revised IORP Directive (see European Commission, 2010), and, in March 2011, a Call for Advice from EIOPA regarding the technical features of the revised directive²⁴. This Call for Advice also requested EIOPA to perform a quantitative impact study in order to provide stakeholders with information on the potential impact and to collect data to feed into the Commission's impact assessment that would accompany the legislative proposal for a new IORP directive. More specific technical specifications for the quantitative impact study were published in October 2012 and EIOPA's final advice to the European Commission was released in February 2012. EIOPA published its final report on 4 July 2013.

As mentioned before, EIOPA is expected to launch a second round of consultations for revisions on the asset side in autumn 2014, in particular on how to value sponsor support and benefit reductions, as well as on the optimal construction of the recovery period. This round of consultations will be followed by another quantitative impact study. Concrete input from EIOPA to the European Commission is expected by 2015.

The rationale for the review of the Directive (2003/41/EC) is manifold: first, according to the European Commission's Call for Advice, there are very few (84 out of 140,000) cross-border pension schemes despite the agency's desire for greater international coverage. Indeed, many of these 84 schemes were already operating on a cross-border basis prior to the introduction of the 2003 directive. The plans for a revised directive aim to provide additional incentives for IORPs to operate across borders by partly or fully pooling their pension schemes into one single pension fund, thereby fostering economies of scale, risk diversification and innovation, as well as simplified governance structures.²⁵

A second rationale for the review is the fact that DC schemes offered by IORPs have risen in popularity since 2003, but do not have adequate coverage in the first IORP Directive as regards the appropriate degree of protection against risks (which may be different from DB arrangements), let alone guidelines for an appropriate DC-specific investment strategy.

²³ The proposal contains, among other things, a holistic balance sheet approach and a concrete approach to value sponsor support.

²⁴ Available at http://eiopa.europa.eu/fileadmin/tx_dam/files/requestsforadvice/20110409-CfA-IORPII-final.pdf

²⁵ The recent endorsement of the pension portability Directive (see also discussion above) should also foster greater consolidation.

Furthermore, it is deemed desirable to harmonise key technical features across the EU, such as the “prudent person rule” by which investment strategies should be determined, as well as the role played by actuaries and the standards for discounting future asset returns and liabilities.

Finally, there are concerns about the pro-cyclical behaviour of pension funds, whereby falling “risk-free” rates and risky asset returns in times of downturns and crises may exacerbate pension funds’ “de-risking” behaviour in these periods, leading to feedback effects to these same asset classes.

In response to the European Commission’s Call for Advice, EIOPA has made further proposals in three areas of regular occupational pension scheme activity: governance, disclosure and quantitative assessment (EIOPA, 2012b). The quantitative assessment proposals would centre around two concepts: risk-based regulation and a so-called “holistic balance sheet” (HBS) framework that values IORPs’ financial assets and contingent assets against their liabilities, as explained in more detail below. However, in May 2013 the European Commission announced that the proposed revision of the IORP Directive would not include the solvency regulatory rules, but only governance and transparency rules.²⁶ The solvency part of the regulation will instead be subject to further impact assessment and may be revisited in the future. This delay in the consideration of solvency arrangements may thus have adjusted EIOPA’s timeline for finalising its proposals in these areas – the proposals made to date are nevertheless summarised below.

The risk-based component of EIOPA’s quantitative proposals – largely similar to those adopted²⁷ in the context of the Solvency II Directive for insurance corporations – would require IORPs to hold sufficient funds to meet their estimated discounted liabilities over a set horizon plus a buffer (currently calibrated at 8%) over these. In addition, IORPs would have to satisfy a minimum capital requirement (MCR), itself a fraction of the Solvency Capital Requirement (SCR). The value of the SCR is determined from requirements for specific individual risk concentration (where applicable to a particular²⁸ IORP), such as operational, intangible asset, market, credit, pension liability (such as longevity or catastrophe risks) and health risks. Specific shocks to each of these components generate changes in the gap between discounted assets and liabilities over a set horizon. Consequently, the impact of each shock on the gap, over a shock-free baseline, then forms the specific capital requirement for this risk.

While aimed at making the regulatory approach to IORPs more risk-sensitive, the revised IORP Directive that was planned would also include potential mitigating instruments that could be used to dampen some of the pro-cyclical impact induced by a risk-based approach. For instance, IORPs may in future be able to draw on a “counter-cyclical premium” that would soften the impact of large shifts in discount rate curves on their funding positions while still ensuring a greater sensitivity of investment strategies to market movements in “normal” times.²⁹ Such shifts have been a key concern in countries where DB arrangements are prevalent, such as the Netherlands, the United Kingdom and, even further afield, the United States, leading to adjustments in regulation governing discount rate calculations to provide relief to funds (see, for example, EIOPA, 2013). Though the

26 See the European Commission’s press release on “Occupational Pension Funds: Next Steps”, dated 23 May 2013; http://europa.eu/rapid/press-release_MEMO-13-454_en.htm.

27 See “Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II)”; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:335:0001:0155:en:PDF>.

28 Intangible assets include items such as the reputation of the IORP, investment savings resulting from economies of scale, and comparative advantages in retirement provision (owing, for example, to greater administrative expertise).

29 The idea of the countercyclical premium is to allow for an adjustment of the discount rate in the event of financial markets being stressed.

exact form of the proposed pro-cyclical dampener is still unclear, EIOPA set a counter-cyclical premium adjustment of 100 basis points in its recently completed quantitative impact study.³⁰

In the autumn of 2012 EIOPA launched a quantitative impact study on the holistic balance sheet approach, with the support of occupational pension schemes in eight Member States. The results were published on 10 July 2013. The study provided tentative insights into the reliability of estimating technical provisions, sponsor support and solvency capital requirements under the holistic approach. The quantitative impact study has reinforced the need to continue working towards an EU regulatory regime for IORPs that would be market-consistent and risk-based. Furthermore, it concludes that, in order to fully assess the holistic balance sheet approach, additional technical work is needed with respect to sponsor support, benefit adjustment mechanisms, discretionary management decision-making processes and supervisory responses.

As far as the holistic balance sheet approach is concerned, the proposals would expand IORPs' balance sheets by requiring both financial assets and contingent assets (such as additional employer/employee support) to be "appropriately" valued against all types of liabilities (i.e. technical provisions, contingent and discretionary liabilities, as well as a risk buffer and the minimum capital requirement) over an "appropriately lengthy" time horizon (not defined by EIOPA). Exhibit 1 illustrates the general concept of the holistic balance sheet approach.

Valuation is intended to be performed on a largely fair-value basis. However, the valuation of contingent financial assets and liabilities is subject to greater discretion.³¹ For example, as regards contingent assets, the valuation of sponsor support, whether in the form of one-off supplementary contributions, pledging contingent assets to be released if needed, sharing of windfall surpluses, or other support, is intended to take into account the maximum possible value of such support. According to EIOPA, this support and its maximum should be a function of both current and future wealth that the IORP could potentially draw upon, taking into account both the probability of the sponsor defaulting (measured by its credit rating) and the expected post-default recovery rates.

Exhibit 1 The revised IORP Directive's holistic balance sheet

Standard IORP balance sheet	
Assets	Liabilities
Financial assets	Technical provisions Risk buffer (depending on regulation) Solvency capital requirement (depending on regulation) Excess liabilities
Proposed holistic IORP balance sheet	
Assets	Liabilities
Financial assets Contingent assets Additional employer support (and/or pension protection fund) Additional employee support	Best estimate of liabilities Technical provisions Contingent and discretionary liabilities Risk buffer Solvency capital requirement Excess liabilities

Source: EIOPA.

30 Detailed specifications are available at <https://eiopa.europa.eu/consultations/qis/occupational-pensions/quantitative-impact-study/index.html>

31 According to the guidance provided by EIOPA, contingent liabilities include items for which there are specific legal rules in place, such as increasing pensions in line with inflation or depending on changes in the quantified funding position of the IORP balance sheet. On the other hand, discretionary liabilities have less legal certainty and may, for example, include rules governing the sharing of surplus funds between members and the sponsor.

On the liability side, in addition to the introduction of capital requirements, the full range of conditional, discretionary and “mixed” benefits that members might enjoy would also be quantified as far as possible. The holistic balance sheet would also include items such as the potential for *ex post* benefit reductions (for example inflation indexing applied on pensions in past years). As regards the discount rate to be used, EIOPA proposes a “matching adjustment”, whereby discount rates are adjusted upwards in line with the expected spread of asset returns over the risk-free rate. This would recognise the long duration of pension fund liabilities (in contrast to, say, banks), which suggests that a longer-term discount rate that matches the long-term approach used for investments may be more appropriate. The matching adjustment is explored by EIOPA (a final guidance has not yet been provided at the time of writing). In addition, the counter-cyclical premium described above would also play a role in determining the appropriate discount rate.

Estimated pension assets and future liabilities (as part of a valuation) are highly unlikely to be equal – many plan parameters, such as contribution rates and investment strategies, are themselves based on forecasts. As a result, parameters are unlikely to be perfectly calibrated to the latest financial and demographic conditions (and, furthermore, cannot be rapidly adjusted owing to legal, procedural and technical barriers). Even so, a difference between assets and liabilities can either raise concerns about the degree of security afforded to members or, in the case of excess assets, raise questions regarding the thresholds above which surpluses might be shared. There are many different national arrangements to govern these situations, with individual IORPs also having discretion. Looking ahead, the feasibility of introducing a common level of security (such as a target solvency ratio) across occupational pension schemes in the EU may also be explored by the European Commission at a later stage, although this will depend on the resumption of analysis in order to investigate common quantitative assessments of IORPs’ balance sheets.

In view of these regulatory proposals, the next section discusses the potential impact of a revised IORP directive on the long-term investment behaviour of IORPs.

4 LONG-TERM INVESTMENT IMPACT OF THE EUROPEAN COMMISSION'S 2011 CALL FOR ADVICE FOR A REVISED IORP DIRECTIVE

As far as the potential impact of the IORP solvency requirements proposed in the context of the review of the IORP directive on the long-term investment behaviour of IORPs is concerned, it should be highlighted that the assessment provided in this and the following sections remains highly preliminary. Should solvency requirements be introduced, there are likely to be further refinements to the relevant specifications set out by EIOPA, since key features of the holistic balance sheet approach and the risk-based framework have not been clarified.³² For example, it is not clear whether IORPs shall be obliged to withstand shocks with a 95%, 97.5% or 99.5% confidence level over a one-year period. Second, it remains to be determined whether IORPs shall use a theoretical risk-free rate or the expected return on assets as a discount rate. Third, the countercyclical premium remains to be fully calibrated. Fourth, appropriate repayment schedules for any pension deficit, a key feature of the holistic balance sheet approach, are yet to be decided upon.

In any event, the ultimate impact of a revised directive on the behaviour of IORPs will depend on their legislative starting point, which tends to differ significantly across EU countries. For example, the existing IORP regulation in the Netherlands already contains many elements found in EIOPA's proposals (albeit with different calibration), chiefly regarding requirements for adequate buffers against market, credit, inflation and other risks. In the United Kingdom, despite having a somewhat less rigorous risk-based approach than the Dutch regulatory regime, the Pension Protection Fund (which works in a similar manner to a deposit guarantee fund) would tend to give UK IORPs a boost in terms of meeting minimum funding requirements (since pension protection funds can count as a substitute for or complement sponsor support in the holistic balance sheet). An ideal long-term impact assessment would thus take each national framework as a starting point.

Importantly, IORPs' investment decisions are but one of several options for adaptation to the requirements of a revised IORP Directive. In particular, IORPs can adopt different long-term policies on pension benefit calculations, member and sponsor contribution rates, surplus sharing and all other aspects of the pension promise. Much as changes in labour mobility regulations spurred the development of DC schemes (see Section 2.2), wholesale changes in IORPs' required balance sheets may well generate new types of pension promises, each with their own demographic profile and underlying approach towards investment (be it low-risk, life-cycle, dynamically hedged or other types).

As a result of these numerous uncertainties, many IORPs could be expected to adopt a "wait and see" attitude towards incorporating principles contained in a revised IORP Directive into their investment behaviour. However, as in the case of the Solvency II Directive for insurers (ECB, 2007a), it is possible that a subtle shift in mentality may already have begun as a result of the financial crisis and wider discussions on risk-based requirements for pension funds.

Indeed, a number of studies are already suggesting a significant shock to the IORP sector in the EU on the whole if the EIOPA specifications, as they stand at the point of writing, are adopted. First, it appears that investment risks among IORPs are not always well understood or adequately hedged (Sender, 2010, and Cocquemas, 2012). Any harmonised, risk-based regulation would not only bring greater clarity, but also a requirement to adapt behaviour, most likely spurring substantial shifts in investment portfolios. Even countries already incorporating risk-based regulation, such as

³² It is worth recalling that, in the case of the Solvency II Directive covering EU insurance providers, five quantitative impact studies have been conducted.

the Netherlands, may feel heavily affected by it. For example, De Haan et al. (2012b) estimate a potential funding gap of between €38 billion and 155 billion for the Dutch IORP sector (up to 19% of assets in 2011) owing to the adoption of the holistic balance sheet approach, depending on whether pension inflation/salary indexation is present or treated as a financial option (assuming full inflation/salary indexation would increase the funding gap to €411 billion). The UK Pensions Regulator projected a gap of around GBP 150 billion (about 15% of IORP assets in 2011), assuming that sponsor support would be recognised in the holistic balance sheet (which would otherwise further increase the gap; see The Pensions Regulator, 2012).

IORPs would have several possible responses available to them if the funding gaps suggested by these studies were to materialise. However, available adjustments such as pension promises, contribution rates and indexation policies often require time and effort to be set and are thus likely to evolve only gradually over time. Adjusting investment strategies is another option, and one that IORPs might prefer to pursue – at least in the short to medium term – given the possibility of avoiding difficult negotiations with members. Were this route to be taken, IORPs that face a funding gap in the presence of risk-based solvency constraints could be expected to adjust their investment strategies towards investments that consume less capital (i.e. are less risky). This would come either in the form of an increased use of derivatives for hedging purposes or a shift away from investments with high risk “weights”, such as equities, towards highly rated fixed-income securities (De Haan et al., 2012a). The key regulatory drivers of such shifts would depend on the country-specific conditions governing the domestic IORPs. This notwithstanding, in general, factors such as the choice of discount rate (i.e. mark to market, expected return on assets, including/excluding the countercyclical premium, etc.), the length of the recovery period permitted to fill any funding shortfall and the risk-based capital charges (e.g. for market risk) should play an important role in shaping the revised IORP Directive’s overall impact on the investment behaviour of IORPs.

Even though the final formulation and timing of the implementation of a revised IORP Directive are unclear at the moment, lessons on the impact of fair value accounting and the implementation of risk-based solvency and funding regulation can be drawn from past experience.

Severinson and Yermo (2012) analyse the impact of fair value accounting, risk-based funding regulations and stress tests on pension funds’ investment strategies in several countries.³³ Some regulatory changes may have accelerated the general de-risking trend that has prevailed since 2001, the introduction of fair value accounting for pensions in the United Kingdom in 2003, of International Financial Reporting Standards (IFRS) in the European Union in 2005 and of the risk-based solvency regime in the Netherlands in 2007. The study comes to the conclusion that de-risking of pension fund portfolios has taken place in all countries under consideration except Finland. The largest share of de-risking is attributed to changes in regulations, since pension funds in several OECD countries that were subject to the same macroeconomic environment did not de-risk their asset allocation to the same extent as the countries where risk-based funding regulation was introduced.

At the same time, two studies (The Pensions Regulator, 2012, and De Haan et al., 2012a) state that the funding ratio³⁴ could decrease substantially with the introduction of a revised IORP Directive, depending on the scenario and the option considered. If this were to occur, further de-risking is to be

33 The countries analysed are the United Kingdom, Denmark, Finland, Germany, the Netherlands and Sweden.

34 The funding ratio is, broadly speaking, expressed as the ratio of a pension fund’s assets to its liabilities. There are various approaches to determining both the assets and liabilities, which must take into account expected returns on investments in the future and appropriate discount rates, as well as issues such as the appropriate forecast horizon (over which to apply investment returns and discounting of liabilities) and whether future contribution rates are to be included or excluded.

expected, as in previous introductions of national risk-based funding regulations. The econometric analysis presented in Section 5, while acknowledging the substantial caveats surrounding it, could suggest that IORPs may already be adjusting their investment strategies, possibly in expectation of more stringent funding constraints once the revised Directive has been approved and implemented.³⁵

Further indications can be drawn from the insurance sector in the context of the Solvency II Directive, scheduled for implementation in 2015-16.³⁶ While the ECB (2007a) suggested a similar de-risking impact was likely, also owing to greater risk-based regulation, more recent analysis by L'Hoir and Sauve (2012) claims that the Solvency II Directive may have already led to a greater appetite for corporate and sovereign debt and a smaller appetite for equities, as well as providing incentives for broader diversification and greater use of derivatives for hedging purposes. The authors assess the impact of insurance corporations' investment flows on stock market returns, corporate bond spreads and government bond yields, and conclude that rebalancing appears to have led to significant downward pressure on corporate bond yields, as well as having a negative impact on equity prices and a very limited impact on government bond yields.

Section 5 empirically explores the high-level hypothesis that that the European Commission's proposals of 2010 for a revised IORP Directive may lead, and may already be leading, to IORPs adapting their investment strategies to focus on asset classes that are not as risky.

35 It is also conceivable that, in addition to de-risking, another result of the Directive could be that the IORP would modify its "pension promises" by i) increasing contributions (to DC plans), ii) reducing pensions (e.g. indexation, etc.) and iii) increasing the retirement age.

36 The size of the insurance sector in terms of total assets is about three times that of the occupational pension funds sector, implying that the impact on asset prices of a shift in the asset mix of the same proportion as that observed for insurance, would be significantly smaller.

5 EMPIRICAL ANALYSIS

This section analyses whether the draft discussions around a revised IORP Directive have already affected the asset allocation and therefore the riskiness of IORPs' investment positions.³⁷ As stated above, in July 2010 the European Commission (2010) issued a Green Paper on European pension systems, integrating the topic of solvency risk into a much broader discussion regarding pension policy across Europe. Since the main principles of a revised IORP Directive had already been laid out in the 2010 Green Paper, it cannot be excluded that IORPs had already begun adjusting their investment strategies in 2010, with the aim of smoothing the transition to a risk-based capital regime. Regarding the Commission's postponement of the solvency requirements in May 2013, the announcement that the risk-based solvency rules would be deferred should not affect the results of the analysis, as the sample for the empirical analysis presented in this section only covers the period up until the end of 2012. The empirical analysis is based on information about the regulatory changes that had been communicated publicly by the European Commission (and EIOPA) up until the end of 2012.

In order to analyse the impact that the plan for a revised IORP Directive may already have had on investment strategies, a variable has to be created that accounts for both investment allocation and the risk of that allocation. In this analysis, risk-weighted assets (RWA) are used for this purpose and are subsequently employed as the dependent variable in the econometric analysis.³⁸ Changes in this variable allow both shifts among asset classes and/or changes in the risk exposure to be captured at the same time. In order to isolate the effect on risk and asset allocation, a number of firm-specific and macroeconomic variables that are commonly believed to influence investment decisions and risk-taking, as well as an IORP time dummy variable reflecting the time of the announcement of the planned revision of the IORP Directive, are regressed on the RWA measure.

However, owing to the highly volatile macroeconomic environment and firm-specific changes in the aftermath of the 2008 financial crisis, it is likely that portfolio shifts have been driven by other factors in addition to those potentially induced by the expected revision of the IORP Directive and the firm-specific and macroeconomic control variables. This issue is addressed through the introduction of several financial stress indicators, which are likely to capture most of the crisis-induced investment changes.

The risk embedded in an IORP's investment position is determined by the relative share of debt, equities, real estate, cash and other assets in total pension assets. As a starting point and reference variable, RWA are weighted in line with the EIOPA's fifth quantitative impact study (III) regarding the Solvency II Directive, as referenced in ECB (2007a). Box 1 (below) sets out further details of the construction of the RWA indicators.

37 Methodologically, this analysis broadly follows ECB (2007a): "Evaluating Solvency II and its potential impact on the financial markets", pp. 28-32.

38 RWA are a common way to assess a bank's or insurance corporation's asset exposures, weighted according to risk, by investors and regulators alike. See, for example, Das and Sy (2012) for a discussion on RWA measures and investors' use thereof.

Box 1

CALCULATING RISK-WEIGHTED ASSET INDICATORS FOR EMPIRICAL ANALYSIS

This box describes the different versions of the risk-weighted asset (RWA) indicator employed in the empirical analysis.

The main reference RWA indicator is based on weights, in line with EIOPA's quantitative impact study regarding the Solvency II Directive. In order to obtain a risk indicator for company i , the following calculation is carried out:

$$RWA_{i,t} = 0.06 Bonds_{i,t} + 0.12 Equities_{i,t} + 0.08 Real Estate_{i,t} + 0.00 Cash_{i,t} + 0.00 Other_{i,t}$$

Various weighting schemes are investigated, since estimation results could depend on the risk weights used in order to construct RWA. As an initial robustness measure, RWA are weighted in line with the Basel II-based standardised approach for banks on the basis of similar credit risks being faced by both banks and pension funds by holding these assets to maturity. This results in the following RWA measure (see Table A2 in Appendix A for regression results with this measure of RWA as the dependent variable).¹

$$RWA_Basel_{i,t} = 0.00 Bonds_{i,t} + 0.20 Equities_{i,t} + 0.35 Real Estate_{i,t} + 0.00 Cash_{i,t} + 0.00 Other_{i,t}$$

As an additional robustness measure, time and country-specific debt weights are constructed^{2, 3, 4} from government bond yields (LTN) and sovereign CDS prices (see Tables A, B and C below) to reflect the potentially increasing discrimination between euro area sovereigns.

$$RWA_ltn_{i,t} = (LTN\ yields) Bonds_{i,t} + 0.12 Equities_{i,t} + 0.08 Real Estate_{i,t} + 0.00 Cash_{i,t} + 0.00 Other_{i,t}$$

$$RWA_CDS_{i,t} = (CDS\ based\ risk\ weight) Bonds_{i,t} + 0.12 Equities_{i,t} + 0.08 Real Estate_{i,t} + 0.00 Cash_{i,t} + 0.00 Other_{i,t}$$

- 1 Owing to data limitations, it was not possible to assess the possible use of risk diversification within asset classes or the use of hedging strategies as alternative investment responses.
- 2 In order to reflect a possible change in the investment risk of government bonds, the debt weight of 0.06, from EIOPA's Solvency II quantitative impact study, is replaced by countryspecific yearly average LTN yields.
- 3 The debt weight of 0.06 is replaced by debt weights constructed from yearly averages of country-specific CDS prices. In order to represent the fact that government bonds are no longer perceived as risk-free assets and to leave ample space for variations of risk between countries, an interval for debt is centred at the weight of 0.06, which was suggested by the EIOPA quantitative impact study (III) on the Solvency II Directive (EIOPA (2003b)). It is allowed to fluctuate by 3 percentage points in either direction so as to surpass the risk weight assigned to real estate in extreme situations and to half the constant risk weight assigned by EIOPA (2003b). On a yearly basis, the country with the highest average CDS price is assigned a debt weight of 0.09, while the country with the lowest average CDS price is assigned a debt weight of 0.03. All other countries are placed depending on their relative position towards these two countries across the interval [0.03; 0.09].
- 4 The debt weight of 0.06 is replaced by debt weights constructed from yearly averages of country specific CDS prices as in footnote 3. The country with the highest yearly average CDS price over the period 2007-12 is assigned a debt weight of 0.09 in the respective year, the country with the lowest yearly average CDS price over the period 2007-12 is assigned a debt weight of 0.03 in the respective year. All other countries are placed depending on their relative position towards these two countries across the interval [0.03; 0.09].

Table A

RWA debt weights, LTN-based	AT	BE	CY	GR	IE	IT	NL	PT	ES	BG	GB
2007	4.42	4.47	4.48	4.63	4.51	4.63	4.41	4.52	4.40	4.74	4.57
2008	3.85	3.77	4.60	5.20	4.44	4.38	3.55	3.96	3.82	4.19	3.02
2009	3.89	3.72	4.60	5.76	4.88	4.16	3.56	4.06	3.99	3.91	4.01
2010	3.49	3.97	4.60	12.54	9.23	4.87	3.14	6.68	5.46	3.31	3.40
2011	3.10	4.10	5.79	33.97	8.52	7.02	2.21	13.56	5.09	2.12	1.98
2012	2.37	3.04	na	24.20	6.25	5.48	1.95	10.63	5.87	4.55	1.87

Table B

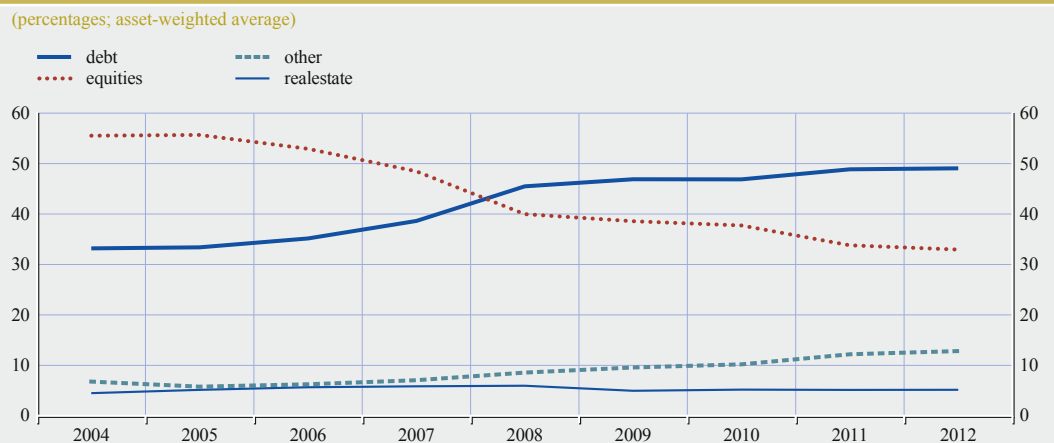
Constant interval; yearly calculation	AT	BE	CY	GR	IE	IT	NL	PT	ES	BG	GB
2007	3.00	3.05	6.22	4.01	3.98	4.19	3.13	3.77	3.63	9.00	3.59
2008	3.29	3.30	3.50	4.60	3.97	4.08	3.00	3.75	3.74	9.00	3.49
2009	4.07	3.20	5.13	5.38	5.95	4.07	3.00	3.49	3.76	9.00	3.59
2010	3.32	3.61	6.18	9.00	5.40	4.14	3.00	5.33	4.51	5.02	3.27
2011	3.08	3.27	5.56	9.00	4.25	3.44	3.00	4.46	3.47	3.39	3.01
2012	3.04	3.07	3.11	9.00	3.22	3.18	3.02	3.44	3.20	3.10	3.00

Table C

Constant interval; yearly calculation	AT	BE	CY	GR	IE	IT	NL	PT	ES	BG	GB
2007	3.00	3.00	3.01	3.00	3.00	3.00	3.00	3.00	3.00	3.02	3.00
2008	3.02	3.02	3.02	3.04	3.03	3.03	3.01	3.02	3.02	3.12	3.02
2009	3.06	3.03	3.08	3.09	3.10	3.06	3.03	3.04	3.05	3.18	3.04
2010	3.04	3.06	3.20	3.36	3.16	3.09	3.02	3.15	3.11	3.14	3.04
2011	3.06	3.11	3.76	4.74	3.39	3.16	3.03	3.45	3.17	3.14	3.04
2012	3.06	3.10	3.14	9.00	3.25	3.21	3.04	3.47	3.22	3.13	3.03

As shown in Chart 7, the asset allocation of firms in the sample (starting in 2004) has moved steadily towards debt securities and away from equities. Even before 2012 an increase in exposure to government bonds could be observed across the pensions industry (Towers Watson, 2013).³⁹

Chart 7 Asset allocation of IORPs that report asset allocations starting in 2004

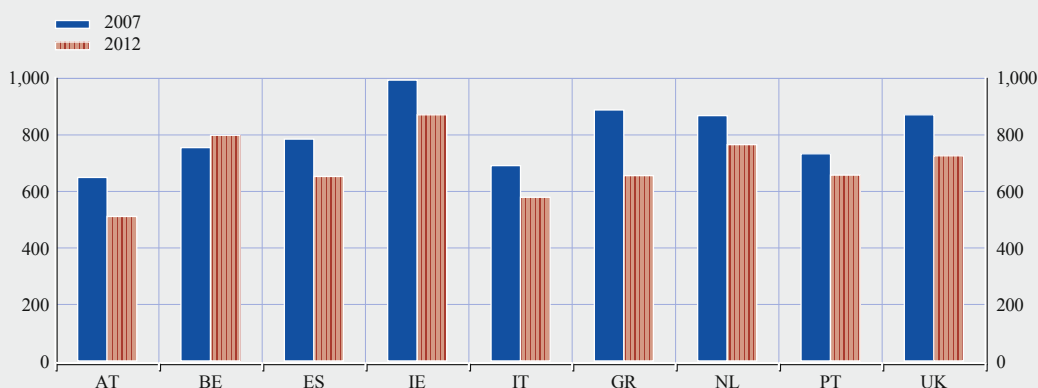


Source: Bloomberg, Thomson Reuters Datastream.

³⁹ A similar finding was reported in ECB (2011).

Chart 8 Risk-weighted assets

(country averages; 2007 and 2012)



Source: ECB.

Note: Not all countries are included in the final estimation sample reported below owing to further reductions in the sample size following the inclusion of company-specific variables.

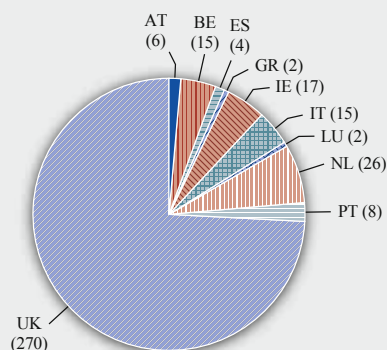
Interestingly, a further marked shift in this direction across the companies in this sample was observed in 2011, compared with allocations over the 2008-10 period. This trend continued in 2012, albeit in a somewhat more moderate fashion.

Country averages of RWA from all companies included in the sample for the years 2007 and 2012 are shown in Chart 8. It can be observed that RWA – and thus the perceived riskiness of allocations – declined in all countries except Belgium, although these estimates should not necessarily be treated as representative for asset allocations in any given country owing to low sample sizes for certain countries.⁴⁰

This paper investigates a possible sample of 5,491 companies in Bloomberg and Datastream covering 27 EU countries. Of these companies, 521 report their pension asset allocations, and 422 of these report their asset allocation in a consistent manner from 2007 onwards and can therefore be considered in the analysis.⁴¹ However, the sample size falls further to 357 firms once the model is refined with additional company-specific variables. Chart 9 illustrates the unbalanced sample breakdown across countries; United Kingdom-quoted firms make up about 52% of the sample, followed by Germany (10%), France (10%) and the Netherlands (5%). A breakdown in terms of country assets suggests a similar profile – in contrast to the asset breakdown suggested above in Chart 2. This

Chart 9 Number of IORPs per country in the estimation sample

(Numbers; 2012)



Sources: Bloomberg and Thomson Reuters Datastream.

Note: Firms reporting pension fund asset allocations consistently from 2007 to 2012.

⁴⁰ Using the definition of risk-weighted assets adjusted for country-level sovereign borrowing costs instead does not alter the picture materially.

⁴¹ Using an “unbalanced” panel could lead to biased results. Moreover, a balanced panel is necessitated by the difference-in-difference estimation carried out below in Section 4.2.

implies that the sample in this paper is under-represented with Dutch firms, but has a comparatively greater coverage of UK firms and other continental European arrangements.

The data used in the quantitative analysis are drawn from various sources. Macroeconomic control variables and crisis indicators are taken from the ECB and Eurostat, while IORPs' investment position and firm characteristics are sourced from Bloomberg and Thomson Reuters Datastream (for more details, see Appendix B). The econometric analysis is based on a balanced panel dataset with an annual frequency, covering the period 2007-12.⁴²

5.1 APPROACH 1: OLS PANEL ESTIMATION

In order to formally assess the impact of the revised IORP Directive on the investment position of IORPs, a panel regression is applied – econometric tests suggest the use of a fixed effects regression model with robust standard errors. Table 2 shows the base case specifications and main results (in OLS first-differenced terms). Column 1 shows the results of a regression of exclusively macroeconomic control variables on the proposed measure of RWA (based on EIOPA's quantitative impact study (III) for the Solvency II Directive) for a balanced panel of 357 companies, starting in 2007.

For the purpose of accounting for the considerable uncertainty regarding the impact of a regulatory change that has not yet been approved, the empirical approaches taken in this subsection are aimed at analysing the potential effects on IORPs' asset allocation strategies from several perspectives. The starting point for the empirical analysis is ordinary least squares (OLS) estimations where the dependent and independent variables are expressed in first-differenced terms (i.e. focusing on the changes in the variables). This approach accounts for the fact that variables are found to be serially correlated⁴³. See Box 2 for a more detailed description of the applied econometric methodology.

The main result is that the IORP Directive dummy variable gets a negative and statistically highly significant coefficient (Table 2, columns 1-5). This finding is consistent across the different model specifications using various combinations of explanatory control variables. The result also holds when incorporating the different crisis-related indicators (i.e. CISS, GIFT and SRI, columns 3-5).

The results therefore suggest that merely proposing stricter solvency-based IORP regulation may have prompted de-risking of aggregate investment portfolios. One plausible motive for this reaction would be to avoid the need for adjustment upon implementation being too abrupt, should the revised IORP Directive include these proposals. Obviously, due caution is needed when interpreting these results, as the sample window includes financial market turbulence and wider policy actions that are likely to have affected IORPs. To account for this uncertainty, specific care has been taken to control for such exogenous factors (see also below), but the sheer magnitude and scope of the economic and financial developments observed in recent years complicates the task of isolating the potential impact of the revised IORP announcement. This is further illustrated by the low statistical fit (r-squared) of the regressions in all variations presented in Table 2.

Including firm-specific control variables (column 2) in the regression slightly increases the size of the revised IORP Directive's effect on RWA and significance remains at the 1% level. Moreover, the findings are in line with the intuition that a greater degree of risk-taking, which may be the case

42 The starting year for the sample is 2007. While a smaller cross-section of firms report pension asset allocations consistently, the further back the start year goes (to 2004), 2007 was chosen in order to compromise between having long enough time series and a sufficiently large cross-section for the panel analysis.

43 The serial correlation test described in Wooldridge (2002), and also examined in Drukker (2003), was applied.

among larger firms⁴⁴, would be met with a correspondingly greater de-risking movement following risk-based regulation. For example, it does not appear that pension plan size (*size_plan_chg*) plays a role in determining the riskiness of investment allocations, either in columns 2-5 or in the more detailed column 7, which attempts to address the distinct effect the revised IORP Directive could have on IORPs of different sizes by introducing interaction terms of the Directive dummy with the size cut-off measures.

44 See Bikker et al. (2010) for a study on Dutch occupational pension funds.

Box 2

OLS ESTIMATION

The framework includes several macroeconomic variables that could be expected to affect the composition of IORPs' investment portfolios, set for country j at time t . These are the year-on-year growth of domestic real GDP (*rgdp_chg*), the year-on-year growth of domestic stock indices (*sto_chg*), the year-on-year (first-differenced) change in yields on country-specific ten-year government bond yields (*ltn_chg*) and the year-on-year growth of domestic residential property prices (*respp_chg*).

The global financial and euro area crises are likely to have affected fund allocation strategies in recent years. It is therefore necessary to control for these events to properly identify the possible impact of the IORP proposals.¹ To this end, different measures for financial stress are included: the Global Index of Financial Turbulence (GIFT),² the Composite Indicator of Systemic Stress in the Financial System (CISS)³ and the Systemic Risk Indicator (SRI).⁴ Chart B1 (below) illustrates the movements observed in recent years for each of these financial stress indicators.

Asset allocation differences between companies, as well as shifts across time, are also likely to be driven by firm-specific characteristics. Thus, firm-specific control variables are included:

- 1 These indicators were not used in ECB (2007a). Instead, standard macroeconomic control variables were assumed to capture market-induced investment changes. In the present analysis, these three indicators are considered owing to the large probability of these indicators being able to control for crisis-specific stress periods and the changes in IORPs' asset allocation that may result. The three financial stress indicators have been reported on in recent issues of the Financial Stability Review and Monthly Bulletin of the ECB.
 - 2 The GIFT is composed of the following variables: the 12-month rolling covariance of banking sector stock returns with overall stock market returns; the 12-month moving averages of the spread between three-month interbank lending rates and three-month government bill rates, spreads between short and long-term government bond yields, spreads between corporate bond yields and long-term government bond yields, and monthly changes in the nominal effective exchange rate; and, finally, the six-month moving averages of the squared month-on-month stock returns and the nominal effective exchange rate. The index is normalised, so a value of zero implies neutral financial market conditions, taking into account the various sub-indices. The index is available at the country level for Denmark, France, Germany, Italy, Spain, Sweden and the United Kingdom; where not available, the euro area aggregate estimate is used for Austria, Belgium, Cyprus, Greece, Netherlands, Portugal and, despite not being in the euro area, Bulgaria. A further description is available in the ECB's Financial Stability Review, December 2009, pp. 21-23.
 - 3 The CISS is constructed using basic portfolio theory to the aggregation of five market-specific sub-indices created from a total of 15 individual financial stress measures. For further details, see Holló et al. (2012).
 - 4 The SRI is constructed using the CDS spreads and equity returns of a basket of 22 global large and complex banking groups (LCBGs). These, in turn, are used to construct aggregate probabilities of simultaneous LCBG defaults, which can also be interpreted as market perceptions of the probability of an adverse systemic event occurring among euro area LCBGs, as well as among global LCBGs. The SRI and its calculation were first presented in the ECB's Financial Stability Review, December 2007, pp. 125-127.
- 3 The CISS is constructed using basic portfolio theory to the aggregation of five market-specific sub-indices created from a total of 15 individual financial stress measures. For further details, see Holló et al. (2012).
 - 4 The SRI is constructed using the CDS spreads and equity returns of a basket of 22 global large and complex banking groups (LCBGs). These, in turn, are used to construct aggregate probabilities of simultaneous LCBG defaults, which can also be interpreted as market perceptions of the probability of an adverse systemic event occurring among euro area LCBGs, as well as among global LCBGs. The SRI and its calculation were first presented in the ECB's Financial Stability Review, December 2007, pp. 125-127.

profits, pension plan size, the funding gap and the sector the sponsoring company operates in.⁵ These are discussed below.

The return on assets, $roa_{i,j,t}$, is used as a control variable, since a high level of profitability may free up company resources to invest according to a different strategy. This is conditional on other firm features being unchanged. The observed effect could, however, be biased if a large change in the return on assets was due to a fundamental change in the firm's balance sheet, such as a restructuring, merger or acquisition. A dummy variable is thus introduced into the regression for the bottom and top 1% of companies in terms of the return on assets ($roa_chg_large_{i,j,t}$).

The size of the IORP's total plan assets, $size_plan_{i,j,t}$ is also expected to influence the risk taken in its investment position. Large-sized IORPs may have easier access to capital markets and a larger risk diversification potential. The logarithm of total plan assets is thus introduced to account for these differences. As a separate sensitivity check, in order to capture potential differences in the adjustment process between various sizes of firms, a dummy variable is constructed that divides firms into small, medium and large groups, according to the amount of pension plan assets. Companies in the sample are split into three parts (using the 33rd and 66th percentiles of the asset size distribution), according to the size of the plan assets.

Next, the ratio of total pension plan assets to projected liabilities, $funding_gap_{i,j,t}$, is included to capture the possible need to adjust investment risk depending on the ability of existing assets to cover future liabilities.⁶ The pension scheme is overfunded if the value of the ratio is above 1 and underfunded if it is below 1. Like the approach taken for the return on assets, a large year-on-year change in the funding gap (1%/99% cut-offs) is controlled for by a dummy variable ($funding_gap_chg_large_{i,j,t}$). As with profits, a further sensitivity check is also conducted to explore whether IORPs' investment risk preferences are influenced by the degree to which they are over or underfunded. A dummy variable is thus constructed: firms are divided into the following three categories: overfunded, underfunded and very underfunded, according to their position relative to the 33rd and 66th percentile of the sample funding gap distribution.

Finally, a dummy variable named *IORP* is included (taking the value of 1 in 2011 and 2012 and the value of 0 otherwise) in order to capture the possible impact of the revision announcements and proposals on IORPs' investment portfolios in these years. Asset allocation changes observed in 2011-12 are hypothesised to have occurred following the publication of the European Commission's Green Paper in August 2010 and, in particular, its subsequent and more explicit Call for Advice in March 2011.

The main estimation equation reads as follows:

$$\begin{aligned}
 &RWA_{i,j,t} - RWA_{i,j,t-1} \\
 &= \beta_0 + \beta_1 rgdp_chg_{i,t} + \beta_2 sto_chg_{i,t} + \beta_3 ln_chg_{i,t} \\
 &+ \beta_4 resp_chg_{i,t} + \beta_5 crisis_variable_chg_{i,t} + \beta_6 roa_chg_{i,t} \\
 &+ \beta_7 size_plan_hg_{i,t} + \beta_8 funding_gap_chg_{i,t} + \beta_9 (country_j \\
 &* IORP_t) + \varepsilon_t
 \end{aligned}$$

5 The question of whether employer pension contribution rates could play a role in determining pension fund investment strategies was also explored. Unfortunately, a sufficient minimum sample size was not possible using this variable owing to limited data availability.

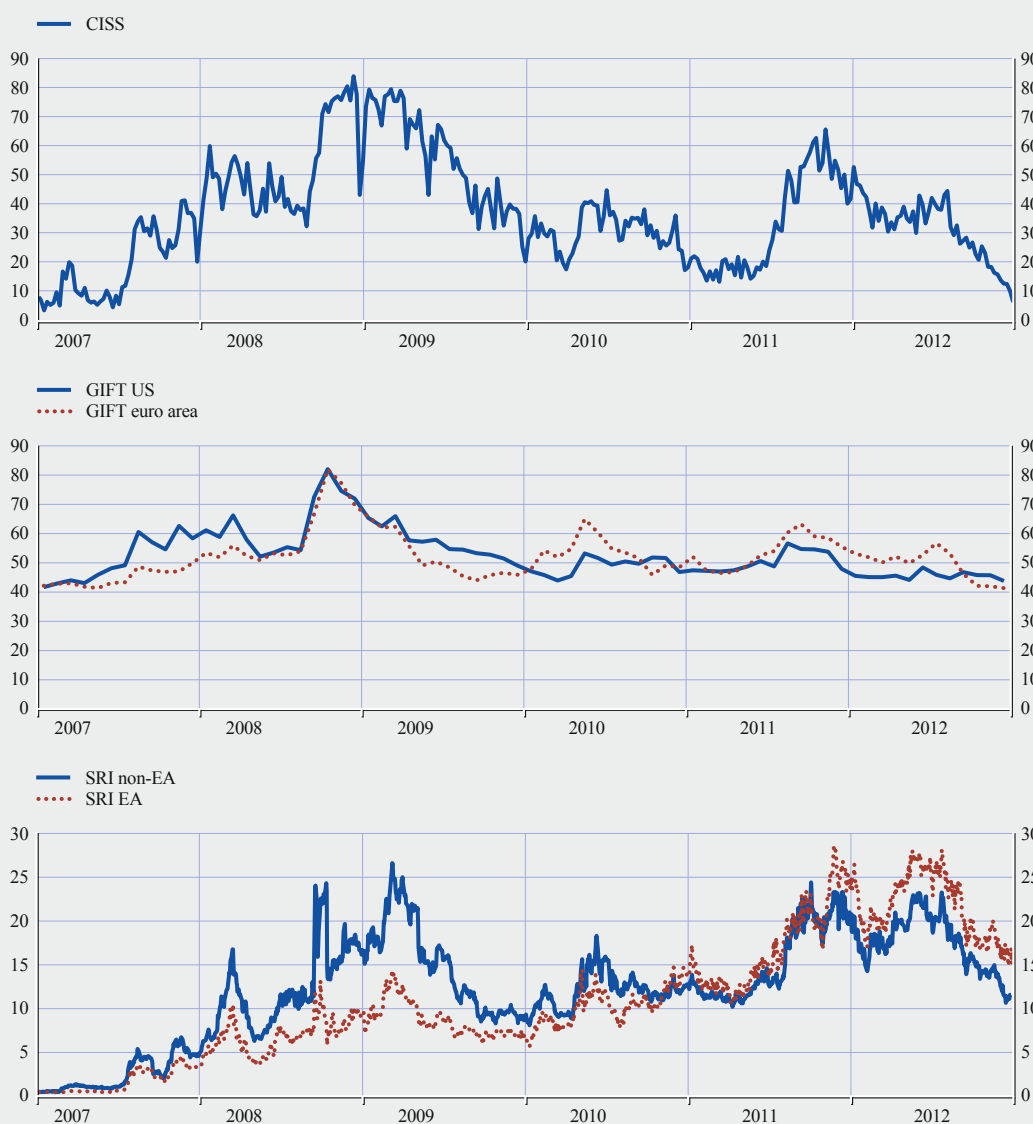
6 The measure of liabilities used is the projected benefit obligation, according to generally accepted accounting principles (GAAP), in order to allow comparability between EU and US samples throughout the analysis.

Although lagged measures of the explanatory variables could also play a role in determining investment allocations, these are not included owing to the small sample size (starting in 2007). Additionally, in order to control for the potentially heterogeneous impact that the revised IORP Directive could have had across countries, a second baseline specification is defined that includes interactions of country dummy variables with the revised IORP dummy variable:

$$\begin{aligned}
 &RWA_{i,t} - RWA_{i,t-1} \\
 &= \text{constant} + \beta_1 \text{Region}_i + \beta_2 \text{IORP}_t + \beta_3 (\text{IORP}_t * \text{Region}_i) \\
 &+ \beta_{cv} \text{Control Variables}_{i,t} + \varepsilon_{i,t}
 \end{aligned}$$

Chart B1

(percentages; CISS and SRI: daily; GIFT: monthly)



Source: ECB.

The same investigation is carried out taking into consideration the degree of funding. The results suggest that firms with a large negative funding gap are more likely to take greater investment risks (relative to slightly underfunded firms) in order to recover a more sustainable position, making them less receptive to regulatory changes through the revised IORP Directive.⁴⁵ Specifically, compared with very underfunded IORPs, the revised IORP Directive appears to motivate more conservative investment strategies (greater RWA reduction) if the IORP is classified as underfunded, but not if the IORP is classified as overfunded (Table 2, column 8). At the same time, there is no statistically significant difference in the impact when comparing overfunded with underfunded firms.⁴⁶ This result also holds when separating the sample into the three categories (very underfunded, underfunded and overfunded; see Appendix A, Table A3 columns 2-4) and further differentiating by country within these funding categories (see Table A3, columns 5-7).⁴⁷

As explained in Section 3, regulatory differences suggest that the impact of a revised IORP Directive could vary across countries. The result of a regression including interaction terms between country dummy variables and the revised IORP dummy is presented in Table 2, column 6. While the effect of the revised IORP Directive interaction term is negative and statistically significant for some countries, large heterogeneity can be observed between countries. While RWA have been reduced in Belgium, Italy and Portugal in the wake of the proposed revision of the IORP Directive, a statistically significant effect cannot be observed in the base equation in the remaining countries.

Several financial stress indicators have also been included in the econometric analysis in order to make sure that changes in asset allocation due to the financial crisis, which occurred concomitantly to the discussions of revising the IORP Directive, are not captured by the IORP dummy. As expected, higher financial market volatility, captured in the form of the first-differenced CISS, GIFT and SRI indicators (see Table 3; columns 3-5), suggests with high statistical confidence in two out of three cases that the recent financial turbulence spurred a reduction in IORPs' RWA. As already noted, the impact of the revised IORP Directive is robust to the inclusion of all three crisis measures. This notwithstanding, while tentatively indicative of the potential impact of the proposals for moving to more risk-based solvency requirements on IORPs, the findings are still subject to major uncertainty and, as shown below, not fully robust to different estimation specifications.

Several additional estimation results for the purpose of robustness checks and in order to obtain additional and more granular results are presented in Appendix A.

First, results obtained in Table 3 are reproduced in Table A1 in level terms. The IORP dummy continues to be statistically significant across a number of specifications (columns 1-5). However, results here illustrate the potential risks of not controlling for serial correlation in regressions of this type – several macro-financial variables become significant. In addition, the country-specific interaction investigations (column 6 in Table A1) present contradictory results to the first-differenced findings in Table 2. Moreover, looking at the relative impact of the discussions for the Directive on firms of different sizes (Table A1, column 7) and different funding levels (Table A1, column 8) would, under this specification, suggest a strong de-risking impact relative to very small and very underfunded occupational pension funds respectively.

45 At the same time, it should be expected that very underfunded IORPs would be subject to supervisory intervention that may mitigate such “excessive” risk-taking behaviour, e.g. by spreading the recovery over a longer period.

46 Standard Wald tests were conducted to test for statistically significant coefficient differences.

47 As regards the country analysis (Table A3, columns 5-7), it appears that the impact of the IORP Directive discussions has affected Italian firms of all funding categories, very underfunded Austrian and Irish firms, and overfunded Portuguese firms. However, it is advisable not to read too much into this finding owing to the small sample size at the country and funding level.

Table 3 Main regression table¹

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE Macro starting 2007 RWA_chg	OLS FE Macro+ Company + IORP starting 2007 RWA_chg	OLS FE Extended Macro + Crisis1 starting 2007 RWA_chg	OLS FE Extended Macro + Crisis2 starting 2007 RWA_chg	OLS FE Extended Macro + Crisis3 starting 2007 RWA_chg	OLS FE Countries starting 2007 RWA_chg	OLS FE Size dummies starting 2007 RWA_chg	OLS FE Funding dummies starting 2007 RWA_chg
Rgdp_Chg	-0.023 2.15	3.710** 1.84	4.793** 2.19	4.378** 1.87	3.823 2.41	5.368** 2.32	4.820** 2.2	4.831** 2.2
Sto_Chg	-0.021 0.02	0.033 0.03	0.013 0.03	-0.014 0.03	0.047** 0.02	0.101* 0.05	0.02 0.03	0.015 0.03
Ltn_Chg	-7.064* 4.08	4.041 3.36	1.206 4.4	-3.41 3.96	5.244 4.26	10.631* 5.66	2.416 4.34	1.753 4.41
Respp_Chg	4.521*** 0.92	1.138** 0.56	0.643 0.87	1.050* 0.56	0.712 0.94	-0.18 0.96	0.6 0.87	0.628 0.87
Funding_Gap_Chg		-0.373 0.4	-0.208 0.41	-0.168 0.43	0.291 0.3	-0.204 0.42	-0.212 0.41	-0.213 0.41
Funding_Gap_Chg_Large		-22.376 39.13	14.694 38.86	-23.005 38.31	16.08 52.43	24.539 39.37	12.161 39.44	12.381 38.79
Roa_Chg		-0.028 0.07	-0.051 0.06	-0.03 0.07	0.013 0.03	-0.054 0.06	-0.05 0.06	-0.05 0.06
Roa_Chg_Large		81.759 132.04	12.53 35.1	81.343 131.8	-200.540*** 22.74	8.544 36.5	12.096 35.8	11.741 35.65
Size_Plan_Chg		-7.513 14.21	-13.673 14.87	-12.519 14.87	2.48 9.57	-12.181 15.24	-13.815 14.94	-13.891 14.85
Size_Plan_Chg_Large		-28.584 47.21	-82.569*** 28.85	-28.297 46.99	47.294 29.85	-75.012** 29.02	-83.298*** 29.02	-85.378*** 28.95
Crisis: CISS_chg			-46.068*** 16.16			-16.356 19.14	-42.086*** 16.12	-44.490*** 16.28
Crisis: Gift_chg				-0.689*** 0.21				
Crisis: SRI_chg					-72.937 51.84			
IORP	-25.809*** 5.27	-10.821** 5.25	-14.234** 5.79	-16.472*** 5.46	-12.337* 7.14			
AT * IORP						-54.864 38.12		
BE * IORP						-61.730* 33.11		
IE * IORP						-25.563 27.82		
IT * IORP						-153.691*** 52.18		
NL * IORP						-13.764 17.17		
PT * IORP						-100.242* 57.92		
UK * IORP						1.079 7.54		
Medium firms * IORP							-12.366 8.04	
Large firms * IORP							-11.678 7.54	
Underfunded pensions * IORP								-13.572**
Overfunded pensions * IORP								6.86 -8.763
Constant	3.019** 1.48	-10.441* 6.09	-6.141** 3.09	-10.778* 6.11	-6.001 4.63	-7.266** 3.24	-7.067** 3.01	-6.589** 3.13

Table 3 Main regression table¹ (cont'd)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company + IORP	Extended Macro + Crisis1	Extended Macro + Crisis2	Extended Macro + Crisis3	Countries	Size dummies	Funding dummies
	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007
VARIABLES	RWA_chg	RWA_chg	RWA_chg	RWA_chg	RWA_chg	RWA_chg	RWA_chg	RWA_chg
Observations	3117	2907	2642	2907	1681	2642	2642	2642
R-squared	0.039	0.021	0.024	0.024	0.032	0.029	0.023	0.024
Number of firms	357	355	355	355	355	355	355	355

1) All regressions are performed, excluding Denmark, Finland, France, Germany and Sweden owing to the large proportion of non-IORPs in these countries' respective occupational pension fund sectors, and Luxembourg, Spain and Greece owing to the small sample size (regarding the latter, the legal framework underpinning the occupational pension sector has only recently been adopted; see European Parliament (2011)).

At the moment of inclusion of more than one additional variable, a Wald test composite linear hypothesis about the added parameters of the model fitted most recently is carried out in order to test if the additional parameters of interest are simultaneously equal to zero. Test statistics suggest that including the estimators reported above into the model substantially increases the fit of the model.

Second, to assess the importance of the RWA definition, Table A2 uses a modified weighting scheme for RWA, depicting a zero risk weight in government debt in line with Basel risk weights. Results do not appear entirely robust compared with the baseline measure of RWA in Table 2, as the IORP dummy is no longer, or only barely, statistically significant at the minimum level in columns 2-5. In addition, the country-specific interactions in column 6 only confirm the findings for Italian IORPs.⁴⁸

Third, overall, the findings suggest that the observed de-risking partially captured by the IORP dummy variable is vulnerable to how the RWA measure is constructed. In other words, the finding of a significant impact on the revised IORP Directive on the funds' asset allocation decisions should be taken with due caution, especially when keeping in mind the considerable uncertainty surrounding the general financial market conditions since 2010. Thus, Tables A5, A6 and A7 show the regression results for RWA measures with country and time-varying debt weights in order to reflect country-specific government bond risk, as perceived by market participants. Debt weights are based on LTN yields (Table B1) and CDS prices (Tables B2 and Table B3). Notably, the significance of the coefficient of the IORP dummy is much less stable and less pronounced when accounting for differences in country-specific sovereign risks.

Fourth, the effect of the revised IORP Directive on RWA appears to be robust and persistent across countries and more recent starting dates (but not if 2006 is used as a starting date), which suggests that the selection of a particular time window does not appear to play a decisive role in the results (see Table A4, columns 1-4). In addition, column 5 of Table A4 looks at the effect of counting an extra year for the IORP dummy (i.e. setting it equal to 1 in 2010, as well as in 2011 and 2012) to capture the fact that the Commission's first concrete signal of a revision of the IORP Directive came in its 2010 Green Paper on the subject – including an extra year also appears to find a significant impact on asset allocations in 2010, 2011 and 2012 (even after controlling for the global financial and euro area crises).

48 Nevertheless, it should be remembered that the size of any effect is not comparable to the initial specification in Table 2 since the variation of RWA_Basel_chg is smaller than in the baseline regression, due to the zero weight added to bond holdings.

5.2 APPROACH 2: DIFFERENCE IN DIFFERENCES ESTIMATION

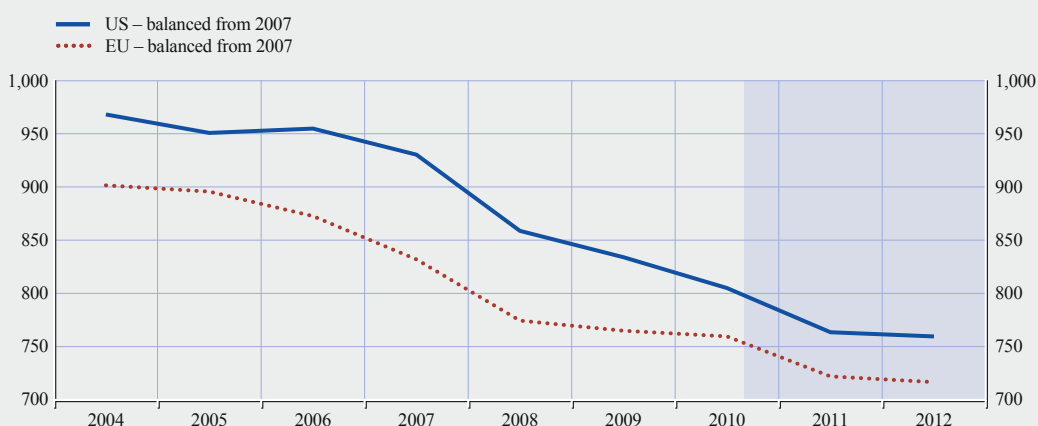
Besides the revised IORP Directive potentially having an impact, the variables included in the panel regression analysis presented in the previous section might also have captured other factors, such as crisis-induced changes in risk aversion, greater awareness of the risks in pension funds' investment portfolios or other changes in the macroeconomic environment not captured by the control variables. Moreover, although attempts have been made to control for all non-regulatory differences among IORPs, the legislative landscape has not remained static since the start of the estimation window in 2007 (European Commission, 2012a; European Parliament, 2011). There may also be additional, difficult-to-capture drivers of IORP investment strategies, such as employer legislation covering benefit bargaining between IORPs and employees, the demographic profile of the potential labour pool available to the IORPs, or further cultural attitudes towards risk-taking that are not well captured by country-level constants.

One way of dealing with this potential omitted variable bias is the difference-in-difference (DiD) approach (see Box 3 for a more detailed description of the econometric methodology). Accordingly, the mean of the RWA of a treatment group (the EU IORP sample) is compared below to that of a control group where regulatory changes have already taken place.⁴⁹ Occupational pension funds in the United States were chosen for the control group owing to the fact that fair value accounting was introduced there in 2006, and many regulatory-driven asset allocation shifts, if present, may have already taken place up to and around the year of introduction, which occurs before the start of the 2007-12 sample window applied in this paper.⁵⁰

Chart 10 (below) supports this intuition: a balanced sample of 353 US IORPs is constructed over the period 2007-12; RWA are calculated in line with the procedure employed for European IORPs.⁵¹ The US IORPs' (weighted) mean RWA appears to be consistently above the same measure for the EU sample, but it has followed the same downward trend in recent years. Against this background,

Chart 10 US and EU RWA

(percentages; asset-weighted average)



Source: Bloomberg, Thomson Reuters Datastream.

49 One of the first and most influential studies employing this approach is Card and Krueger (1994).

50 Amir et al. (2009) claim that the shift from equities into bonds as a result of the introduction of fair value accounting was relatively small.

For a detailed analysis of the regulatory changes in US fair value accounting, see Blome et al. (2007).

51 Data are also sourced from Bloomberg and Thomson Reuters Datastream.

the US sample might form an appropriate control group. This reasoning is also strengthened by the broadly similar economic environment of the two economies (at least until the start of the European sovereign debt crisis in early 2010); at an aggregate level, both groups include deep and liquid financial markets, well-developed pension systems and labour legislation, and strong minimum governance arrangements.

Results presented in Table 3 (above) suggest that the treatment effect, i.e. the announcement of risk-based valuation in the form of a revised IORP Directive, is not statistically significant.⁵² Hence, to conclude, the impact of the revised IORP Directive cannot conclusively be said to have led to an increase in de-risking above the de-risking trend induced through changes in the perception of risk or the macroeconomic environment.

52 The result also holds when controlling for financial distress by introducing the crisis-dummy variables.

Box 3

DIFFERENCE-IN-DIFFERENCE ESTIMATION

The difference-in-difference approach estimates the “normal” difference in RWA between the sample of US IORPs and that of euro area IORPs before the publication of the European Commission’s Call for Advice in 2011, and compares this with the actual difference in RWAs in 2011-12. In line with the standard difference-in-difference approach, a fixed, structural difference is assumed between US and EU pension funds prior to being “treated” (i.e. prior to the publication of the Call for Advice). This assumption is based on observing the same trend in RWA prior to 2011 in the United States and the EU.

The estimation equation reads as follows:

$$\begin{aligned}
 & RWA_{i,t} - RWA_{i,t-1} \\
 & = \text{constant} + \beta_1 \text{Region}_i + \beta_2 \text{IORP}_t + \beta_3 (\text{IORP}_t * \text{Region}_i) \\
 & + \beta_{cv} \text{Control Variables}_{i,t} + \varepsilon_{i,t}
 \end{aligned}$$

The region variable is a dummy variable, taking the value of one for the treatment group (EU), and zero for the control group (US). The IORP variable is a dummy variable which, as before, takes on the value of one in the post-treatment period (2011-12) and zero in the pre-treatment period (2007-10). The estimator, β_3 , represents the difference-in-difference estimate, which is the coefficient of a dummy variable taking on the value of one for the EU in the post-treatment period.

Table 4 Difference-in-difference estimation

VARIABLES	(1)	(2)	(3)
	DiD no crisis starting 2007 RWA_2007_chg	DiD w/ Gift starting 2007 RWA_2007_chg	DiD w/ CISS starting 2007 RWA_2007_chg
IORP	-15.316*	-15.817**	-14.692*
	8.05	8.06	8.06
EU	-14.590*	-12.080	-11.470
	7.96	8.15	8.33
IORP * EU	9.022	7.577	6.706
	9.77	9.82	9.94
Rgdp_Chg	2.363	3.085*	3.273*
	1.52	1.60	1.68
Sto_Chg	0.053**	0.040	0.046*
	0.03	0.03	0.03
Ltn_Chg	6.862***	4.579	5.593**
	2.45	2.92	2.64
Respp_Chg	1.227*	0.938	0.816
	0.65	0.68	0.73
Funding_Gap_Chg	0.280*	0.340**	0.267*
	0.15	0.15	0.15
Funding_Gap_Chg_Large	0.405	0.747	0.561
	5.97	5.97	5.97
Roa_Chg	0.018	0.018	0.019
	0.04	0.04	0.04
Roa_Chg_Large	2.372	2.169	2.353
	5.73	5.73	5.73
Size_Plan_Chg	-6.036	-7.836	-6.487
	5.16	5.31	5.17
Size_Plan_Chg_Large	-4.581	-4.641	-4.508
	6.16	6.16	6.16
Crisis: Gift_chg		-0.285	
		0.20	
Crisis: CISS_chg			-18.616
			14.65
Constant	0.689	-2.398	-2.896
	8.20	8.48	8.68
Observations	3998	3998	3998
R-squared	0.022	0.023	0.023

6 POTENTIAL IMPACT ON FINANCIAL STABILITY

At this stage, the potential financial stability implications of introducing the revised IORP Directive remain elusive. The lack of granular and comprehensive statistics covering the IORP subsector (among other occupational pension arrangements), and the fact that the revised directive is yet to be approved and implemented makes it inherently difficult to assess its wider implications for the financial system and beyond. Hence, the financial stability considerations provided below are largely of a qualitative nature.

6.1 THE ROLE OF IORPS IN THE FINANCIAL SYSTEM

Table 4 (above) provides some summary measures to illustrate the extent to which IORPs can be considered important financial market participants. In 2011 the IORP sector in the EU (where data are reported) held an estimated EUR 2.6 trillion in assets, or about 22% of the GDP of the 27 EU Member States. The majority of these holdings are concentrated in the United Kingdom and the Netherlands (mirroring the relative importance of the occupational pension fund sector in these countries), followed by Sweden, Germany, Italy and Ireland.

IORPs appear to hold a significant proportion of the outstanding equity of the 27 EU Member States (about 18%), suggesting some potential to affect share prices, should IORPs' equity investments broadly move in the same direction. Interestingly, IORPs in the Netherlands, United Kingdom, Ireland and Estonia have equity investments worth more than 20% of their respective national market capitalisations. Of course, these relatively large proportions are likely to be lower in reality; equity holdings may well be spread elsewhere in the euro area, EU as a whole or the rest of the world.

This notwithstanding, average 2011 geographical breakdowns provided by the European Federation for Occupational Retirement Provision (EFRP) across reporting countries point to a substantial home (or at least regional) bias in IORP investment strategies. IORPs from non-euro area EU countries concentrate their investments in the euro area (47% of asset holdings) and the EU excluding the euro area (44%). The picture is even more skewed towards the euro area as regards euro area IORPs – these hold on average 82% of their investments in the euro area, compared with 11% in the EU Member States not in the euro area.

Furthermore, the aggregate IORP sector also appears to be an important player in the EU fixed-income markets, accounting for 3% of outstanding government and corporate bonds in the EU at the end of 2011. IORPs appear to play important roles in both government and corporate bond markets, considering that local regulations (and the “prudent person” investment rule in the first IORP Directive) are likely to steer them towards higher-rated instruments, which form a subset of the totals provided in Table 5.

In addition, any home bias (discussed further below and shown in Chart 11 for the wider occupational pension fund sector) would imply that concentrations in respective national markets could be even larger and approach the proportions reported in columns 9 and 11 of Table 4. While noting that such an analysis can only be performed on a crude basis⁵³, the potential to affect national prices seems higher in certain countries (Estonia, the United Kingdom and Sweden) than in others (France, Belgium, Italy and Germany). IORPs also appear to hold substantial investments in real

53 For example, the fixed income holdings of Romanian and Bulgarian IORPs appear to be far too high when compared with the outstanding corporate bonds (535% and 136% respectively) in these countries.

Table 5 Ratio of EU IORP asset holdings to respective benchmarks

(EUR billion; end-2011)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Total IORP assets	nGDP		IORP Equity inv.	Outstanding shares		IORP Fixed income inv.	Outstanding govt. bonds		Outstanding corp. bonds		Real estate inv.	Outstanding RMBS	
	€bn	€bn	%	€bn	€bn	%	€bn	€bn	%	€bn	%	€bn	€bn	%
AT	15	285	5	5	98	5	9	179	5	301	3	0.4	2	23
BE	16	356	4	6	187	3	8	328	2	192	4	0.6	47	1
BG	2	71	3	0.5	5	12	0.9	4	24	0.9	97	0.1		
EE	1.2	14	8	0.5	2	29	0.3	0.2	128	0.8	35	0		
FI	10	179	6	4	159	2	4	79	4	102	3	1.4	3	50
FR	4	1,937	0	1.4	1,318	0.1	1.0	1,362	0.1	1,734	0.1	0	21	0
DE	139	2,495	6	62	1,091	6	42	1,527	3	1,834	2	9	58	15
HU	14	97	15	1.3	21	6	8	57	14	27	29	0.03		
IE	76	158	48	44	156	28	22	97	23	877	3	3	45	7
IT	83	1,552	5	11	424	3	47	1,549	3	1,134	4	6	133	4
LU	0.7	40	2	0.3	121	0	0.2	4	5	344	0.1	0.04		
PT	20	173	11	3	61	5	8	140	6	157	5	2	34	6
RO	1.1	524	0	0.1	12	1	0.9	19	5	0.3	321	0		
ES	51	1,049	5	10	472	2	25	596	4	1,093	2	2	185	1
SE	16	350	5	6	446	1	8	127	6	459	2	0.6		
NL	801	587	137	514	423	121	40	295	14	1,396	3	9	199	5
UK	1,176	1,732	68	494	2,496	20	475	1,223	39	2,389	20	54	387	14
EA17	1,216	8,824	14	660	4,581	14	208	6,490	3	9,254	2	33	748	4
EU27	2,425	11,597	21	1,162	7,610	15	700	8,240	8	12,792	5	88	1,293	7

Sources: AFME, Bloomberg, ECB, EFRP, Haver Analytics, ECB calculations.

Notes: IORP equity, bond holdings and real estate investments are not available for Germany and Luxembourg; each are estimated for these two countries using the weighted (by assets) average share of each instrument in the aggregate assets of IORPs in the remaining countries. Fixed income instruments (both for IORPs and benchmarks) are assumed to cover all rating classes. Outstanding corporate bonds are the sum of non-financial corporate, monetary and financial institutions, and other financial intermediary outstanding bonds. Outstanding country RMBS instruments are calculated by pro-rating the aggregate country securitised instrument estimate by the share of RMBS in total European securitised instruments. Countries where data are not available are left blank.

estate instruments, at least when compared with outstanding residential mortgage-backed securities (RMBS – column 14); 8% of the estimated outstanding RMBS instruments in the 27 EU Member States. Although data are incomplete for many IORPs (or national regulations restrict these investments), investments appear to be large in Austria and Finland (albeit at a low absolute level), as well as in Germany and the United Kingdom. Nevertheless, substantial uncertainty (see the note to Table 5) implies that these estimates, and the implied possibility of IORPs being able to affect real estate markets considerably, should be treated with prudence.

In addition to stocks of assets, pension funds regularly transfer pension contributions into financial markets, making them an important source of regular capital flows (see Chart 3 for their contribution rates). In particular, any potential impact on asset prices and government bond yields within the euro area might be amplified owing to the increase in home bias observed during the period of extreme financial turbulence over the 2008-12 period. As can be seen in Chart 11 (below), IORPs were increasing their purchases of debt securities and equities within their home country over that period, as opposed to investments in non-euro area countries (thereby reducing currency risk), and more recently to their activity in other euro area countries. This suggests that geographic preferences are closely linked to broader financial market conditions, thus potentially amplifying financial shocks.

These considerations notwithstanding, several characteristics of (DB) pension funds' investment behaviour are important. First, the asset allocation strategies of pension funds are often static – adjustments are made only every few years or, if more frequent, they are based on detailed

simulations on a complex investment universe that takes time to implement. Second, there is likely to be substantial herding in pension funds' investment decisions, given homogeneous country regulations and, more implicitly, the key role of pension funds in recruitment negotiations (Antolin et al., 2011). Third, pension funds tend to be highly risk-averse, be it due to regulation, employer-employee covenants or the funding profile. As a result, occupational pension funds, and IORPs in particular, given their arm's length status to employers, are expected to move on a "slowly but surely" basis – their impact on short-term financial market movements is likely to be limited in the absence of any regulation.

6.2 POTENTIAL IMPACT OF A REVISED IORP DIRECTIVE ON PRO-CYCLICALITY

IORPs, in their current framework, are likely to respond in a somewhat pro-cyclical manner to asset price movements, as described in Yermo and Severinson (2010) and Bikker et al. (2010).

For DB schemes in particular, such behaviour would most likely be exacerbated by any regulation requiring a minimum risk-based level of capital, such as a revised IORP Directive. In other words, under a more risk-sensitive regulatory framework, pension funds would generally have a stronger incentive to de-risk when capital requirements become more binding; that is, by selling risky assets when markets and projected returns are low in order to meet the minimum capital requirements. In addition, it could force employers to increase pension contribution rates during economic downturns, while not raising them during economic upturns.⁵⁴ Also, pension plans are likely to behave pro-cyclically in the adjustment of pension benefits during economic downturns. Given their relative size in financial markets, this could have a further impact, albeit probably small, on asset returns and volatility, leading to larger market movements and a further negative feedback loop to IORPs' funded status. Finally, a significant reduction in market liquidity could ensue owing to one-way selling by pension funds *en masse* as asset allocations are shifted simultaneously.

However, the mechanism by which this pro-cyclical behaviour may occur is complex and difficult to verify owing to the interplay between asset returns as both determinants of investment positions and as components of discount rates.⁵⁵ For example, sovereign bond yields are used as a discount rate for comparing future total pension payments with current assets. At the same time, they are included in projections for asset returns – an increase in sovereign yields would thus signal falling pension payments, but also a riskier investment strategy.⁵⁶ As a result, more detailed asset-liability simulations would have to be conducted to assess, among other items, the impact of the counter-cyclical premium and matching adjustment on pension funds' investment behaviour in order to disentangle the different effects.

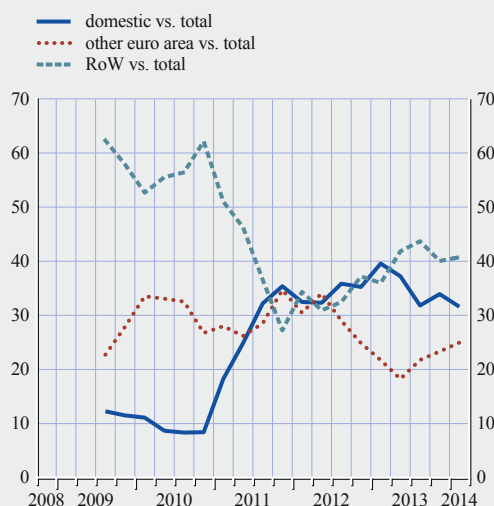
54 See Yermo and Severinson (2010). The study also proposes a set of measures in order to make pension regulation less pro-cyclical.

55 EIOPA's 2013 quantitative impact study explores a scenario which includes a counter-cyclical capital buffer, which may alleviate this channel if it were implemented.

56 In his theoretical study, Jacques (2010) pointedly illustrates the complexity and the number of channels at play in the influence of regulation on institutions and, in turn, on pro-cyclicality.

Chart 11 Euro area IORPs' combined purchases of equities and bonds

(Q4 2008-Q1 2013; percentages)



Source: ECB.

Note: Domestic refers to an IORP in a given euro area country purchasing bonds and equities issued by entities resident in that country.

A further illustration of the complexity of this mechanism is that the investment behaviour of IORPs and pension funds may differ, depending on the relationship between the demographic situation and the entity's funding situation. For example, a DB arrangement operating with both a funding deficit and a projected sharp increase in retirees in the near-term may well seek to "chase returns" by adopting riskier investment strategies to improve the expected return and thus close its funding gap in time (Antolin et al., 2011; BIS, 2011). Minimum capital requirements would help dampen this movement in the long run, once firms have adjusted their investment strategies to incorporate these rules. However, mark-to-market accounting and the constraint to use "market-determined" discount rates would, in contrast, exacerbate this behaviour.

Denmark, Sweden, Switzerland, the Netherlands and the United Kingdom have some experience of the potential impact of risk-based regulation on pro-cyclicality. For example, Severinson and Yermo (2012) discuss the (allegedly negative) impact of fair value accounting on the funding position of Danish pension funds during the recent financial crisis. Several changes to the discount rate calculation guidance (introducing both an uplift to the discount rate to reflect real estate investments and a smoothing of the discount rate over a 12-month period) were mandated by the Danish pensions regulator. These adjustments were implemented to avoid undue falls in the discount rate due to high foreign and domestic demand for Danish government bonds, whose yields, it was feared, would be affected further if pension funds were to make substantial equity divestments. In Sweden, the fear of pro-cyclical investment behaviour in late 2011 led to a lengthening of recovery periods for rebuilding sustainable funding positions. The same study also finds that the introduction of fair value accounting standards and minimum funding requirements in the United Kingdom led to an inversion of the long-term (beyond ten years) yield curve, relative to the ten-year yield. Concerning the insurance industry, as stated in BIS (2011), the Swiss Solvency Test applied on Swiss companies⁵⁷ was found to be a contributing factor to the inverted yield curve between maturities of 15 and 30 years. At the same time, De Nederlandsche Bank⁵⁸ came to the conclusion that, in spite of fair value accounting, Dutch pension funds contributed positively to financial stability during the financial crisis owing to net purchases of equities between 2008 and March 2009. This may also reflect the fact that the Dutch authorities amended the discount rate as well as allowed for longer adjustment periods to deal with a funding gap.

However, when comparing the effects of risk-based against rule-based regulation of pension funds on the Sharpe ratio, Boon et al. (2014) come to the conclusion that pension systems in countries with more mature risk-based regulatory regimes, on average, tend to demonstrate superior investment performance (as measured by the Sharpe ratio).

Furthermore, a revised IORP Directive's emphasis on cross-border activities would be likely to help reduce home bias and boost diversification of investment portfolios. As long as markets are not perfectly correlated, international investment in a portfolio offers better diversification, offering lower risk for a given return or, conversely, a higher return for a given risk. A reduction of the home bias thanks to a revised IORP Directive, in addition to an appropriately constructed European or global portfolio should, in principle, significantly reduce idiosyncratic risk in IORPs' balance sheets.⁵⁹ Importantly, it should reduce any potential pro-cyclicality between IORPs' investment decisions on asset prices, given their greater diversification across world markets and thus reduced "herding".

57 The Swiss Solvency Test, a risk-based capital requirement for Swiss insurers, was implemented in Switzerland in 2006. The Test shares important features with the Solvency II Directive and key ratios became binding across the whole industry in 2011.

58 De Nederlandsche Bank (2011).

59 Davis and Hu (2009).

7 CONCLUSIONS

The impact of the solvency rules proposed in the context of the revision of the IORP Directive has the potential to be a significant driver of IORPs' long-term investment behaviour, judging from experiences following the introduction of risk-based regulation for occupational pension schemes in Member States. In addition, there appears to be tentative empirical evidence to suggest that the proposed revisions to the IORP Directive – if implemented as they stood at the end of 2012 – could induce a shift towards less risky investment classes.

For several reasons, however, it is too early to conclude that discussions around the Directive have already begun to exert such an impact. First, key technical features of the revised Directive are yet to be agreed upon and the solvency requirement aspects have been postponed, making the impact of, for example, the Holistic Balance Sheet concept difficult to identify. Second, national legislation will play a key role in shaping the response of IORPs. Third, IORPs have other adaptation avenues at their disposal in addition to adjusting their investment allocations; the fundamental reforms proposed by the European Commission in March 2014 may well lead to wholesale changes in the pensions promise (for example, exacerbating trends toward DC schemes) that go beyond mere adjustments to investment strategies.

The aggregate IORP sector plays an important role in financial markets, and there is evidence to suggest that pro-cyclical concerns may be well-founded to a degree. Nevertheless, the inclusion of a counter-cyclical premium would be expected to help mitigate these concerns; *inter alia* judging from recent national attempts to introduce similar approaches. In addition, the introduction of a common risk-based framework could lead to an increased awareness of investment risks, since they would be better incorporated into IORPs' own asset-liability simulations, implying that investment strategies would be less risky for the wider financial system and thus further dampening pro-cyclicality risks. On the other hand, greater “herding” behaviour might result following the introduction of a common risk-based framework. In turn, any investment concentration in specific asset classes in order to reduce aggregate capital requirements may increase the role of IORPs in determining asset prices and, therefore, wider financial stability.

REFERENCES

AEGON (2010), “Pension provision in Germany – The first and second pillars in focus”, *AEGON Global Pensions*, September.

Agnew, J., Balduzzi P. and Sundén, A. (2003), “Portfolio choice and trading in a large 401(k) plan”, *American Economic Review*, Vol. 93, No 1, pp. 193–215.

Antolin, P. and Stewart, F. (2009), “Private pensions and policy responses to the financial and economic crisis”, *Financial Market Trends*, OECD, Vol. 2009/1.

Antolin, P., Schich, S. and Yermo, J. (2011), “The economic impact of protracted low interest rates on pension funds and insurance companies”, *Financial Market Trends*, OECD, Vol. 2011/1.

Biggs, J. H. and Richardson, M. (2014), “Modernizing insurance regulation: An overview”, *Modernizing Insurance Regulation*, pp. 1-18.

Bikker, J., Broeders, D.W.G.A. and de Dreu, J. (2010), “Stock market performance and pension fund investment policy: Rebalancing, free float, or market timing?”, *International Journal of Central Banking*, Vol. 6, No 2, June, pp. 57-79.

BIS (2011), “Fixed income strategies of insurance companies and pension funds”, *CGFS Publications*, No 44, July 2011.

Blome, S., Fachinger, K., Franzen, D., Scheuenstuhl, G. and Yermo, J. (2007), “Pension fund regulation and risk management: Results from an ALM optimisation exercise”, *OECD Working Papers on Insurance and Private Pensions*, No 8, OECD Publishing, Paris.

Boon, L., Briere, M., Gresse, C. and Werker, B. (2014), “Pension regulation and investment performance: Rule-based vs. risk-based”, *Network for Studies on Pensions, Ageing, and Retirement Discussion Paper*, No DP 02/2014-005.

Broadbent, J., Palumbo, M. and Woodman, E. (2006), “The shift from defined benefit to defined contribution pension plans – implications for asset allocation and risk management”, a paper prepared for a working group on institutional investors, global savings and asset

allocation established by the Committee on the Global Financial System.

Card, D. and Krueger, A. (1994), “Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania”, *American Economic Review*, Vol. 84, No 4, pp. 772-793.

Catarineu-Rabell, E., Jackson, P. and Tsomocos, D. (2005), “Procyclicality and the new Basel Accord: Banks’ choice of loan rating system”, *Economic Theory*, 26 (3), pp. 537-557.

Cocquemas, F. (2012), “Improving risk management in DC and hybrid pension plans”, EDHEC-Risk Institute, Nice, November.

Committee of European Insurance and Occupational Pensions Supervisors (2008), “Survey on fully funded, technical provisions and security mechanism in the European occupational pension sector”, CEIOPS-OPSSC-01/08, March.

Das, S. and Sy, A. (2012), “How risky are banks’ risk weighted assets? Evidence from the financial crisis”, *Working Paper*, No 12/36, International Monetary Fund.

Davis, E. and Hu, Y. (2009), “Should pension investing be regulated?”, *Rotman International Journal of Pension Management*, Vol. 2, No 1, Spring, available at <http://ssrn.com/abstract=1408689>.

De Haan, J., Janssen, K. and Ponds, E. (2012a), “The Holistic Balance Sheet as the new framework for European pension supervision – evaluation from a Dutch perspective”, *Discussion Paper*, Network for Studies on Pensions, Ageing and Retirement, Tilburg.

De Haan, J., Joseph, A., Siert, J.V. and Wijckmans, J-W. (2012b), “The Impact of Solvency II rules”, *Investment & Pensions Europe*, April, available at: <http://www.ipe.com/the-impact-of-solvency-ii-rules/44584.fullarticle>.

De Nederlandsche Bank (2011), “Pension funds made net purchase of equities during crisis”, *DNBulletin*, April, accessed on 7 February 2013, available at <http://www.dnb.nl/en/news/news-and-archive/dnbulletin-2011/dnb250677.jsp>

Drukker, D. M. (2003), “Testing for serial correlation in linear panel-data models”, *Stata Journal*, Vol. 3, No 2, pp. 168-177.

European Central Bank (2007a), “Potential impact of Solvency II on financial stability”, July.

European Central Bank (2007b), *Financial Stability Review*, December.

European Central Bank (2009), *Financial Stability Review*, December.

European Central Bank (2011), “Insurance corporations and pensions funds in the euro area”, *Financial Integration Report*, May.

European Central Bank (2012), *Financial Stability Review*, December.

European Commission (2010), “Towards adequate, sustainable and safe European pension systems”, *Green Paper*, COM(2010)365, July.

European Commission (2012a), “The 2012 ageing report: Economic and budgetary projections for the 27 EU Member States (2010-2060)”, May.

European Commission (2012b), “Quantitative impact study (QIS) on institutions for occupational retirement provision (IORPs) – technical specifications”, Ares(2012)1182662, October.

European Commission (2014) “Proposal for a Directive of the European Parliament and of the council on the activities and supervision of institutions for occupational retirement provision”, available at http://ec.europa.eu/internal_market/pensions/docs/directive/140327_proposal_en.pdf

- European Commission/Eurostat (2004), “Classification of funded pension schemes and impact on government finance”, Luxembourg.
- European Federation for Retirement Provision (2010), *Annual Report 2010*, available in the European Federation for Retirement Provision Library.
- European Insurance and Occupational Pensions Authority (2012a), *Financial Stability Report 2012 – second half-year report*, EIOPA-FS-12-097, December.
- European Insurance and Occupational Pensions Authority (2012b), “EIOPA’s advice to the European Commission on the review of the IORP Directive 2003/41/EC” EIOPA-BOS-12/015, February.
- European Insurance and Occupational Pensions Authority (2013a), *Financial Stability Report 2013 – first half-year report*, EIOPA-FS-13/041, June.
- European Insurance and Occupational Pensions Authority (2013b), *Quantitative impact study*. Detailed information available at <https://eiopa.europa.eu/consultations/qis/occupational-pensions/quantitative-impact-study/index.html>
- European Parliament (2011), “Pension systems in the EU – contingent liabilities and assets in the public and private sector”, European Parliament, Directorate General for Internal Policies, Policy Department A: Economic and Scientific Policy, October.
- European Union (2003), “Directive 2003/41/EC of the European Parliament and of the Council - of 3 June 2003 on the activities and supervision of institutions for occupational retirement provision”, *Official Journal of the European Union*, L 235/10.
- Gobierno de Espana, “Informe del Segundo Trimestre 2013, Planes y Fondos de Pensiones”.
- Holló, D., Kremer, M. and Lo Duca, M. (2012), “CISS – a composite indicator of systemic stress in the financial system”, *Working Paper Series*, No 1426, European Central Bank.
- Impavido, G. (2011), “Stress tests for defined benefit pension plans – a primer”, *Working Paper*, No 11/29, International Monetary Fund.
- IOSCO (2012), “Development and regulation of institutional investors in emerging markets”, FR04/12, Emerging Markets Committee of the International Organization of Securities Commissions, Madrid.
- Jacques, K. (2010), “Procyclicality, bank lending, and the macroeconomic implications of a revised Basel Accord”, *The Financial Review*, Vol. 45 No 4, pp. 915-930.
- Le Blanc, J. (2011), “The third pillar in Europe: institutional factors and individual decisions”, *Discussion Paper*, Series 1: Economic Studies, No 09/2011, Deutsche Bundesbank.
- L’Hoir, M., Sauve, M. (2012), “Solvency II has and will make corporate bonds more expensive”, *Research & Investment Strategy*, AXA Investment Essentials, AXA.

Organisation for Economic Co-operation and Development (2005), “Private pensions: OECD classification and glossary”, OECD Publishing, Paris.

Organisation for Economic Co-operation and Development (2008), “Private pensions outlook 2008, pension profile Spain”, OECD Publishing, Paris.

Organisation for Economic Co-operation and Development (2011), “Pensions at a glance 2011: Retirement-income systems in OECD countries”, OECD Publishing, Paris.

Organisation for Economic Co-operation and Development (2012), “Pension markets in focus 2012: Pension fund assets hit record USD 20.1 trillion in 2011 but investment performance weakens”, OECD Publishing, available at <http://www.oecd.org/daf/fin/private-pensions/PensionMarketsInFocus2012.pdf>

Pugh, C. and Yermo, J. (2008), “Funding regulations and risk sharing”, *OECD Working Papers on Insurance and Private Pensions*, No 17, OECD Publishing, Paris.

Sender, S. (2010). “EDHEC survey of the asset and liability management practices of European pension funds”, EDHEC-Risk Institute, June.

Severinson, C. and Yermo, J. (2012), “The effect of solvency regulations and accounting standards on long-term investing: implications for insurers and pension funds”, *OECD Working Papers on Finance, Insurance and Private Pensions*, No 30, OECD Publishing, Paris.

Stewart, F. and Yermo, J. (2008), “Pension fund governance: Challenges and potential solutions”, *OECD Working Papers on Insurance and Private Pensions*, No 18, OECD Publishing, Paris.

The Pensions Regulator (2012), “UK impact assessment”, *Quantitative Impact Assessment Report*, The Pensions Regulator, London, March.

Towers Watson (2013), “Global pension assets study 2013”, January.

Van Meerten, H. (2009), “Pensions reforms in the European Union: Recent developments after the implementation of the IORP directive”, *Pensions: An International Journal*, Vol. 14. No 4, pp. 259-272.

Wooldridge, J. M. (2002), *Econometric analysis of cross section and panel data*, MIT Press, Cambridge, MA.

Yermo, J. and Severinson, C. (2010), “The impact of the financial crisis on defined benefit plans and the need for counter-cyclical funding regulations”, *OECD Working Papers on Finance, Insurance and Private Pensions*, No 3, OECD Publishing, Paris

APPENDIX A: ECONOMETRIC RESULTS FOR SECTION 5

Table A1 Main regressions – level terms								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company+ IORP	Extended Macro + Crisis1	Extended Macro + Crisis2	Extended Macro + Crisis3	Countries	Size dummies	Funding dummies
	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA	starting 2007 RWA
Rgdp_Chg	-0.092	0.039	1.246	-1.649	-5.294***	1.021	1.284	1.270
	1.380	1.600	1.570	1.650	1.940	1.540	1.580	1.580
Sto_Chg	0.115***	0.036	0.113***	0.148***	0.051**	0.018	0.127***	0.105**
	0.040	0.040	0.040	0.050	0.020	0.040	0.040	0.040
Ltn_Chg	17.976***	-0.231	11.764**	17.613***	5.558	2.180	14.428***	10.915**
	4.440	4.210	4.950	5.870	3.680	4.350	4.920	5.040
Respp_Chg	0.579	3.200***	2.230***	3.366***	0.447	3.055***	2.156***	2.276***
	0.760	0.650	0.780	0.650	0.730	0.80	0.780	0.780
Funding_Gap		0.215	0.034	-0.084	0.069	0.146	0.030	-0.065
		0.490	0.460	0.500	0.500	0.460	0.470	0.460
Funding_Gap_Large		-4.340	27.106	-6.209	29.332	21.368	18.604	25.945
		51.91	59.790	51.070	43.200	60.280	57.790	61.170
Roa		-0.092	-0.046	-0.091	-0.019	-0.037	-0.046	-0.039
		0.090	0.060	0.080	0.03	0.060	0.060	0.060
Roa_Large		73.979	-7.800	73.201	-108.476***	-4.852	-12.944	-10.423
		72.970	60.410	72.160	19.840	61.170	61.130	60.660
Size_Plan		-22.573	-15.129	-20.186	-0.308	-15.806	-17.578	-15.413
		17.190	16.900	17.340	13.490	16.840	16.460	16.870
Size_Plan_Large		110.394*	54.785	108.899*	13.593	36.851	56.889	49.513
		59.350	63.590	60.140	39.150	61.640	63.020	64.600
Crisis: CISS			119.219***			89.760***	127.785***	116.005***
			16.990			14.390	17.640	17.300
Crisis: Gift				1.596***				
				0.250				
Crisis: SRI					167.005***			
					44.660			
IORP	-51.117***	-69.433***	-59.954***	-55.548***	-36.752***			
	9.090	9.310	8.750	9.460	6.660			
AT * IORP						-58.810		
						45.720		
BE * IORP						9.251		
						45.740		
IE * IORP						-68.360**		
						33.070		
IT * IORP						48.305		
						75.030		
NL * IORP						5.493		
						26.620		
PT * IORP						43.058		
						64.600		
UK * IORP						-80.598***		
						9.860		
Medium firms * IORP							-65.976***	
							14.100	
Large firms * IORP							-68.715***	
							12.010	

Table A1 Main regressions – level terms (cont'd)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company+ IORP	Extended Macro + Crisis1	Extended Macro + Crisis2	Extended Macro + Crisis3	Countries	Size dummies	Funding dummies
	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007
VARIABLES	RWA	RWA	RWA	RWA	RWA	RWA	RWA	RWA
Underfunded pensions * IORP								-66.643***
								11.410
Overfunded pensions * IORP								-68.199***
								15.890
Constant	808.578*** 1.870	1,072.079*** 193.450	999.176*** 191.880	1,069.585*** 194.580	793.547*** 148.540	998.664*** 191.920	1,027.467*** 186.010	1,010.839*** 190.630
Observations	3126	3001	2717	3001	1698	2717	2717	2717
R-squared	0.032	0.082	0.092	0.096	0.083	0.100	0.092	0.095
Number of firms	357	356	356	356	356	356	356	356

Table A2 Robustness test, RWA reweighted

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company+ IORP	Extended Macro + Crisis1	Extended Macro + Crisis2	Extended Macro + Crisis3	Countries	Size dummies	Funding dummies
	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007
Variables	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg	RWA_ Basel_chg
Rgdp_Chg	3.720	10.217***	11.965***	11.669***	18.052***	13.187***	12.019***	12.016***
	3.420	2.970	3.680	2.970	4.830	3.800	3.690	3.690
Sto_Chg	-0.012	0.063	-0.000	-0.040	0.073	0.074	0.012	0.002
	0.050	0.050	0.050	0.050	0.050	0.100	0.050	0.050
Ltn_Chg	-1.838	15.168**	5.329	-1.033	15.105	14.144	7.607	6.034
	7.230	6.660	8.610	7.800	9.760	10.370	8.360	8.590
Respp_Chg	6.533***	1.546	0.979	1.354	0.212	-0.003	0.903	0.956
	1.500	1.040	1.570	1.040	1.980	1.660	1.570	1.570
Funding_Gap_Chg		-0.613	-0.186	-0.168	0.990*	-0.206	-0.188	-0.191
		0.630	0.630	0.670	0.570	0.630	0.630	0.630
Funding_Gap_Chg_ Large		-64.032	-16.684	-65.399	-74.961	-5.102	-20.185	-20.178
		56.23	48.25	55.17	59.55	48.65	48.64	48.23
Roa_Chg		-0.050	-0.087	-0.055	-0.076	-0.091	-0.086	-0.085
		0.110	0.100	0.110	0.100	0.110	0.100	0.100
Roa_Chg_Large		87.790	-20.877	86.884	-517.211***	-23.041	-22.254	-21.948
		178.720	57.420	178.040	48.090	55.850	58.860	58.320
Size_Plan_Chg		-24.887	-40.045	-35.770	-27.277	-38.005	-40.497	-40.263
		26.080	27.950	27.450	19.890	28.320	28.030	27.930
Size_Plan_Chg_Large		23.428	-45.658	24.052	156.294	-41.847	-49.372	-49.071
		77.670	57.850	76.310	96.340	57.860	57.990	58.190
Crisis: CISS_chg			-120.621***			-91.911***	-113.216***	-118.532***
			31.220			35.210	30.820	31.710
Crisis: Gift_chg				-1.498***				
				0.420				

Table A2 Robustness test, RWA reweighted (cont'd)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+	Extended	Extended	Extended	Countries	Size	Funding
		Company+	Macro +	Macro +	Macro +		dummies	dummies
	starting	starting	starting	starting	starting	starting	starting	starting
	2007	2007	2007	2007	2007	2007	2007	2007
Variables	RWA_	RWA_	RWA_	RWA_	RWA_	RWA_	RWA_	RWA_
	Basel_chg	Basel_chg	Basel_chg	Basel_chg	Basel_chg	Basel_chg	Basel_chg	Basel_chg
Crisis: SRI_chg					-181.017*			
					104.25			
IORP	-24.768***	-5.129	-15.256	-17.416*	-24.807*			
	9.160	9.230	10.190	9.610	14.320			
AT * IORP						-74.424		
						101.000		
BE * IORP						-56.979		
						68.900		
IE * IORP						-75.759		
						50.140		
IT * IORP						-165.086**		
						80.650		
NL * IORP						-4.382		
						35.050		
PT * IORP						-74.332		
						103.710		
UK * IORP						-0.538		
						13.210		
Medium firms * IORP							-5.146	
							14.970	
Large firms * IORP							-7.182	
							13.340	
Underfunded pensions* IORP								-15.488
								12.330
Overfunded pensions* IORP								-5.204
								18.520
Constant	-16.046***	-35.002***	-28.125***	-35.735***	-3.076	-29.649***	-29.857***	-28.628***
	2.570	8.860	5.360	8.880	7.410	5.380	5.220	5.410
Observations	3,117	2,907	2,642	2,907	1,681	2,642	2,642	2,642
R-squared	0.043	0.030	0.038	0.035	0.059	0.040	0.038	0.038
Number of firms	357	355	355	355	355	355	355	355

Table A3 Funding levels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Funding	Very	Underfunded	Overfunded	Very	Underfunded	Overfunded
	dummies	underfunded	only	only	underfunded	only + country_	only + country_
		only			only + country_	int	int
	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007
Variables	RWA_2007_chg	RWA_2007_chg	RWA_2007_chg	RWA_2007_chg	RWA_2007_chg	RWA_2007_chg	RWA_2007_chg
Rgdp_Chg	4.831**	9.863	3.033	5.463	12.180*	3.328	6.091
	2.200	7.450	2.420	3.900	7.080	2.620	4.040
Sto_Chg	0.015	0.020	0.026	-0.026	0.002	0.092	0.102
	0.030	0.090	0.040	0.040	0.180	0.070	0.070
Ltn_Chg	1.753	-6.385	7.977	-5.993	-4.423	16.082**	5.129
	4.410	13.590	5.470	4.930	21.650	6.470	9.050

Table A3 Funding levels (cont'd)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	OLS FE Funding dummies	OLS FE Very underfunded only	OLS FE Underfunded only	OLS FE Overfunded only	OLS FE Very underfunded only + country_ int	OLS FE Underfunded_ only + country_ int	OLS FE Overfunded only + country_ int
	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg	starting 2007 RWA_2007_chg
Respp_Chg	0.628	0.468	0.807	0.226	-0.356	0.254	-0.844
	0.870	2.940	1.030	1.340	3.300	1.090	1.500
Funding_Gap_Chg	-0.213	-0.889	0.446	-0.143	-0.923	0.450	-0.142
	0.410	0.940	0.770	0.370	0.900	0.780	0.390
Funding_Gap_Chg_ Large	12.381	100.168**	26.644***	-5.884	140.581***	63.409***	-5.130
	38.790	38.990	6.210	57.230	40.090	20.630	55.460
Roa_Chg	-0.050	-0.068	0.000	-0.193	-0.107	-0.001	-0.192
	0.060	0.090	0.080	0.170	0.100	0.080	0.170
Roa_Chg_Large	11.741	-74.866	93.871	-18.125	-5.852	91.772	-8.636
	35.650	53.390	70.190	29.230	79.960	72.430	34.400
Size_Plan_Chg	-13.891	-2.324	-33.774	6.750	0.741	-34.288	7.632
	14.850	20.630	32.180	8.140	23.060	32.490	8.730
Size_Plan_Chg_ Large	-85.378***	-95.019**	-51.353*	-74.230	-89.842*	-57.124**	-58.030
	28.950	44.610	28.450	68.860	45.640	27.160	72.100
Crisis: CISS_chg	-44.490***	-57.530	-39.916	-54.750**	-26.531	-16.147	-24.148
	16.280	38.270	25.900	24.920	54.220	27.610	31.510
IORP		-26.552*	-9.226	-13.563			
		13.860	7.480	11.490			
Underfunded pensions * IORP	-13.572**						
	6.860						
Overfunded pensions * IORP	-8.763						
	11.230						
AT * IORP					-68.854*	no obs	no obs
					40.100		
BE * IORP					-76.601	-52.151	-73.847
					58.510	52.810	70.330
IE * IORP					-245.718*	31.575	-52.511
					122.390	28.420	50.370
IT * IORP					-165.974***	-158.162**	-124.423***
					61.660	78.000	22.380
NL * IORP					-12.048	11.329	-35.212
					40.700	23.100	29.610
PT * IORP					53.906	-66.778	-167.486**
					164.800	55.260	63.800
UK * IORP					-1.043	0.797	5.230
					22.710	9.280	14.830
Constant	-6.589**	18.478**	-15.274***	-7.505	8.363	-15.587***	-8.952
	3.130	7.780	4.430	6.230	9.410	4.600	6.200
Observations	2,642	357	1,608	677	357	1,608	677
R-squared	0.024	0.060	0.027	0.027	0.077	0.032	0.032
Number of firms	355	51	214	90	51	214	90

Table A4 Different starting dates¹⁾

Variables	(1)	(2)	(3)	(4)	(5)
	OLS FE Countries_int starting 2007 RWA_2007_chg	OLS FE Countries_int starting 2006 RWA_2007_chg	OLS FE Countries_int starting 2008 RWA_2007_chg	OLS FE Countries_int starting 2009 RWA_2007_chg	OLS FE Countries_int IORP (2010-12) starting 2006 RWA_2007_chg
Rgdp_Chg	5.368**	2.649	1.132	-0.619	3.454
	2.320	2.150	2.690	2.570	2.130
Sto_Chg	0.101*	0.073	0.031	0.056	0.046
	0.050	0.050	0.050	0.050	0.030
Ltn_Chg	10.631*	0.996	2.829	4.202	-1.972
	5.660	5.120	6.020	5.760	4.240
Respp_Chg	-0.180	1.088	1.291	1.358	0.975
	0.960	0.910	1.140	1.070	0.860
Funding_Gap_Chg	-0.204	-0.582	-0.299	-0.395	-0.571
	0.420	0.420	0.410	0.400	0.410
Funding_Gap_Chg_Large	24.539	63.005***	22.655	0.373	56.552***
	39.370	20.790	39.010	34.620	19.190
Roa_Chg	-0.054	-0.052	-0.114	-0.089*	-0.049
	0.060	0.060	0.070	0.050	0.060
Roa_Chg_Large	8.544	-30.151*	3.346	6.685	-27.371*
	36.500	15.640	31.080	26.720	16.350
Size_Plan_Chg	-12.181	-5.513	-12.639	-8.898	-6.466
	15.240	16.290	15.680	14.690	15.980
Size_Plan_Chg_Large	-75.012**	-105.572***	-53.492*	-42.802	-108.868***
	29.020	26.480	31.730	30.180	26.200
Crisis: CISS_chg	-16.356	-44.784**	-8.952	-17.917	-62.412***
	19.140	18.380	18.690	18.510	18.300
AT * IORP	-54.864	-61.379	-155.510*	-151.760*	
	38.120	37.270	91.540	79.880	
BE * IORP	-61.730*	-39.674	-74.553**	-71.688**	
	33.110	35.050	31.880	30.800	
IE * IORP	-25.563	-17.928	-27.859	-15.985	
	27.820	26.670	29.900	29.210	
IT * IORP	-153.691***	-109.707	-131.575***	-131.202***	
	52.180	73.350	45.230	45.100	
NL * IORP	-13.764	-14.463	-43.468**	-63.119***	
	17.170	16.730	17.750	18.890	
PT * IORP	-100.242*	-45.628	-56.262	-93.879*	
	57.920	61.560	57.950	54.620	
UK * IORP	1.079	-6.771	-7.175	-7.940	
	7.540	7.360	7.700	7.510	
IORP (2010-12)					-10.860*
					6.130
Constant	-7.266**	-8.455***	-0.773	4.764	-7.686***
	3.240	2.570	3.130	3.160	2.510
Observations	2,642	2,520	2,744	2,840	2,520
R-squared	0.029	0.036	0.025	0.025	0.033
Number of firms	355	335	373	390	335

1) Note: The later starting dates allow sufficient observations for additional countries to be included in the analysis, compared with the baseline regression.

Table A5 Robustness test, RWA reweighted (LTN-based debt weights)

Variables	(1) OLS FE Macro starting 2007 RWA_ltn_ constant_chg	(2) OLS FE Macro+ Company+ IORP starting 2007 RWA_ltn_ constant_chg	(3) OLS FE Extended Macro + CISS_chg starting 2007 RWA_ltn_ constant_chg	(4) OLS FE Extended Macro + gift_chg starting 2007 RWA_ltn_ constant_chg	(5) OLS FE Extended Macro + SRI_EA_chg starting 2007 RWA_ltn_ constant_chg	(6) OLS FE Countries_int starting 2007 RWA_ltn_ constant_chg	(7) OLS FE Size dummies starting 2007 RWA_ltn_ constant_chg	(8) OLS FE Funding dummies starting 2007 RWA_ltn_ constant_chg
Rgdp_Chg	4.537**	4.184*	4.458**	5.490**	6.554**	4.319*	4.476**	4.476**
Sto_Chg	2.080	2.220	2.230	2.330	2.580	2.530	2.230	2.240
Ltn_Chg	0.128***	0.123***	0.101***	0.079**	0.109***	0.065	0.100***	0.099***
Respp_Chg	0.030	0.030	0.030	0.030	0.030	0.060	0.030	0.030
Funding_Gap_Chg	47.861***	47.306***	43.960***	41.529***	44.860***	42.852***	43.877***	43.813***
Funding_Gap_Chg_Large	3.610	3.720	4.170	4.430	4.130	5.560	4.140	4.100
Roa_Chg	-0.070	0.120	-0.247	-1.168	-0.463	0.152	-0.235	-0.228
Roa_Chg_Large	0.880	0.940	0.950	1.120	0.980	1.150	0.960	0.940
Size_Plan_Chg		0.189	0.230	0.256	0.245	0.253	0.231	0.230
Size_Plan_Chg_Large		0.320	0.330	0.330	0.33	0.340	0.320	0.330
Crisis: CISS_chg		12.441	11.412	4.232	9.787	25.277	10.835	9.855
Crisis: Gift_chg		41.600	39.640	38.650	40.810	39.660	39.840	39.780
Crisis: SRI_chg		-0.005	-0.005	-0.002	-0.004	-0.004	-0.004	-0.004
IORP		0.040	0.040	0.040	0.040	0.040	0.040	0.040
AT*IORP		-189.249***	-194.674***	-213.059***	-202.979***	-192.542***	-195.758***	-195.539***
BE*IORP		22.240	22.400	24.590	23.390	25.000	22.280	22.160
IE*IORP		2.074	-0.204	-1.499	0.246	2.005	-0.073	-0.210
IT*IORP		10.490	10.570	10.640	10.660	10.110	10.570	10.590
NL*IORP		76.711*	74.603*	73.736*	78.216*	63.857	75.994*	73.885*
PT*IORP		42.180	41.130	39.860	41.900	39.120	41.530	41.830
UK*IORP			-37.135**			-33.716*	-37.077**	-37.383**
Medium firms *IORP			16.950			17.890	16.970	16.960
Large firms *IORP				-0.717**				
Underfunded pensions *IORP				0.300				
Overfunded pensions *IORP					-110.559*			
Constant	-0.355	-2.548	-3.278	-1.280	-7.035			
Observations	6.180	6.510	6.570	6.660	7.200			
R-squared						-35.983		
Number of firms						54.160		
						-6.869		
						35.710		
						8.336		
						33.940		
						-87.011		
						53.750		
						24.655**		
						11.750		
						70.575		
						61.030		
						-7.679		
						9.110		
							-6.082	
							8.950	
							-4.521	
							8.600	
								-5.886
								7.870
								0.400
								12.020
	-18.226***	-14.976***	-17.098***	-20.994***	-10.761**	-15.871***	-16.883***	-16.813***
	3.040	4.110	4.190	5.020	4.580	4.280	3.990	4.280
	1,732	1,681	1,681	1,681	1,681	1,681	1,681	1,681
	0.242	0.243	0.246	0.247	0.245	0.252	0.246	0.246
	357	355	355	355	355	355	355	355

Table A6 Robustness test, RWA reweighted (CDS-based debt weights)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE Macro	OLS FE Macro+ Company+ IORP	OLS FE Extended Macro + CISS_chg	OLS FE Extended Macro + gift_chg	OLS FE Extended Macro + SRI_EA_chg	OLS FE Countries_int	OLS FE Size dummies	OLS FE Funding dummies
	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg
Rgdp_Chg	2.021 2.150	1.522 2.290	1.962 2.27	3.737 2.35	5.498** 2.55	3.455 2.44	1.831 2.29	1.854 2.30
Sto_Chg	0.037* 0.020	0.030 0.020	-0.005 0.02	-0.044* 0.02	0.007 0.02	0.085 0.05	-0.001 0.02	-0.005 0.02
Ltn_Chg	9.052** 3.760	8.381** 4.11	2.993 4.49	-1.423 4.46	4.277 4.47	12.989** 5.58	3.739 4.39	3.151 4.49
Respp_Chg	1.565* 0.920	1.931* 0.980	1.338 0.98	-0.256 1.14	0.951 1.00	0.066 1.10	1.229 0.97	1.314 0.97
Funding_Gap_ Chg		0.371	0.437	0.484	0.463	0.424	0.425	0.436
Funding_Gap_ Chg_Large		0.310 11.113	0.31 9.457	0.32 -2.817	0.32 6.661	0.32 16.595	0.31 6.254	0.32 5.236
Roa_Chg		39.800 -0.013 0.040	36.55 -0.013 0.04	35.12 -0.008 0.05	38.51 -0.011 0.04	36.33 -0.016 0.04	37.21 -0.010 0.04	36.56 -0.011 0.04
Roa_Chg_ Large		-192.620***	-201.358***	-233.028***	-215.659***	-217.590***	-206.709***	-205.676***
Size_Plan_Chg		23.720 -2.9720 9.610	23.61 -6.641 9.36	25.45 -9.034 9.33	24.18 -6.038 9.49	25.79 -4.022 8.98	23.26 -6.148 9.39	23.21 -6.846 9.43
Size_Plan_ Chg_Large		75.198*	71.804*	70.150*	77.725**	58.114	72.718*	69.345*
Crisis: CISS_ chg		39.880	38.53 -59.804***	36.67	39.27	36.18 -31.248*	39.22 -59.016***	39.44 -60.489***
Crisis: Gift_chg			16.30			17.56	16.35	16.41
Crisis: SRI_chg				-1.216*** 0.28				
IORP					-185.516*** 53.32			
AT* IORP						-44.516 51.44		
BE* IORP						-28.150 36.69		
IE* IORP						-57.169* 29.38		
IT* IORP						-143.832***		

Table A6 Robustness test, RWA reweighted (CDS-based debt weights) (cont'd)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS FE Macro	OLS FE Macro+ Company+ IORP	OLS FE Extended Macro + CISS_chg	OLS FE Extended Macro + gift_chg	OLS FE Extended Macro + SRI_EA_chg	OLS FE Countries_int	OLS FE Size dummies	OLS FE Funding dummies
	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg	starting 2007 RWA_CDS_ constant_chg
NL* IORP						49.24		
						25.938**		
						11.09		
PT* IORP						-101.398		
						65.77		
UK* IORP						-1.425		
						8.92		
Medium firms* IORP							-16.897*	
							9.00	
Large firms* IORP							-12.731	
							8.18	
Underfunded pensions* IORP								-14.919*
								7.93
Overfunded pensions* IORP								-9.535
								12.32
Constant	-16.621***	-12.576***	-15.992***	-22.789***	-5.502	-16.183***	-17.013***	-16.331***
	3.130	3.94	3.99	4.77	4.29	4.17	3.81	4.08
Observations	1732	1681	1681	1681	1681	1681	1681	1681
R-squared	0.040	0.045	0.054	0.061	0.053	0.068	0.054	0.054
Number of firms	357	355	355	355	355	355	355	355

Table A7 Robustness test, RWA reweighted (CDS-based debt weights)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company+ IORP	Extended Macro + CISS_chg	Extended Macro + gift_chg	Extended Macro + SRI_EA_chg	Countries_int	Size dummies	Funding dummies
	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007	starting 2007
	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg	RWA_CDS_ yearly_chg
Rgdp_Chg	5.954*** 2.120	5.578** 2.240	5.742** 2.230	7.091*** 2.310	6.934*** 2.480	5.836** 2.420	5.682** 2.250	5.694** 2.250
Sto_Chg	0.046** 0.020	0.041* 0.020	0.028 0.020	-0.009 0.020	0.033 0.020	0.029 0.050	0.030 0.020	0.027 0.020
Ltn_Chg	11.968*** 3.660	11.562*** 3.950	9.556** 4.330	4.867 4.370	10.164** 4.270	11.514** 5.320	9.909** 4.250	9.563** 4.310
Respp_Chg	0.081 0.910	0.386 0.970	0.166 0.970	-1.107 1.140	0.052 0.980	0.169 1.070	0.114 0.970	0.162 0.960
Funding_Gap_ Chg		0.373	0.397	0.450	0.404	0.423	0.391	0.396
Funding_Gap_ Chg_Large		0.320	0.320	0.320	0.320	0.320	0.310	0.320
Roa_Chg		5.248	4.631	-4.266	3.730	15.467	2.488	1.370
Roa_Chg_ Large		39.400	38.33	36.65	39.18	38.120	38.860	38.460
		-0.015 0.040	-0.015 0.040	-0.012 0.040	-0.015 0.040	-0.015 0.040	-0.013 0.040	-0.014 0.040
Size_Plan_Chg		-219.775*** 23.350	-223.029*** 23.300	-247.373*** 25.170	-227.630*** 23.700	-227.285*** 25.160	-226.575*** 23.040	-225.898*** 22.970
Size_Plan_ Chg_Large		3.660 9.550	4.330 9.550	4.370 9.470	4.270 9.620	5.320 9.020	4.250 9.580	4.310 9.580
Crisis: CISS_ chg		66.298* 40.170	65.034 39.540	62.851* 37.930	67.159* 40.150	52.809 38.230	66.338 40.230	63.212 40.360
Crisis: Gift_ chg			-22.272 15.890			-12.273 17.050	-21.804 15.930	-22.778 15.940
Crisis: SRI_chg				-0.831*** 0.280				
IORP	-6.992 6.120	-9.105 6.510	-9.542 6.530	-7.635 6.640	-11.671* 7.040			
AT* IORP						-39.960 51.960		
BE* IORP						-6.491 38.350		
IE* IORP						-5.384 25.620		
IT* IORP						-103.662** 49.550		
NL* IORP						21.866* 11.140		
PT* IORP						14.053 56.110		
UK* IORP						-9.558 8.800		
Medium firms* IORP							-13.095 8.910	

Table A7 Robustness test, RWA reweighted (CDS-based debt weights) (cont'd)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE	OLS FE
	Macro	Macro+ Company+ IORP	Extended Macro + CISS_chg	Extended Macro + gift_chg	Extended Macro + SRI_EA_chg	Countries_int	Size dummies	Funding dummies
VARIABLES	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg	starting 2007 RWA_CDS_ yearly_chg
Large firms* IORP							-9.316	
							8.14	
Underfunded pensions* IORP								-11.650
								7.78
Overfunded pensions* IORP								-4.682
								12.03
Constant	-15.403*** 3.010	-9.108** 3.800	-10.380*** 3.970	-16.084*** 4.800	-6.697 4.140	-9.281** 4.200	-10.803*** 3.810	-10.404** 4.060
Observations	1,732	1,681	1,681	1,681	1,681	1,681	1,681	1,681
R-squared	0.045	0.049	0.050	0.056	0.050	0.057	0.050	0.050
Number of firms	357	355	355	355	355	355	355	355

APPENDIX B: DATA SOURCES

Table BI Data sources	
Variable	Empirical analysis
	Source
IORPs investment position (bond, equity, real estate, cash, other)	Bloomberg; Thomson Reuters Datastream
<i>macroeconomic variables</i>	
growth of domestic real GDP	Haver Analytics
growth of domestic stock indices	Bloomberg
residential property prices	Haver Analytics
10 year government bond yields	Bloomberg
<i>firm specific variables</i>	
return on asset	Bloomberg; Thomson Reuters Datastream
total pension plan asset	Bloomberg; Thomson Reuters Datastream
funding gap	Bloomberg; Thomson Reuters Datastream
sector breakdown	Bloomberg; Thomson Reuters Datastream
<i>Crisis-related indicators</i>	
Global Index of Financial Turbulence	ECB Financial Stability Review, December 2009, pp. 21-23
Composite Indicator of Systemic Stress	ECB calculations
Systemic Risk Indicator	ECB calculations

