

Retirement System Risk Management

Implications of the New Regulatory Order

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Pension Fund Investment in Infrastructure and Global Financial Regulation

Javier Alonso, Alfonso Arellano, and David Tuesta

A topic attracting attention in recent global regulatory discussions is the possibility that private pension funds should invest in alternative assets, particularly infrastructure projects.¹ As defined by the OECD, this refers to

the system of public works in a country, state or region, including roads, utility lines and public buildings. Infrastructure is typically used for performing long term capital activities which provide essential services to the public. Infrastructure investments are expected to produce predictable and stable cash flows over the long term. Infrastructure assets normally operate in an environment of limited competition as a result of natural monopolies, government regulation or concessions. Investments are usually capital intensive and include a tangible asset that must be operated and maintained over the long term. (Della Croce et al. 2011: 15–16)

Although there are relevant pros and cons to be considered by pension funds when investing in infrastructure, there have been at least three alluring factors that make it interesting for pension funds to invest in alternative assets. First, these assets are attractive in terms of profitability and risk, and many pension funds have had apparently successful experiences with them. Second, there are arguments about the suitability of such long-maturity assets, given institutional investors' long-term horizons. Third, there are perceived needs to fund infrastructure when governments have budgetary limitations and banks are forced to disinvest from these assets due to financial regulation.

Against this backdrop, countries around the world are introducing regulatory changes to allow or increase pension fund investments in infrastructure. Generally speaking, this means allowing pension funds to invest more in specific projects and, at the same time, designing specific financial vehicles to balance the investment criteria of pension fund members in terms of profile, risk, returns, and portfolio diversification. Our goal in this chapter is to assess the role of regulation on pension fund decisions to invest in this specific financial asset. We carry out a quantitative analysis with the aim of shedding some light on the different explanatory variables which might affect whether or not pension funds invest in infrastructure, among them financial regulatory

factors. In what follows, we first highlight the elements encouraging pension funds to invest in infrastructure projects. Next, we analyze the pros and cons of pension investments in this alternative asset. We then focus on financial regulatory factors that interact with pension fund investments in infrastructure in different regions. We also offer an econometric analysis to assess which factors are currently the most influential on pension funds investing in infrastructure. We close with our key conclusions.

Factors Accelerating the Trend for Pension Funds to Invest in Infrastructure

We have constructed a database for 72 pension funds across 21 countries, where their investment menu includes investing in infrastructure (see Table 10.1). For those countries currently investing in infrastructure, this averages 5.6 percent. This average is influenced by two countries that actively invest in infrastructure, namely Canada (6.6 percent) and Australia (8.6 percent). Interestingly, in our sample, there are a dozen pension funds which invest between 10 and 31 percent of their portfolios in unlisted infrastructure assets. Moreover, Della Croce (2012) estimates that, between 2010 and 2013, the world's ten largest pension funds boosted their allocation to alternative assets from 17.6 to 19.5 percent. Several factors have contributed to this trend.

The financial crisis

The straitjacketing of public spending in the wake of the financial crisis has suppressed much infrastructure funding vital to economic growth.

The European Commission (2014c) suggests that Europe will need to raise €1.5–2.0 trillion in funds for infrastructure investment by 2020, and the US will seek \$1.7–3.0 trillion by the same date. Several groups including the European Commission (2014a, 2014b) seek formulas for co-financing by the private sector. One reason is that banks, which had fulfilled this role in the past, are now facing problems in providing funding, owing to the restrictions imposed under Basel III, specifically under the Capital Requirement Regulation (CRR). Given this, the Commission has suggested that the insurance and pension fund industry may be the ideal candidate to step in.

Pension funds and their role in the economy

There has been increasing support for pension funds investing in infrastructure, as a win-win situation for pension funds and macroeconomic stability (Escrivá et al. 2010). Figure 10.1 shows the interaction between pension

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TABLE 10.1. Pension fund investment in infrastructure

	Actual (%)	Target (%)	Year
Aust-Ausfund	0	10.0	2010
Aust-BUSS (Q)	17.9	0.0	2010
Aust-Care	6	0.0	2010
Aust-Catholic	0	5.0	2010
Aust-Cbus	14.1	0.0	2010
Aust-Firstsuper	0	7.5	2010
Aust-First State SA	3.5		2011
Aust-Future	8	0.0	2013
Aust-Health Super	4.6		2009
Aust-AusGov Superfund	6.7		
Aust-Hesta	0.8	10.0	2010
Aust-Hosplus	0	4.0	2009
Aust-Military	9	0.0	2010
Aust-MTAA	31.1	25.0	2010
Aust-Q Super	6.2		2011
Aust-QIC	4	0.0	2010
Aust-State Super	1.9	0.0	2010
Aust-Sun Super	5.1	5.0	2013
Aust-Australian Super	9.8	14.0	2013
Aust-Retail Employees	13.8		2011
Aust-Reward	13.8		2011
Aust-Telstra	3	0.0	2010
Aust-Unisuper	4.4	6.5	2010
Aust-VIC	5.5	0.0	2010
Aust-West Schem	17.9	0.0	2010
Argentina-Sustainability Guarantee Fund	13.6	20.0	2013
Bras-Pension Funds	1.0	0.0	2010
Brasil-Previ	6.9	0.0	2013
Brasil-Funcef	6.9	0.0	2013
Brasil-Fapes	0.0	0.0	2013
Can-CPP Alberta	6.1		2012
Can-Caisse de Depo	1.4	8.8	2010
Can-CPP	6.1		2012
Can-CPIIB	5.5	0.0	2010
Can-OMERS	14.9	21.5	2013
Can-OTTP	8.4	8.5	2013
Can-PSP	6.1		2012
Can-Quebec Pension Plan	4.0	5.0	2013
Chil-AFP	1.2	0.0	2010
Chil-Provida	0.0	0.0	2013
Chil-Habitat	0.2	0.0	2013
Chil- Pension Reserve Fund	0.0	0.0	2013
Col-AFP	0.7	0.0	2010
Den-PFA	0.8	0.0	2013
Finland-Ilmarinen	0.3	0.0	2013
Finland-Keva	0.0	0.0	2013
Israel-Menora-Mitvachim	2.9	0.0	2013
Japan-Pension Fund Association	0.1	0.0	2013

Mex-AFORE	4.8	0.0	2010
Mex-AFORE XXI Banorte	0.3	5.0	2013
Mex-Banamex	1.8	2.5	2013
Ned- ABP	1.5	3.0	2013
Ned- PFZW	2.4	3.0	2013
Ned-PGGM	0.8	0.0	2010
Ned-PMT	0.6	1.0	2013
New Zealand-Superannuation Fund	1.9	0.0	2013
Per-AFP	3.7	0.0	2010
Portugal-BPI Pension Fund	3.3	0.0	2013
Portugal-CGD Staff's Pension Fund	1.6	1.6	2013
RSA-Gov Employees	0.1	0.0	2013
Swe- AP Fonden	0.8	0.0	2010
Swe- AP 4	0.0	0.0	2013
Swe- AP 3	1.4	2.0	2013
Spain-Endesa	0.0	0.0	2013
Spain-Fonditel	0.1	0.0	2013
Turkey -Oyak	4.4	0.0	2013
UK-USS	4.4	5.0	2013
USA-Alaska PFC	0.0	18.0	2010
USA-Calpers	0.0	3.0	2010
USA-MERS	0.0	5.0	2010
USA-Calsters	0.0	2.5	2010
USA-NYC Combined Retirement Service	0.0	0.0	2013

Sources: Derived by the authors from Inderst (2014), OECD (2014a), Tuesta (2013), Weber and Alfen (2010), Future Fund Board (2011), Infrastructure Partnerships Australia (2010), and Macquarie (2009).

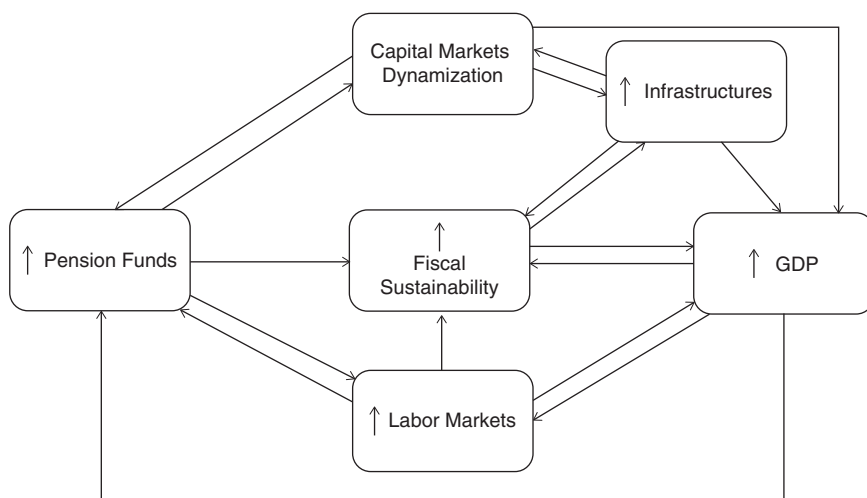


Figure 10.1 Pension funds and infrastructure: the theoretical virtuous circle

Source: Authors' depiction.

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funds and economic growth through various channels of transmission, foremost among these being financial, fiscal, and labor market mechanisms. The same figure highlights the role fulfilled by infrastructure and its impact on growth, suggesting that pension funds could become the backers of infrastructure projects and their effects on growth. A study by Alonso et al. (2009) revealed that elasticity of growth with respect to infrastructure could be between 7.0 and 13.5 percent.

Also in Figure 10.1, it is important to focus on the fiscal channel. This could be positively affected, since the presence of the private sector means a lower public borrowing requirement, thus reducing its vulnerability and boosting growth. Likewise, capital markets play a major role through pension fund financing, by bringing more resources to economic agents, greater efficiency, and improving fiscal sustainability.

It should be pointed out that for such a 'virtuous circle' between pension funds and infrastructures to crystallize, there must be well-defined and sound projects, a good financing vehicle for them, and an institutional framework that enables the interests involved in carrying out infrastructure projects to be harmoniously aligned in pursuit of the success of the investment.

Ultra-low interest rates

Another important incentive for pension funds to think about investing in infrastructure projects is the low interest rate environment. This type of alternative asset could counterbalance the negative effects. In the case of defined contribution (DC) plans, the low interest rate scenario has a direct impact on the pension accumulation process, already threatened by rising longevity. Systems with defined benefit (DB) pensions will have difficulties in ensuring that their commitments comply with lower interest rates.

Why Might Pension Funds Invest in Infrastructure?

Beyond the forces that are driving forward the policy trends in favor of pension funds investing in infrastructure projects, it is important to take into account at least three relevant conceptual criteria.

The perspective of the pension fund member

Various reasons are cited by the literature as justification for greater pension fund investment in infrastructure (Alonso et al. 2009). These can be reduced to six basic concepts:

- (1) there is a neat fit between the pension fund portfolio and the long-term time horizon for infrastructure projects to mature;
- (2) infrastructure tends to operate like natural, regulated monopolies, or oligopolies, with reduced or non-market competition, resulting in a portfolio with more stable asset values;
- (3) there is a low correlation between the assets in infrastructure projects and other financial asset classes, which normally track the vicissitudes of the economic cycle;
- (4) infrastructure provides protection against inflation;
- (5) it offers a good risk–return tradeoff; and
- (6) infrastructure assets have greater cash-flow stability when the project has matured.

In a nutshell, infrastructure offers an improved portfolio efficient frontier (Andrews and Wahba 2007; Weber and Alfen 2010; Sawant 2010).

In spite of these attractive features of infrastructural investments, a lack of statistical data can thwart attempts to examine this issue in depth. One country that provides much information on this matter is Australia: Peng and Newell (2007), Bird et al. (2012), Connolly (2012), and Inderst (2014) all report high risk-adjusted returns and low correlations with other asset classes in this context. Inderst (2014) states that some aspects require deeper analysis, as many of these studies make their estimates using small samples and valuations of unlisted infrastructure assets based on expected values, which tends to underestimate volatility and correlations to listed instruments, while overestimating potential portfolio diversification.

Pension fund liabilities and their role in investment selection

A decision to include infrastructure investments in a pension fund's portfolio should also depend on the characteristics of the pension liabilities. The value of a liability is related to the expected benefit payments (the future cash outflows) and the discount rate, which implies inherent risks that could impose volatilities attributable to wages, inflation, and many non-market-related factors. They also exhibit growth attributable to future service costs and other non-market-related factors. Uncertainty in pension benefits varies greatly by demographic group, with exposures which are either market-related or not. During the recent financial crisis, many DB schemes did experience funding problems; considering that infrastructure projects are long-term investments, these could match the long duration of pension liabilities (Della Croce 2012; Della Croce and Yermo 2013). Accessibility

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has also proven to be a problem in the past, particularly for smaller pension schemes in the case of the UK (NAPF 2013).

Focusing on the characteristics of pension fund liabilities and the financial situation they are facing, it may be savvy for pension funds to increase their exposure to long-term infrastructure. For instance, healthcare infrastructure could be an interesting choice. Healthcare is poised to be the most significant growth industry of the century, one of the few asset classes that can generate consistently high returns according to Yun (2012). A declining, aging population is a demographic headwind for most investment assets, but for healthcare it is a tailwind. Thus investing in healthcare infrastructure could allow pension funds to isolate longevity risk, the variable that most imbalances their revenues and obligations. Investing in the healthcare sector may be a natural hedge for pension funds.

Limitations for investing in infrastructure

Investing in infrastructure is a very complicated endeavor, requiring the alignment of several different stakeholder interests: shareholders, financial institutions, regulators, insurance companies, constructors and operators of infrastructure projects, suppliers of raw materials, and end users (Tuesta 2015). Besides that, a Special Purpose Vehicle designed for this end needs to deal with different risks and coverages: construction (delays, extra costs, technical failures), operational (insufficient production, increase in costs, quality of the product), supply contract (deficit or supply, interruptions, price of supply), financial markets (rates of return, currency), market fluctuations (demand, price, delay in payments), and politics (expropriation, political turmoil, regulation).

Accordingly, it may be difficult for a pension fund to deal with all the issues and risks. In order to deal efficiently with an infrastructure portfolio, the pension funds need to invest important resources in human capital and develop a degree of expertise that interplays with the characteristic of the project, market functioning, and the institutional framework. This is probably the most important lesson learnt from Australia and Canada (Inderst 2014). From these country cases, there are at least three areas that must be reinforced to facilitate the participation of pension funds investing in infrastructure projects.

The availability of good projects

Pension funds face a combination of factors that disincentivize infrastructure investment. These are principally characterized by the relation of the concession (or project finance) process and the different conditions in each country's domestic financial market. Additionally, there may be other

barriers more specific to the sector, related to their technical capacity to evaluate investment in this type of asset and country-specific regulation. Project financing also involves inherent risks (OECD 2014d). For greenfield projects, the risks are apparent at the time that the project is conceived, and the construction risk can cause deviations in the costs of the project. In the operational phase, there can be supply, operating, and market risks. The latter are the most recurrent and appear when the expectations of the use of the infrastructure fall to much lower levels than those initially estimated, which affect the profitability of the operation. There are also other risks, including regulatory, legal, and credit risk.

A more fundamental concern has to do with the scant availability of high-quality investment projects. Although estimates by international institutions indicate a broad availability of potential investment projects around the world, in reality, available opportunities are much more limited. Depending on the country, there are enormous differences in the tradition of private-sector financing. In Europe, the usual procedure is that local development companies themselves undertake domestic infrastructure projects. For instance, in Spain and Germany, most toll roads are financed by the public sector, while in other countries, such as Portugal and France, they are financed by the private sector. In addition, in developed countries, the more profitable infrastructure projects have already been completed, while those still pending tend to involve more risk and less certain profitability. In this context, one of the proposals made by the European Commission (2014a, 2014b) to mitigate this problem is the creation of a pipeline of infrastructure projects at a European level that makes the necessary information available, such that any potential institutional investor in any country can participate in financing a project.

Rule of law

Other equally important elements are those related to legal uncertainties regarding contracts. Investors in public infrastructure need clear and stable regulations, together with efficient contractual procedures (OECD 2014b). This has not always been the case, however, and some governments have changed the contractual terms of their concessions. For example, the Spanish government has not complied with the contracts signed in solar electricity generation and the developers have seen a cut in the price per kilowatt-hour generated. This type of failure to comply can have an enormous impact on a project's financial return.

Risk mitigation tools

The regulatory framework for the financial sector (Basel II and III and Solvency II) prioritizes the need to measure such risks and provide the

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necessary capital to cover them. Yet this presents a disincentive for some institutions to finance infrastructure. Moreover, traditional insurers such as monoline companies collapsed in the last financial crisis. Without such insurance support, many infrastructure projects would be poorly rated by the rating agencies. For example, the use of project bonds has shrunk since 2008, due to the lowered ratings on the monoline companies that had been insuring them (OECD 2014d).

Many argue that the participation of international financial institutions such as the World Bank, the International Development Bank, or the European Investment Bank (EIB) has become fundamental in the wake of the financial crisis. Nevertheless, public–private partnerships (PPPs) can be seen as helpful in incentivizing the participation of the private sector in financing infrastructure (World Bank 2011). Some projects might be unviable from a financial point of view but might nonetheless be socially viable or generate positive externalities. In such a case, the private sector would not undertake the project unless it had some kind of guaranteed minimum level of earnings that would ensure an appropriate return on investment. Yet governments must ensure that the conditions for the infrastructure investment provide value for money, in relation to construction costs and underwriting risks.

Global Financial Regulation and Pension Fund Investment in Infrastructure

When Basel II came into effect in 2004, it forced lending institutions to build up capital to cover operating risks and market risk. Basel II allows the entities to use internal models to calculate their risk-weighted assets. The financial crisis in 2008–10 revealed the weaknesses of the system due to the high leverage of the lending institutions, their liquidity problems, and the low level and quality of their capital. Basel III is the consequence of this, and it obliged the institutions to improve the quality and quantity of their capital, enhance their risk management systems, reduce leverage, increase liquidity, and take counter-cyclical measures.

Global financial regulation limits the participation of banks in infrastructure projects

The consequences for infrastructure finance were immediate. First, financing entities became more risk-averse. Some countries have established a Liquidity Coverage Ratio (LCR) of 50 percent, which practically eliminates infrastructure projects. Second, the degree of coverage depends on the time

horizon: the longer the time horizon, the higher the consumption of capital. As financing infrastructure construction and operation is long-term, this has provided a further disincentive to continuing investment.

In addition to the global legislation, there are also local regulations that can have a negative impact on the development of products linked to infrastructure. For example, infrastructure funds have been unsuccessful in Spain because the solvency requirements for these funds when tendering for PPP projects present an obstacle, as they normally manage funds that are not in themselves corporate. These tenders are normally designed for construction companies (CEOE 2013).

Pension fund investment in infrastructure and its regulation

Infrastructure regulation is complex for several reasons. First, there is the problem of defining what infrastructure to launch. Second, historical data are insufficient to evaluate the possible impacts of this regulation. These assets are supported by physical installations, so their characteristics will determine the specific type of project finance. A project for investment in a toll road is not the same as for a photovoltaic electricity generating plant, or a hospital. Nor is a toll road connecting the two principal cities in a country directly comparable with one connecting relatively unpopulated areas, for example. In addition to the different types of infrastructure, the type of investment project must reflect whether it is a greenfield investment, or whether it is for the maintenance or improvement of a previously existing asset (brownfield). The financing project must also consider whether the investment is based on shares or debt, and also whether these instruments are traded in an organized market. Sometimes the investment is directly to build the infrastructure itself, while other times it is indirect through other financial vehicles. Investments that have a direct link include, for example, pension fund loans to the developer through project bonds, obligation bonds, or by taking an equity stake in one or several specific infrastructure assets through greenfield shares. Indirect investments would be made by buying shares in quoted companies involved in infrastructure development, or by buying into an infrastructure investment fund, whether quoted or not. Given this wide range of possibilities, the ideal would almost be to establish specific regulations for each project, although this is evidently impossible, and therein lies the difficulty of specifying general regulations.

In several countries, pension funds investing in infrastructure assets have done so within the limitations imposed by their respective financial investment regulations, the degree of sophistication of their respective capital markets that allow or forbid this type of investment, and the pension fund's

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technical possibility of accessing infrastructure financing, either direct or indirect. Individual countries also adopt different regulatory responses to this complexity, which varies between relying on total flexibility of pension funds' investment in infrastructure and imposing restrictions.

Geographies with extremely flexible financial regulation

Countries that have completely flexible regulations probably find that legislating for investment in this type of asset is too expensive, given the enormous diversity of the potential projects. They assume that the best entities to assess the risks of the project are the investors themselves, and as such, only establish that the investments should be 'prudent' and well planned (OECD 2014a). Adopting this model implies that the pension funds should have the necessary knowledge to successfully evaluate each project. This group typically comprises the Anglo-Saxon countries (UK, US, Australia, and Canada), plus Belgium and the Netherlands, all of which establish no quantitative limits on infrastructure investment.

Within this group, there is also a significant diversity in terms of the investment policy adopted. For example, in Canada and Australia, the instruments selected vary considerably. Canada has an interesting combination of direct investment in unlisted infrastructure asset projects; it has one of the most developed project bond markets and at the same time invests a significant proportion of its infrastructure portfolio abroad. Meanwhile, Australia has developed great expertise in packaging the risks in special financing vehicles managed by infrastructure funds, and it recently has invested more actively in unlisted assets. We also note that pension fund investment in Australian infrastructure was incentivized by the introduction of an obligatory DC pension system, while in Canada this boost came from very mature private DB pension funds (Inderst 2014).

Regulation of infrastructure investment by means of limits or conditionality

Some countries set limits on pension fund investment in infrastructure. For example, one-third of the countries analyzed by the OECD (2014a) did not allow investment in private investment funds or via direct loans. Yet a majority of the countries allow investment in private bonds (including infrastructure bonds), though the limit is almost always lower than for holdings of government bonds. Most countries do not allow investment in unlisted shares and have limits for quoted assets, as is exemplified by various Latin American countries. According to Tuesta (2015), Brazil, Chile, Colombia, Mexico, and Peru, the countries with the most important private

pension schemes in the region, are investing around 2.6 percent of their total portfolios in infrastructure. Mexico is of particular note, which to date has invested an average of 4.8 percent of its portfolio in infrastructure projects.

The regulatory experience of these countries has been limited. The first infrastructure bonds were developed under the 1998 monoline scheme in Chile, which enabled the financing of that country's key infrastructure. Later on, this scheme had to be dropped, however, and current investments in such assets occur via infrastructure funds. Mexico is leading the way in developing packaged instruments for pension fund investment in such projects, with the so-called Fibra (Real Estate Investment Trusts) and CKD (Development Capital Certificate). Colombia, meanwhile, has developed infrastructure bonds with limited government financing. Peru has opted for trust funds to invest in infrastructure set up by the pension funds themselves; these take stakes in infrastructure funds where they play an active role on the board. Peru has also developed the so-called CRPI (Work in Progress Certificates) for mega infrastructure projects that are more like public works, as they have substantial guarantees from government tax revenues.

All the Latin American infrastructure investments have some type of quantitative limitation, either direct, in the case of identifying the special vehicle itself, or indirect, such as the general quantitative cap for debt or equity instruments. Countries such as Colombia and Mexico have set limits on their infrastructure investment vehicles that vary depending on the risk profiles of the workers participating in the pension funds and of the portfolios in which the funds are invested (Tuesta 2015). In the case of Mexico, these can be up to 12 percent, while in Colombia the limit is 7 percent of certain portfolios.

The case of Europe

Several efforts have been made to encourage institutional infrastructure investment in Europe in recent years (European Commission 2014a, 2014b). Nonetheless, the enormous diversity of pension systems has so far prevented regulation of a common infrastructure investment market. Within the EU, national legislation predominates, with significant differences between the least restrictive countries regarding such investments (Belgium, with 10.58 percent) and the strictest (Spain, 6.06 percent) (see Appendix and results in Table 10.2).

In 2009, the European Commission proposed a directive on Alternative Investment Fund Managers (AIFMs) with the objective of creating a regulatory and supervisory framework for AIFMs at a European level, which would make the management of these funds more transparent for both the

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TABLE 10.2. Index of regulatory liberalization for the investment of pension funds in infrastructure

Country	Index	Country	Index	Country	Index	Country	Index
Belgium	10.58	Sweden	7.93	Iceland	6.01	Zambia	4.91
Canada	10.58	Germany	7.93	Jordan	6.01	Nigeria	4.57
Ireland	10.58	South Korea	7.78	Switzerland	5.68	Nigeria	4.57
Netherlands	10.58	Portugal	7.61	Brazil	5.68	Romania	4.57
Gibraltar	10.58	United States	7.59	Malta	5.66	Czech Republic	4.33
Malta	10.58	Hungary	7.22	Poland	5.50	Albania	4.18
Malawi	10.22	Greece	6.80	Bulgaria	5.50	Colombia	4.18
Australia	9.86	Mauritius	6.79	Slovak Republic	5.32	China	4.18
United Kingdom	9.86	Austria	6.74	Armenia	5.31	Pakistan	4.18
Israel	9.85	Italy	6.47	Armenia	5.31	Russian Federation	3.98
New Zealand	9.83	Turkey	6.47	Costa Rica	5.29	Maldives	3.79
Norway	8.71	France	6.43	Slovenia	5.29	Egypt	3.74
Japan	8.41	Thailand	6.10	Tanzania	5.29	Dominican Republic	3.38
Estonia	8.36	Trinidad and Tobago	6.07	Peru	5.29	Chile	3.07
Jamaica	8.31	South Africa	6.07	Kenya	4.93	Uganda	3.02
Luxembourg	7.95	Spain	6.06	Republic of Macedonia	4.93	India	2.30
Finland	7.94	Mexico	6.04	Namibia	4.91	Ukraine	2.25

Source: Derived by the authors from OECD (2014a).

authorities and investors (European Commission 2014a, 2014b). The body responsible for regulating pension funds in Europe (EIOPA) proposed the IORP and IORP II directives to homogenize national legislation on occupational pension funds with the requirements of Solvency II. In other words, the European focus prioritizes solvency and active risk management through models that allow the appropriate evaluation of the associated risks, not forgetting the required pillar of control and reporting.

Although EIOPA has recognized the importance of infrastructure for economic growth and its potential advantage for pension funds, it cautions that more work needs to be done and consultations carried out before any common legislation can be passed. In this respect, EIOPA proposed a discussion paper which first establishes how the various infrastructure and other long-term assets should be treated within the Solvency II framework, and for what type of financial investor (2013). EIOPA considers that the preferred type of investment for insurance companies in long-term assets would be direct project finance (bonds, loans, or equity), infrastructure investment funds (listed and unlisted), and infrastructure loan securitization vehicles.²

The most advanced initiative that tries to mitigate the problems noted is the Europe 2020 project bond initiative under the auspices of the EIB. The EIB plays a role like the former monoline insurers, covering greenfield infrastructure risks and providing the projects with an adequate credit rating. More specifically, the principal characteristics would be as follows: limiting loss coverage below 20 percent; aiming for an ‘A’ rating for the project (the minimum requirement for pension funds and insurance company asset portfolios); the possibility of subordinated loans from the EIB based on their financial situation and rating; and selecting the project finance or PPP projects available for audit by the EIB itself. In 2015, EIOPA created a working group to define what types of infrastructure investment offer predictable cash flows in the long term with well-identified risks. This group is also evaluating criteria for new types of infrastructure assets including transparency and standardization.

What Variables Have Influenced Pension Fund Investment in Infrastructure?

The Empirical Evidence

As we have noted, both regulatory and non-regulatory factors may encourage or discourage the participation of pension funds in infrastructure funding. In this section we propose a model to quantify which factors are most empirically relevant.

Data

Our data come from several sources. Information on pension investment regulation and aspects of the institutional and business environment is available in several OECD publications and the World Economic Forum USA’s report. To determine which variables could affect the investment of pension funds in infrastructure, we use three sets of variables.

A first group of variables was collected from the OECD (2014a), with data as of December 2013. This report contains information about all forms of restriction and legal regulation for pension funds to invest in infrastructures. Variables refer to the limits on OECD and selected non-OECD pension funds investment in several asset categories (equity, real estate, bonds, retail investment funds, private investment funds, loans, and bank deposits). Information is also available on whether the assets are domestic or foreign.

A second set of variables is taken from the World Economic Forum USA (2012), with data on institutional and business environments, financial stability, non-banking financial services, and financial access. One subset focuses

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on the capital account liberalization and the quality of overall infrastructure, both standardized on a scale from one (least) to seven (most).

A second subset is formed by an index of the strength of legal rights, the strength of investor protection index, and a financial strength indicator. These three factors take values from zero (worst) to 10 (best). The third subset includes the number of procedures to enforce a contract (in number of days) and the share of total number of securitization deals (as a percentage of total deals).

A supplementary group of variables is available in OECD (2014c) which tracks trends in pension fund financial performance (assets, investments, and industry structure). In particular, variables selected refer to the importance of pension fund assets as a share of GDP, the percentage of non-financial corporate bonds with respect to total bonds, and the amount of DB pension plans' assets as a percentage of total assets.

As the dependent variable we use the investment of pension funds in infrastructure (OECD 2014b). Here the total investment in infrastructure includes assets belonging to sectors such as transport, telecommunications, utilities, and energy. Pension funds can access infrastructure through different channels and the infrastructure investment (as a percentage of total investment) can be distinguished by three different categories: unlisted equity, listed equity, and debt. In this study, we consider the total amount of infrastructure investment (total infrastructure investment = unlisted equity + listed equity + debt). Table 10.3 provides further details on all variables.

Our unit of observation is the pension fund, not the country. Given the legislation of several countries (in alphabetical order, Armenia, Bulgaria, Czech Republic, Estonia, Finland, Germany, Luxembourg, Malta, Nigeria, Poland, the Russian Federation, Slovak Republic, and South Korea), these countries have different types of pension funds with different conditions of financial regulation and levels of investment. To study the effect of financial regulation and the institutional framework on the weight of the investment of pension funds in infrastructure, we use a Tobit model. The use of this model is conditioned by the particular characteristics of the dependent variable. The dependent variable is observed only over some interval, so we see a mixture of observations with zero and positive values. Therefore, the likelihood function has to take into account this particularity and involves additional computational complications.

The financial regulation is associated to the financial product considered. The high number of variables compared to the small number of observations and the limitations derived from the information of the variables require the use of principal components methodology. This procedure allows aggregating the information into two indicators: the portfolio limit in domestic asset categories and the portfolio limit in foreign asset categories (see Appendix).

TABLE 10.3. Variable descriptions

Variable	Description	Source
Portfolio limit in domestic asset categories	Relying on the OECD's report about the restrictions and regulation of pension funds, this index is created to measure how easy it is to make investments in different types of domestic assets. The OECD's report includes seven categories: equity, real estate, bonds, retail investment funds, private investment funds, loans, and bank deposits. Different codes are used for each of them depending on the existent regulation or restrictions, the higher the value for this index, the higher degree of flexibility when investing.	BBVA Research, OECD (2014a)
Portfolio limit in foreign asset categories	Relying on the OECD's report about the restrictions and regulation of pension funds, this index is created to measure how easy it is to make investments in different types of foreign assets. Seven categories are also included in this variable: equity, real estate, bonds, retail investment funds, private investment funds, loans, and bank deposits. Different codes are used for each of them depending on the existent regulation or restrictions, the higher the value for this index, the higher degree of flexibility when investing.	BBVA Research, OECD (2014a)
Capital account liberalization	This index measures the degree of capital account liberalization within a country, standardized on a scale from 1 (least liberalized) to 7 (most liberalized). This variable includes the level of capital controls based on information from the IMF's <i>Annual Report on Exchange Arrangements and Exchange Restrictions</i> , the Legal and Regulatory Issues subpillar and the Bond Market Development subpillar of the Financial Development Index included in <i>The Financial Development Report 2012</i> .	World Economic Forum USA Inc. (2012)
Quality of overall infrastructure	It includes the assessment of general infrastructure in each country (e.g., transport, telephony and energy) on a scale from 1 (extremely underdeveloped) to 7 (extensive and efficient by international standards).	World Economic Forum USA Inc. (2012)
Strength of legal rights index	This index measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges from 0 to 10 (the higher the score, the better are collateral and bankruptcy laws designed to expand access to credit).	World Economic Forum USA Inc. (2012)
Strength of investor protection index	This index is the average of the extent of disclosure index, the extent of director liability index, and the ease of shareholder suits index. The index ranges from 0 to 10, with higher values indicating more investor protection.	World Economic Forum USA Inc. (2012)

(continued)

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TABLE 10.3. Continued

Variable	Description	Source
Number of procedures to enforce a contract	This variable is the number of procedures from the moment the plaintiff files a lawsuit in court until the moment of payment. A procedure is defined as any interaction between the parties, or between them and the judge or the court officer (e.g., steps to file the case, steps for trial and judgment, and steps necessary to enforce the judgment).	World Economic Forum USA Inc. (2012)
Importance of pension funds relative to the size of the economy in the OECD	This indicator measures the market value of pension funds' assets relative to the size of the economy: in this case, it is measured by the GDP.	OECD (2014c)
DB pension plans' assets as % of total assets	This indicator reflects the relation among total investment of DB plans and total investment.	OECD Stats (2015)
Financial strength indicator	This indicator is a weighted average of financial strength rating by bank assets. It is a measure of a country's banks' ability to meet obligations to depositors and other creditors. It incorporates quantitative and qualitative information on a country's banks' operating environment (only larger banks are included in each country).	World Economic Forum USA Inc. (2012)
Non-financial corporate bonds to total bonds and notes outstanding (%)	Total amount of domestic nonfinancial corporate bonds and notes outstanding to total amount of domestic bonds and notes outstanding, both corporate and noncorporate.	BIS (2015)
Share of total number of securitization deals	It is the three-year average of the sum of asset-backed securities (ABS), mortgage-backed securities (MBS), high-yield bonds, and highly leveraged loans deals as % of total deals.	World Economic Forum USA Inc. (2012)
Anglosphere countries	Countries in which English is the first language of the majority of the population and other countries which present possess substantial English knowledge dating back to the British Empire.	
EU countries	Countries corresponding to one of the 28 current member states of the European Union (from 2013 onwards).	
EFTA countries	Countries belonging to the European Free Trade Association (EFTA), an intergovernmental organization created for the promotion of free trade and economic integration. Its members are Iceland, Liechtenstein, Norway, and Switzerland.	
Latin American and Caribbean countries	Considering the following countries: Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Jamaica, Mauritius, Mexico, Panama, Peru, and Trinidad and Tobago.	

Source: Authors' derivations from sources listed.

Geographic binary variables are also included in the model. Several areas are considered: Anglosphere countries in a broad sense (those countries in which English is the first language of the majority of the population and those countries with substantial English knowledge) dating back to the British Empire, EU countries, EFTA countries, and Latin American and Caribbean countries. Table 10.4 presents the main descriptive statistics of all the variables.

Pension funds can access infrastructure through different channels. We follow the OECD (2014b) in considering infrastructure investment in unlisted equity, listed equity, and debt, which we aggregate to obtain the fraction of infrastructure investment relative to total investment. The average value shows that the investment of pension funds in these assets represents a small part of the total, though this varies widely across countries. Several countries do not invest anything in infrastructure, whereas countries like Portugal, Canada, Brazil, and Australia have a significant pension fund participation in infrastructure.

Focusing on the portfolio limits in domestic and foreign asset categories, the results suggest that the investment of pension funds in domestic asset

TABLE 10.4. Descriptive statistics

	Mean	Standard Deviation	Min	Max
Total infrastructure investment (as % of total investments)	3.104	8.843	0	51.3
Portfolio limit in domestic asset categories	5.847	2.8	0	10.579
Portfolio limit in foreign asset categories	1.891	2.515	0	9.848
Capital account liberalization	5.199	2.026	1	7
Quality of overall infrastructure	5.033	1.042	2.83	6.64
Strength of legal rights index	6.456	2.105	3	10
Strength of investor protection index	5.825	1.368	3	9
Number of procedures to enforce a contract	32.93	5.454	21	46
Importance of pension funds relative to the economy in OECD	24.105	35.449	0	166.3
DB pension plans' assets as % of total assets	20.329	35.506	0	100
Financial strengths indicator	4.561	2.044	0	9
Non-financial corporate bonds to total bonds and notes outstanding (%)	6.722	11.297	0	36.21
Share of total number of securitization deals	2.13	7.27	0.02	53.63
Anglosphere countries (broad version)	0.123	0.331	0	1
EU countries	0.474	0.504	0	1
EFTA countries	0.018	0.132	0	1
Latin American and Caribbean countries	0.105	0.31	0	1

Sources: Derived by the authors from OECD (2014a, 2014b, 2014c) and World Economic Forum USA Inc. (2012).

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categories overtakes the investment in foreign assets. Regulation for domestic categories is often more comprehensive than for foreign ones.

Regarding the capital account liberalization, which measures the degree of capital account liberalization within a country, the mean shows that the liberalization degree is quite high (a value of 5.2 with seven as the maximum value). However, there is high inequality, as shown by the value of the standard deviation.

The quality of overall infrastructure takes into account the business environment and assesses the infrastructure (transport, telephony, energy, etc.) in the country. An index standardized on a scale from one (extremely underdeveloped) to seven (extensive and efficient) is used. The mean shows that the infrastructure in the countries analyzed is developed (5.8, and 6.64 is the maximum value), but it does not reach high levels of efficiency. The countries with the best performance in this index are Switzerland and Finland. Least developed countries along this dimension are Romania, Tanzania, and Nigeria.

The strength of legal rights index refers to the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending). In the case of the first variable, the protection of the rights of borrowers and lenders is similar to the average (6.5). Yet significant differences across the countries are observed. Countries like Kenya, South Africa, and the UK have a high level of protection and thus access to credit. By contrast, Brazil, Egypt, Indonesia, Italy, Portugal, and the Russian Federation present a low index, indicating vulnerability and difficulties in accessing credit.

In relation to investor protection, the average value shows that the majority of the countries are around the mean (6.0). We can highlight the position of some countries such as Canada, Colombia, and Ireland, where the protection index almost reaches the maximum, while other countries, such as Austria, Greece, and Switzerland, present low values of this index.

The number of procedures required to enforce a contract measures the number of procedures from the moment the plaintiff files a lawsuit in court until the moment of payment. The mean value shows that almost 33 procedures are needed. In general, countries range between 30 and 40 procedures except some extraordinary cases, such as Ireland, which only requires 21 procedures, versus Pakistan and India, which need 46 procedures.

Most pension funds are small relative to the size of the economy, though cross-country differences are remarkable. In most countries, pension funds represent less than 10 percent of the economy. But in a few, like Australia, Iceland, the Netherlands, and the UK, the relative size of pension funds to the economy exceeds 100 percent.

We also measure DB pension plan assets as a percentage of total assets. The mean value of this variable shows that DB pensions are not widespread, but the large standard deviation confirms notable differences among countries.

The indicator of financial strengths is the weighted average of the financial strengths rating by bank assets. The mean value is 4.6 and it ranges from four to six. Only a few countries such as Canada and Australia have higher values.

Concerning the share of non-financial corporate bonds relative to the total bonds and notes outstanding, the data indicate a very low percentage with high variability. In the Russian Federation and South Korea, these products represent 30 percent of the total, while for the other countries this percentage is much lower.

The share of the total number of securitization deals shows the three-year average of the sum of asset-backed securities, mortgage-backed securities, high-yield bonds, and highly leveraged loans deals, as a percentage of total deals. As the mean and the standard deviation suggest, there is a huge disparity among the countries analyzed because securitization deals represent less than 1 percent of total deals for most. This percentage reaches 53.63 percent in the US.

The model

To incorporate the information on these variables, the results of the regression models are presented in Table 10.5.

Model 1 includes as regressors only the financial regulation variables. Coefficient estimates on the portfolio asset limit suggest that a reduction of the limits in domestic assets significantly raises infrastructure investment as a percentage of the total, but this effect is not statistically different from zero in the case of foreign asset limits. Therefore, the main restriction for infrastructure investment by pension funds comes from domestic assets. These results indicate that much work remains to be done in the field of financial regulation.

Model 2 includes financial regulation variables as well as other variables associated with general regulation, legislation, institutional factors, and pension characteristics. The effect of financial regulation now becomes negative in both cases, but negligible in the domestic option and slightly significant for the foreign assets. The importance of other factors also determines the relationship between financial regulation and investment decisions, which do not exclusively depend on portfolio limits.

The degree of capital account liberalization, the strength of the legal rights index (measuring the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders), and the importance of pension funds relative to the size of the economy are all significant. The investor protection index has a negative and slightly significant effect on the percentage of infrastructure investment. A potential explanation comes

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TABLE 10.5. Tobit model coefficient estimates^a

	Model 1	Model 2	Model 3	Model 4
Portfolio limit in domestic asset categories	2.58 ^c	-1.73	-2.79	-4.85
Portfolio limit in foreign asset categories	-0.40	-2.34 ^d	-4.66 ^c	-4.93
Capital account liberalization		6.40 ^c	12.87 ^b	49.61 ^c
Quality of overall infrastructure		-5.96	-19.50 ^c	-65.18 ^c
Strength of legal rights index		4.24 ^d	4.84 ^c	15.04 ^c
Strength of investor protection index		-5.96 ^d	-11.73 ^b	-38.67 ^c
Number of procedures to enforce a contract		-0.23	-1.62	-5.55 ^c
Importance of pension funds relative to the economy in OECD		0.19 ^d	0.09	-0.07
DB pension plans' assets as % of total assets		0.04	0.01	0.39 ^c
Financial strengths indicator			9.00 ^c	32.41 ^c
Non-financial corporate bonds to total bonds and notes outstanding (%)			0.94 ^c	5.14 ^c
Share of total number of securitization deals			0.34 ^d	2.14 ^c
Anglosphere countries (broad version)				47.65
EU countries				140.59 ^c
EFTA countries				90.24 ^d
Latin American and Caribbean countries				94.61 ^b
Constant	-33.142 ^b	0.628	69.281	29.45
No. of observations	57	57	57	57
Pseudo R ²	0.018	0.088	0.147	0.23
Log pseudolikelihood	-80.655	-74.884	-70.026	-63.68

Notes:

^a Dependent variable: pension fund infrastructure investment (as % of total investments).

^b Denotes estimates significant to 1%.

^c Denotes estimates significant to 5%.

^d Denotes estimates significant to 10%.

Source: OECD (2014a, 2014b, 2014c) and World Economic Forum USA Inc. (2012).

from the tradeoff between protection levels and pension fund investment opportunities, versus other investors in the context of infrastructure. Other variables considered are not statistically different from zero.

Further details relating to the financial system are included in Model 3, and results reinforce our observations from Model 2. Only the importance of pension funds relative to the size of the economy declines in significance. The financial system instruments variable has a positive and significant coefficient, establishing a direct relationship between flexibility, size, and development degree of the financial markets and the level of pension fund infrastructure investment.

A last group of variables is included in Model 4, related to geographic area. The results confirm the importance of all factors considered in Model 3. The geographic effects suggest that country characteristics affecting the percentage of pension fund infrastructure investments are especially important in the EU, EFTA, Latin American, and Caribbean countries.

Other results in Model 4 confirm the relevance of the development of financial protection, stability and fairness of legal rights, and the quality and strength of financial institutions. Financial market development also has positive and significant effects on the percentage of pension fund infrastructure investment.

Conclusion

This research explored factors driving pension fund investments in infrastructure projects. Pension investments in infrastructure could be attractive to the extent that these assets offer less correlation than other financial assets in their portfolios, better risk–return features, and long maturities. Yet investing in infrastructure projects is also risky and requires much expertise.

Pension regulations are adapting to allow pension funds to become more involved in infrastructure projects. Australia and Canada have a regulatory framework that allows them to invest with enormous flexibility, and apparently with success. Current discussions in Europe are taking place in the context of the development of a Capital Markets Union, as the EU seeks to deal with the different countries' regulatory issues. In Latin America, specialized financial vehicles have been developed for pension funds to invest in infrastructure, especially in Mexico.

Our empirical analysis also shows that the degree of development in the financial markets (i.e., capital account liberalization, non-financial corporate bonds as a share of the total bonds and notes outstanding, and the share of total number of securitization deals) is positively associated with infrastructure investment.

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Appendix: Measuring the Regulatory Flexibility of Pension Fund Infrastructure Investment through a Synthetic Index

In an attempt to homogenize and standardize the diversity of regulations on pension fund infrastructure investment, we create an index that measures how much of an opening or facility these funds have to make this kind of

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investment. We use principal component analysis (PCA), which is the statistical technique for data reduction. PCA uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

PCA is mathematically defined as an orthogonal linear transformation. This transformation is defined in such a way that the first principal component has the largest possible variance (and thus accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components.

The OECD (2014a) reports details of the regulation for each financial product describing different forms of restriction and legal regulation on pension funds. The products are Equity, Real Estate, Bonds, Retail Investment Funds, Private Investment Funds, Loans, and Bank Deposits. We use four different codes for each product (not allowed to invest, allowed with restrictions, allowed with restrictions and with exceptions in some particular cases, and allowed with no limit). Therefore, a higher value of this indicator (for any product) implies a higher degree of flexibility. Each country's laws also distinguish between portfolio limits on pension fund investment in (_in) or outside (_out) the country using these seven asset categories.

The PCA procedure allows aggregating the information of the seven products in two indicators, the portfolio limit in domestic asset categories and the portfolio limit in foreign asset categories:

$$\begin{aligned} \text{Portfolio limit in domestic asset categories} &= 0.3850 \times \text{Equity_in} + 0.3640 \\ &\times \text{Real Estate_in} + 0.3863 \times \text{Bonds_in} + 0.3896 \times \text{Retail Investment} \\ &\text{Funds_in} + 0.3832 \times \text{Private Investment Funds_in} + 0.3603 \times \text{Loans_in} \\ &+ 0.3763 \times \text{Bank Deposits_in} \end{aligned}$$

$$\begin{aligned} \text{Portfolio limit in foreign asset categories} &= 0.3992 \times \text{Equity_out} + 0.3439 \\ &\times \text{Real Estate_out} + 0.4142 \times \text{Bonds_out} + 0.4113 \times \text{Retail Investment} \\ &\text{Funds_out} + 0.3615 \times \text{Private Investment Funds_out} + 0.3111 \times \text{Loans_} \\ &\text{out} + 0.3927 \times \text{Bank Deposits_out} \end{aligned}$$

The values of the weights of these two formulas correspond to the results derived from the first principal component (eigenvector) for each set of products. The weights in both cases are similar among the financial products, although the differences seem to be higher in the foreign asset categories.

Results show that countries with regulations allowing pension fund investment in infrastructure are those of Anglo-Saxon origin, followed by those from northern Europe and Japan. Many developed countries have restrictive legislation including Spain, France, Italy, and Switzerland. In developing regions, especially in Africa and one or two in Latin America, very restrictive regulations are in place.

Endnotes

1. At the recent meeting of the International Organisation of Pension Supervisors (IOPS) and the International Organisation of Pension Funds Supervisory Authorities (AIOS) in San José, Costa Rica, on Feb. 2015, this topic took a starring role in the discussions.
2. It does not specify if this would also apply to pension funds.

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