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Pension Regulation and Investment Performance

Rule-Based vs. Risk-Based

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Pension Regulation and Investment Performance: Rule-Based vs. Risk-Based

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Abstract

We investigate the relationship between rule-based versus risk-based regulatory choices in different countries and the real investment performance of their pension funds. Pension systems in countries with more mature risk-based regulatory regimes tend to demonstrate superior investment performance. The benefit of implementing risk-based regulation is more pronounced in countries with low regulatory quality. The core of rule-based regulations, i.e., quantitative investment limits, has no significant impact on the Sharpe ratio of pension investment returns.

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1 Introduction

The regulatory environment for funded pension schemes varies across countries. While the purpose of pension provision institutions worldwide is broadly similar, i.e., to safeguard retirees' welfare, national regulations are heterogeneous.[1] In this paper, we analyze the extent to which the type of regulation and its quality can influence a pension system's financial performance in a cross-country analysis. Since a pension portfolio allocation is key in determining the investment return (Brinson et al., 1986; Aglietta et al., 2012), we focus only on asset management regulations.

Two different conceptions of financial regulation coexist: rule-based and risk-based (e.g., Ford, 2008; Black and Baldwin, 2010). Rule-based regulation refers to inflexible bright-line requirements such as direct restrictions on investments. From a compliance perspective, rule-based regulation is appealing as its ex-post verification is unambiguous. But some rules, such as investment limits, may in theory yield lower risk-adjusted returns when they are binding.

A number of reasons, such as the increasing complexity of financial instruments and the merging of supervisory agencies for pension funds with those for banks and insurers, have fostered the emergence of risk-based regulation. The aim of introducing this type of regulation is to ensure that institutions establish a sound risk management framework. Risk-based regulation usually relies on quantitative financial models to determine the adequate level of buffer capital needed to withstand adverse financial market conditions. Using a methodology prescribed by the supervisor, funds identify and evaluate risk factors. It is therefore necessary to specify an underlying model in order to define, qualify, and/or quantify risks. This bestows legitimacy and, perhaps, greater credibility to the regulatory framework. However, imposing a simplistic model may jeopardize the soundness of a regulatory environment. Shi and Werker (2012) demonstrate that substantial economic costs are incurred when regulatory risk constraints imposed on pension funds are shorter-dated than their long investment horizon. Bec and Gollier

[1] For example, the European Union Institutions for Occupational Retirement Provision (IORP) Directive (2003/41/EC) outlines the common objectives for occupational pensions, but countries are free to adapt national legislation as long as these same goals are achieved.

(2010) and Severinson and Yermo (2012) contend that risk-based regulation induces procyclical investment, which threatens not only the funds' well-being, but also macroeconomic stability. Thus, whether or not risk concepts are employed in a manner that fosters pension funds' financial health is a crucial consideration. We use countries' perceived ability to create policies that promote sound private-sector development, namely the index of Kaufmann et al. (2009), as a measure of regulatory quality.

Many countries worldwide have gradually shifted from rule-based to risk-based regulation (OECD, 2010). In the European pension industry, a regulatory revision is underway (EIOPA, 2012), whereby the proposed regime incorporates solvency regulations founded on risk-based concepts. Denmark, Germany, Hungary, the Netherlands, and Finland,[2] along with Australia and Canada, are among the pioneers of risk-based pension regulation. The regulatory environment in these countries is unlike that in Latin America, where pension funds generally face stringent portfolio limits. For example, Chilean funds were only allowed to invest in fixed income in their nascent years, though the regulator gradually relaxed these limits over time and introduced risk-based regulation in 2011. A country's regulatory environment can prominently display both rule-based and risk-based regulation. This is the case in Mexico, where investment restrictions exist alongside a daily value-at-risk constraint. In sum, the global trend towards risk-based regulation makes it relevant to investigate the influence of rule and risk-based regulation on pension funds' investment performance.

Extensive discussions on the regulatory impact of pension investment performance were initiated in the late 1990's, after many countries undertook pension reform. None of the studies we have come across rely on empirical analysis of wide cross-country samples, most likely because pension investment data was not available until recently. Attempts at evaluating pension investment performance globally are mainly descriptive (e.g., Tapia, 2008). Otherwise, they are theoretical (e.g., Davis, 2002) or geographically restricted (e.g., Srinivas and Yermo, 2010).

[2]Finnish statutory occupational plans are part of the social security system and are thus beyond the scope of the IORP Directive.

Using the largest publicly accessible dataset on pension investment returns worldwide, hand-collected from multiple sources, we conduct a cross-country analysis to assess the impact of the regulatory framework on pension fund performance. We introduce a novel perspective on the types of pension regulation (i.e., rule vs. risk-based), taking into account the countries' regulatory quality with the index devised by Kaufmann et al. (2009). Pension investment performance is found to be higher under risk-based rather than rule-based regulation. Moreover, risk-based regulation tends to be particularly beneficial for countries with low regulatory quality. The paper proceeds by describing the data and methodology in Section 2, before discussing the results in Section 3. Section 4 concludes.

2 Data Description and Methodology

Funded pension systems' annual real investment returns in 20 countries (listed in Table 1) in local currencies from 2002-2012 are collected from OECD Global Pension Statistics and Federación Internacional de Administradoras de Fondos de Pensiones (FIAP).[3] Using panel regression analysis, we seek to explain the Sharpe ratio of pension real investment returns, SR^{INV}, by regulatory variables. The standard deviation used in the definition of SR^{INV} is computed using all years of observation for each country, and hence is constant through time. The chosen risk-free rate is the six-month real interest rate (i.e., interbank rates, government bond yields, or deposit rates, depending on data availability).

Key variables of interest for investigating rule and risk-based regulations are investment limits (*Rule*), and years since the introduction of risk-based regulation (*Risk*), respectively. For *Rule*, portfolio limits for seven asset classes (listed equities, bonds, foreign assets, real estate, investment funds, loans, and deposits) are collected from the OECD Annual Survey of Investment Regulation of Pension Funds and national sources. Each limit is subtracted from 100%, then averaged across all asset classes to obtain a value between zero and one. The higher the

[3]The OECD provides nominal investment returns data so we use inflation data from the World Bank World Development Indicators to convert the data in real terms. When multiple funds are included, all data sources report the average returns of individual funds, weighted by assets under management. The authors would like to thank Ricardo A. Pasquini and Alberto R. Musalem for sharing their data, which were used to construct the series in a preliminary version of this paper.

Rule, the more stringent the investment limits are. As for *Risk*, it is defined as the number of years since risk-based regulations were introduced. This information is gathered from the International Organization of Pension Supervisors and the respective pension supervisory authorities. It is implicitly assumed that every additional year of implementation has marginally the same influence on risk-adjusted returns. A variable incorporating the passage of time is deemed vital because pension regulation is typically refined over the years. Our definition of *Risk* is hence preferred to alternatives such as a dummy variable for risk-based regulatory regimes.[4]

It is essential to consider not only the existence but also the quality of regulation. Given the numerous alternatives to classifying and quantifying risks, as well as countries' different constitutional, administrative and political environments, there are various ways in which the pension fund regulator supplements or replaces the existing regulatory framework with risk-based concepts. The challenge of measuring the quality of regulation is addressed with the regulatory quality indicator (*Quality*) devised by Kaufmann et al. (2009).[5] This is a composite index reflecting a government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. The underlying indices are drawn from surveys of non-governmental organizations,[6] and aggregated using an unobserved components model. The higher the value of *Quality*, the better the perception of the lawmaker's ability to establish a business-conducive regulatory environment.

Since many countries' pension fund portfolios contain mainly domestic equities and bonds, the Sharpe ratio of local equity and bond index returns (SR^E, SR^B) are included as controls to disentangle investment returns due to market performance from those attributable to regulatory differences across countries. The variables' definitions and sources are presented in Table 2,

[4] As a robustness check, we also considered a non-linear regulatory impact by replacing *Risk* with $Risk_2 = log(1+Risk)$, obtaining similar results.

[5] World Governance Indicators (WGI): `http://info.worldbank.org/governance/wgi/index.asp`. The WGI is among the most carefully constructed and widely used governance indicator (Oman and Arndt, 2006).

[6] More than fifty underlying indices are included, on topics such as unfair competitive practices, burden of government regulations, and price liberalization. Examples of sources include the Economist Intelligence Unit, Global Competitiveness Report, and the Gallup World Poll.

whereas summary statistics are reported in Table 3.

To analyze the impact of rule and risk-based regulation on pension funds' risk-adjusted investment returns, we estimate four panel regression models, two for each regulatory variable, *Rule* and *Risk*. Specification (2.1) is the basic setup, and specification (2.2) adds a term interacting the regulatory variable with the regulatory quality variable.

$$SR_{it}^{INV} = \beta^{REG} REG_{it} + \beta^{Quality} Quality_{it} + \beta^{B} SR_{it}^{B} + \beta^{E} SR_{it}^{E} + \varepsilon_{it} \tag{2.1}$$

$$SR_{it}^{INV} = \beta^{REG} REG_{it} + \beta^{Quality} Quality_{it} + \beta^{REG \times Quality} (REG_{it} \times Quality_{it}) + \beta^{B} SR_{it}^{B} + \beta^{E} SR_{it}^{E} + \varepsilon_{it} \tag{2.2}$$

with $\varepsilon_{it} = \alpha_i + \eta_{it}$, the sum of an unobserved fixed effect and an error term

$REG = Rule$ or $Risk$

SR^{INV} is the Sharpe ratio of pension investment return, REG is either the *Rule* or *Risk* variable, reflecting the prominence of either type of regulation, $Quality$ is the Regulatory Quality Index of Kaufmann et al. (2009), $SR^{B \text{ or } E}$ is the Sharpe ratio of local bond (B) or equity (E) market. i is the country index and t is the year index.

3 Impact of Regulation on Risk-Adjusted Returns

The panel regression results of (2.1) and (2.2) are presented in Table 4. Countries with a longer history of risk-based regulation tend to attain higher Sharpe ratios, especially when regulatory quality is low. Conversely, rule-based regulation has a minimal harmful impact on the Sharpe ratio of real investment returns. As is consistent with intuition, superior equity and bond market performance tends to yield higher Sharpe ratios of real investment returns, with equities being statistically and economically more significant than bonds.

Rule-based regulation, as measured by *Rule*, has, on average, no statistically significant influence on the Sharpe ratio of investment returns in the specification with no interacted term,

but it has a minimal, adverse effect on the investment performance of countries with poor regulatory quality (Column 1 and 2 of Table 4, respectively). For countries with decent regulatory quality (i.e., above 1.71), investment limits pose no threat to risk-adjusted real return, possibly because these limits are non-binding in most instances. This situation is more likely when both rule and risk-based types of regulation exist. Risk limits generally reduce the riskiness of the asset allocation, so rule-based regulation may end up being non-binding. For example, German Pensionskassen, subject to risk-based regulations, typically hold less than the permitted maximum of 35% in equities (Davis, 2013).

Risk-based regulation is positively linked to the pension funds' real performance (Column 3 of Table 4). The greater a country's experience in enforcing risk-based regulation, the higher its Sharpe ratio in real terms. The estimated coefficient for *Risk* being positive while the one for $Risk \times Quality$ is negative (Column 4 of Table 4), implies that *Risk*'s positive influence on the risk-adjusted investment performance diminishes in the countries' regulatory quality. For instance, an additional year of risk-based regulation is associated with an increase in the Sharpe ratio by 0.182 for Colombia, the country with the worst average regulatory quality in our database. As for the country with the best mean regulatory quality, Denmark, more experience in implementing risk-based regulation is estimated to yield only 0.002 higher Sharpe ratio of investment return. Therefore, risk-based regulation enhances risk-adjusted real returns among pension funds on average, and the improvement is greater in countries with poorer regulatory quality.

The opposing signs for the estimated coefficients for *Risk* and $Risk \times Quality$ induce threshold levels of *Quality* on *Risk*'s direction of impact. However, caution is advised in interpreting this as a decision rule for policymakers. Our results imply that economically significant gains in the Sharpe ratio of investment returns are attainable under risk-based regulatory regimes, especially for countries with low regulatory quality.

4 Conclusion

We investigate the relationship between rule-based versus risk-based regulatory environments and the Sharpe ratio of funded pensions' real investment returns. Rule-based regulations are bright-line requirements with straightforward verification, while risk-based regulations stress prevention and mitigation. Our panel regression analysis suggests that risk-based regulation is associated with a superior Sharpe ratio of real investment returns, and its merit increases for countries with low regulatory quality. Conversely, rule-based regulation slightly impairs the performance of countries with poor regulatory quality. Contemporaneous with the trend that sees pension regulation transitioning from rule to risk-based types, our analysis elucidates the impact of such regulatory development, and adds a strand to the literature on financial regulation and performance, where empirical evidence relying on pension fund data is lacking. In future work, we hope to extend this analysis to micro-level data of individual pension funds' performances.

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5 Tables

Table 1: List of Countries

This table presents the list of countries included in our study, categorized by their level of economic development as determined by the IMF. The year when a country adopts risk-based regulation, if ever, is in parentheses.

Economic Development	**Countries**
Advanced Economies	Australia (2003), Belgium, Canada (2001), Denmark (2001), Finland (2006), Germany (2003), Italy, Netherlands (2007), New Zealand, Norway, Portugal, Spain, Switzerland.
Economies in Transition	Czech Republic, Hungary (2001), Poland
Emerging Market Economies	Chile (2011), Colombia, Mexico (2004), Peru

Table 3: Summary Statistics

This table presents summary statistics for all of the variables used in our analysis. We have complete observations for 20 countries over 2002-2012.

Variable	**No. of Obs**	**Mean**	**St. Dev.**	**Min**	**Max**
SR^{INV}	220	−0.016	1.010	−3.131	2.356
$Rule$	220	0.349	0.275	0.000	0.869
$Risk$	220	2.041	3.370	0	13
SR^{B}	220	−0.286	1.626	−6.979	2.781
SR^{E}	220	0.203	0.985	−2.489	2.321
$Quality$	220	1.243	0.513	−0.078	1.967

Table 2: Description of Variables

This table presents all of the variables used in our analysis. Sources are listed in the rightmost column.

Variable Name	**Variable**	**Description**	**Source**
Sharpe Ratio[a] of Funded Pension Real Investment Returns	SR^{INV}	Sharpe ratio of funded pensions' real investment returns in local currency.	OECD GPS, FIAP.
Rule-based Regulation	$Rule$	Sum of 100%− investment limits in seven asset classes (i.e., equities, bonds, foreign assets, real estate, investment funds, loans, and bank deposits.), re-scaled to be between 0 and 1.	OECD, National Sources.
Risk-based Regulation	$Risk$	Number of years since risk-based regulation was first introduced. Zero if a country has not adopted risk-based regulation.	IOPS, National Sources.
Sharpe Ratio of Bond Market Index	SR^{B}	Sharpe ratio of the real bond index of the country where the pension schemes are located.	Various[b]
Sharpe Ratio of Equity Market Index	SR^{E}	Sharpe ratio of the real equity index of the country where the pension schemes are located.	MSCI Total Return Index & others[c]
Regulatory Quality	$Quality$	Index capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Kaufmann et al. (2009)

[a]Short rates used in the calculation of $SR^{\{INV,B,E\}}$ are interbank rates for Australia, Belgium, Czech Republic, Denmark, Finland, Germany, Hungary, Italy, Netherlands, Poland, Portugal, Spain, Switzerland; government bond yields for Canada, Chile, Colombia, Mexico, Norway; deposit rates for New Zealand and Peru. Inflation data is from the World Bank Development Indicators.

[b]Bonds of all maturities (or those between 5-10 years) in local currencies from Barclays, JP Morgan, or Bank of America, whichever is available for the country. For Germany, the REX Index is used.

[c]Dow Jones Titans 30 (the Netherlands), FTSE World (Portugal).

Table 4: Impact of Rule-Based and Risk-Based Regulation on the Sharpe Ratio of Pension Real Investment Returns

Columns (1) and (2) present the regression results concerning *Rule*-based regulations, non-interacted and interacted with *Quality* respectively. Corresponding non-interacted and interacted specifications results for *Risk*-based regulation are shown in columns (3) and (4). White heteroskedasticity robust standard errors are in parentheses. Specifications in columns (2), (3) and (4) are fixed effect panel regression by within estimation. By contrast, a random effect model is used instead with the specification in column (1) as *Rule* is constant over time for multiple countries; within estimation cannot be applied.

	Dependent variable:			
	SR^{INV}			
	(1)	(2)	(3)	(4)
Rule	0.104	-3.310^{*}		
	(0.259)	(1.795)		
Risk			0.042^{**}	0.199^{***}
			(0.021)	(0.030)
Quality	0.125	-0.398	0.280	0.571
	(0.144)	(0.551)	(0.464)	(0.479)
Rule $*$ *Quality*		1.937^{*}		
		(1.068)		
Risk $*$ *Quality*				-0.108^{***}
				(0.023)
SR^{B}	0.103^{**}	0.119^{*}	0.110^{*}	0.100^{**}
	(0.045)	(0.068)	(0.067)	(0.067)
SR^{E}	0.776^{***}	0.800^{***}	0.784^{***}	0.793^{***}
	(0.049)	(0.048)	(0.048)	(0.047)
Constant	-0.336			
	(0.027)			
Observations	220	220	220	220
R^2	0.596	0.623	0.621	0.632
Adjusted R^2	0.583	0.553	0.553	0.560
F Statistic	79.409^{***} (df = 4; 215)	64.565^{***} (df = 5; 195)	80.144^{***} (df = 4; 196)	67.049^{***} (df = 5; 195)
Note:				*p<0.1; **p<0.05; ***p<0.01