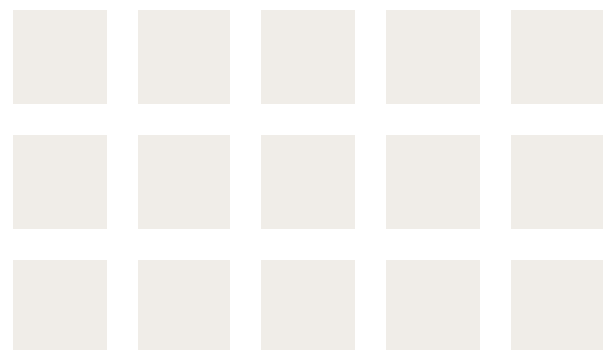




Does Regulation Matter?

Riskiness and Procyclicality of Pension Asset Allocation



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Preliminary – Do not quote

Motivation

- Ongoing debate on pension regulation in Europe: application of a Solvency Framework (EIOPA, 2012)?
- Our question : does regulation have an influence on the asset allocation of DB pension funds?
 - Capacity to take risk
 - Financial stability: procyclicality of investment ?
- We attempt to quantify empirically the importance of regulatory factors compared to traditional factors (individual characteristics, guarantees etc.) explaining pension funds' asset allocations
- US, Canada and the Netherlands are particularly interesting cases:
 - Significant DB pension fund market
 - Underwent notable regulatory changes: Pension Protection Act in 2006 in the US, Financial Assessment Framework in 2007 in the NL
 - Fund regulation varies across countries and types of funds

Motivation

- Objective of regulation : promote financial stability and protect stakeholders of financial institutions
 - Control the funding risk of financial institutions
 - In some cases impose solvency capital requirements
- Disagreement about the definition of ideal regulation
 - Unintended consequences were demonstrated, especially for banks
 - Strong heterogeneity in pension regulation across and within countries

Related Literature: Debate on the efficiency of regulation

■ On financial institutions' asset allocations and performances

- Use of risk models to calibrate solvency buffers

 - Limit financial institutions' ability to take risk (Severinson and Yermo, 2012)

 - Generate substantial economic costs when repeated short term VaR constraints are imposed on long term investors (Shi and Werker, 2012)

- Mark-to-market accounting methods

 - Constitute an additional source of price volatility, especially for long maturity or illiquid assets (Plantin et al., 2008)

■ On the financial system's stability

- Use of risk models

 - Generate procyclical investment (Bec and Gollier, 2009)

- Mark-to-market accounting methods

 - Generate procyclical investment (Novoa, Scarlata and Solé, 2009)

 - Generate contagion (Allen and Carletti, 2008)

Related Literature: Drivers of pension fund's allocation

- Individual characteristics of the funds are a major determinant of the riskiness of pension plan's asset allocation
 - Size (Dyck and Pomorski, 2011)
 - Maturity (Rauh, 2009; Bikker, 2011)
 - Inflation indexation (Sundaresan and Zapatero, 1997; Lucas and Zeldes, 2006)
- Institutional characteristics of the plan: presence of a guaranteeing mechanism (PBGC in the US, PBGF in Ontario)
 - This insurance is in effect a put option that reduces the negative impact of pension liabilities on the firm's value (Sharpe, 1976; Treynor, 1977; Nielson and Chan, 2007; Crossley and Jametti, 2013)
- Regulatory environment
 - US public funds increased their risky asset allocation to maintain high discount rates and present lower liabilities (Pennachi and Rastad, 2011; Andonov et al. 2013)

Our Paper

- Empirical investigation of the drivers of pension fund's asset allocations
 - Expanding the literature over all regulatory dimensions
 - Quantifying/ comparing the impact of regulation with other explanatory factors

- Main Finding
 - **Regulatory factors play a major role** in explaining pension fund's asset allocation choices

Our Results: Riskiness of asset allocation

- Regulatory changes induce a **significant reduction in global risky asset** allocation
- **Risk-based capital requirements** have the largest impact
 - They induce a strong reduction in risky asset weights, especially equities
 - They have a positive impact on alternatives (especially private equity, real estate) and high yield bonds
- **Recognition of unfunded liabilities** is the second largest factor

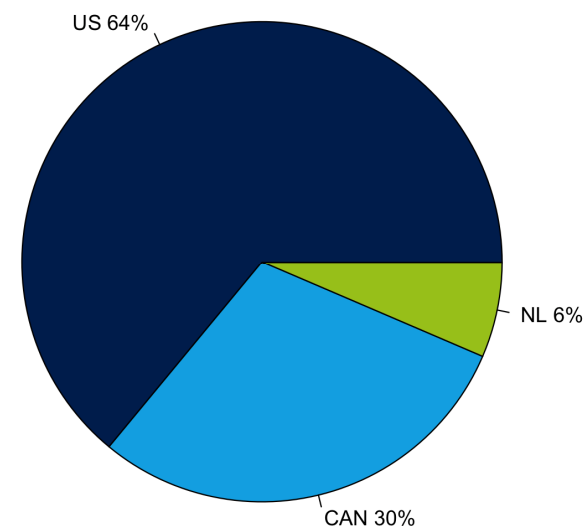
Our Results: Procyclicality

- We build an original procyclicality measure
 - On average, around 30% **of funds are procyclical**
 - Strong evidence of **additional procyclicality during financial crises**
- Little evidence of the impact of regulation on procyclicality
 - Quantitative investment restrictions encourage procyclicality on the unrestricted asset classes
 - Counterintuitively, **risk-based regulation has no influence on procyclical behavior**
 - Result may be driven by the temporary regulatory slackening during the last crisis in the Netherlands

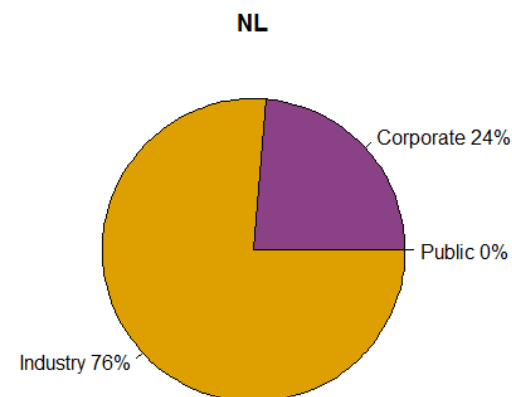
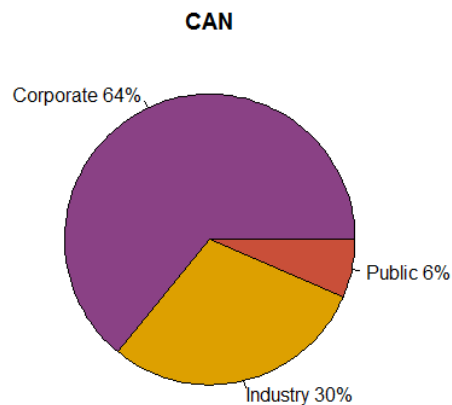
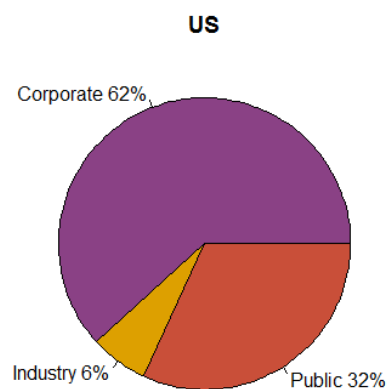
Data

■ CEM Benchmarking Database

- Unbalanced panel of 589 unique DB funds
- Representative (> 30% of DB assets in all countries)
- Annual asset allocation and performance
- 1991-2011
- 4059 observations



Breakdown of funds analyzed



Comparing different regulatory frameworks

- Unfortunately, not a single change in regulation in our sample
- Classification of the different regulatory dimensions
 - Investment restrictions
 - Valuation requirements (assets and liabilities, recognition in sponsor's balance sheet)
 - Funding requirements (min funding, risk-based capital requirements, etc.)

Differences in Pension Funds' Regulatory Environment

	US public	US private (Single- employer)	US private (Multi- employer)	Canada public and private	Dutch corporate and industry
Investment restrictions					
Quantitative investment restrictions	No unified regulation.	None	None	<u>Prior to 2005</u>: 30% limit on foreign assets <u>Prior to 2010</u>: 15% limit on resource property, 25% limit on real estate and Canadian natural resource property.	None

Differences in Pension Funds' Regulatory Environment

	US public	US private (Single-employer)	US private (Multi-employer)	Canada public and private	Dutch corporate and industry
Valuation requirements					
Asset valuation	GASB: Actuarial valuation allowing five years smoothing of gains and losses.	<u>For funding:</u> Before 2006: ERISA Fair value with smoothing		<u>For funding:</u> CICA 4600: Fair value	<u>For funding:</u> Before 2007: PSW Market value
		<u>After 2006: PPA</u> Fair value with smoothing option up to 24 months	<u>Since 1986:</u> ERISA Reasonable actuarial assumptions.	<u>For sponsors'</u> <u>accounting:</u> Up till 2011: CICA 3460 and 3461 Market value or market-related value (5Y smoothing permitted)	<u>After 2007: FTK</u> Market value
		<u>For sponsors'</u> <u>accounting:</u> Before 2006: FAS 87 fair value with option to smooth			<u>For sponsors'</u> <u>accounting:</u> Before 2005: RJ 271 edition 2002-03 2002 ed. did not require recognition of investment assets. 2003 ed. adopted many of the principles in IAS 19
		<u>After 2006: FAS 157</u> Market value or market- related value (e.g., 5Y smoothing permitted)		<u>Since 2011: IAS 19</u> Market value	<u>After 2005: IAS 19</u> Market value
In red: funding regulation					

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In red: funding regulation

In blue: accounting regulation

Differences in Pension Funds' Regulatory Environment

	US public	US private (Single-employer)	US private (Multi-employer)	Canada public and private	Dutch corporate and industry
Balance Sheet recognition of funded status	<u>Between 1986 and 1994:</u> GASB No. 5 Disclosure but no recognition <u>Since 1994:</u> GASB No. 27 Recognition of Net Pension Obligation (shortfall to the annually required contribution)	<u>Before 2006:</u> FAS 87 Unfunded liabilities in excess of ABO <u>Since 2006:</u> FAS 158 Over/underfunded liabilities in excess of PBO	<u>Since 1986:</u> ERISA Contributions are reported on their financial statements	<u>Before 2011:</u> CICA 3460 and 3461 Surplus/insufficiency of funding relative to pension expense <u>Since 2011:</u> IAS 19 Present value of ABO less unrecognized past service costs, ± actuarial gains / losses not recognized less fair value of plan assets	<u>Since 2005:</u> IAS 19 Present value of ABO less unrecognized past service costs, ± actuarial gains / losses not recognized less fair value of plan assets

Differences in Pension Funds' Regulatory Environment

	US public	US private (Single-employer)	US private (Multi-employer)	Canada public and private	Dutch corporate and industry
Liability discount rate	GASB: Expected return of assets.	For funding: Before 2004: ERISA Corridor around the 4- year weighted average of the 30Y T bond rate. 2004-06: PFEA Corporate bond rate, 4- year smoothing allowed. Since 2006: PPA Corporate bond rate, 2- year smoothing allowed. For sponsors' accounting: FAS 87 Corporate bond rate, 4- year average prior to 2006, 2-year average after.	Since 1986: ERISA "Actuarially reasonable" discount rate	For funding: Government bond rate plus additional factor. For sponsors' accounting: Before 2000: CICA 3460 Management's "best estimate" of the long-term rate of return on assets. After 2000: CICA 3461 AA Corporate bonds rate	For funding: Before 2007: PSW Fixed actuarial interest rate. Since 2007: FTK Swap rate For sponsors' accounting: Since 2005: IAS 19 High quality corporate bond yield only for listed corporate sponsors.

In red: funding regulation

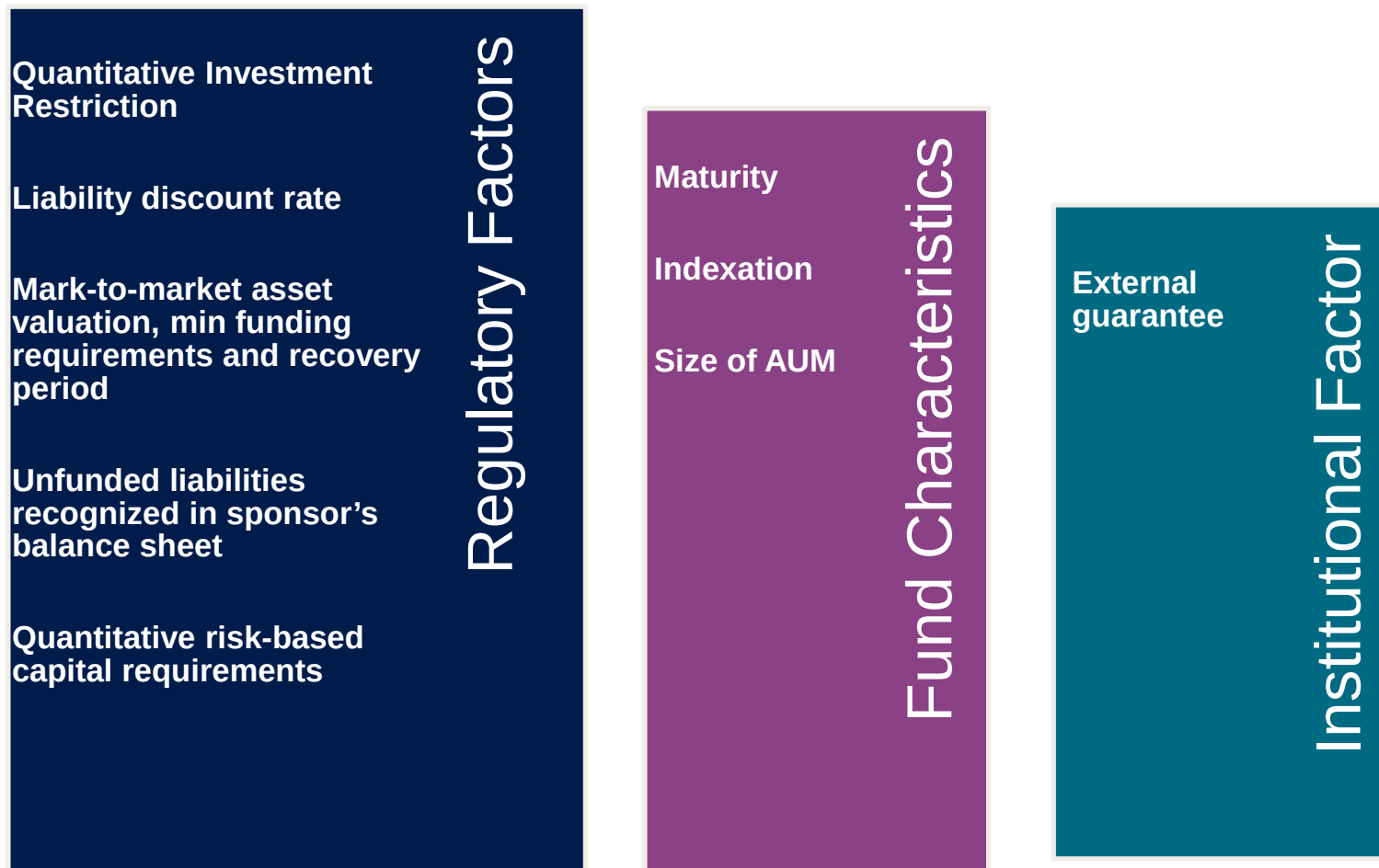
In blue: accounting regulation

Differences in Pension Funds' Regulatory Environment

	US public	US private (Single-employer)	US private (Multi-employer)	Canada private	public and Dutch corporate and industry
Funding requirements					
Minimum funding requirements		Since 1994: Retirement Protection Act Min funding of 90%			Before 1999: PSW "65-x" funding standard
	No min (0%)	Since 2006: PPA 92% (2008) 94% (2009) 96% (2010) 100% after.	100%	100%	Since 1999: PSW 100% Since 2007: FTK 100%
Risk-based capital requirements	None	None	None	None	Since 2007: FTK Yes
Recovery period		Before 2006: 30Y	Before 2006: ERISA No provision.		Before 2007: PSW 10Y
	None	Since 2006: PPA 7Y	Since 2006: PPA 5-10Y 10Y, 15Y for endangered plans.		Since 2007: FTK 3Y for solvency margin, up to 15Y for buffer depending on continuity analysis

Methodology

Panel regression analysis with the following explanatory variables



Methodology : Regulatory Variables Definition

Variable	Definition	Riskiness	Procyclicality
Investment requirements			
Quantitative investment restrictions	% Restricted	-	-
Valuation requirements			
Asset valuation	• Mark-to-market: 1 • Fair value with smoothing: 0.5 • Neither of the above: 0	-	+
Liability discount rate	As disclosed by fund	+	≈
Recognition of funded status on the sponsor's/ government balance sheet	• Above PBO: 1 • Above ABO: 0.5 • Neither of the above: 0	-	+

Methodology : Regulatory variables definition

Variable	Definition	Riskiness	Procyclicality
Funding requirements			
Minimum funding requirement	Level of funding requirement	-	≈
Risk-based capital requirements	1 if requirement exists	-	+
Recovery period	Recovery period in years	+	-

Methodology : Individual and institutional variables definition

Variable	Definition	Riskiness	Procyclicality
Individual characteristics			
Maturity	% of retired members	-	≈
Inflation indexation	% of contracts indexed to inflation	+	≈
Size	Market value of AUM (billions of USD)	+	≈
		(for alternatives)	
Institutional characteristics			
Guarantee	1 if fund type is eligible for protection	+	≈

Methodology

Allocation to risky assets

- We estimate the following regression model:

$$\begin{aligned}
 w_{it} = & \beta_1 QIR_{it} + \beta_2 AssetVal_{it} + \beta_3 LDR_{it} + \beta_4 LiabRecog_{it} \\
 & + \beta_5 Funding_{it} + \beta_6 RBCR_{it} + \beta_7 Recovery_{it} \\
 & + \beta_8 Maturity_{it} + \beta_9 Inf Indx_{it} + \beta_{10} Size_{it} \\
 & + \varepsilon_{it}
 \end{aligned} \tag{3}$$

Fixed Effects

1. No FE
2. Year FE
3. Country, type & year FE
4. Fund & year FE

$$\varepsilon_{it} = \alpha + \vartheta_{it} \tag{4}$$

$$\varepsilon_{it} = \eta_t + \vartheta_{it} \tag{5}$$

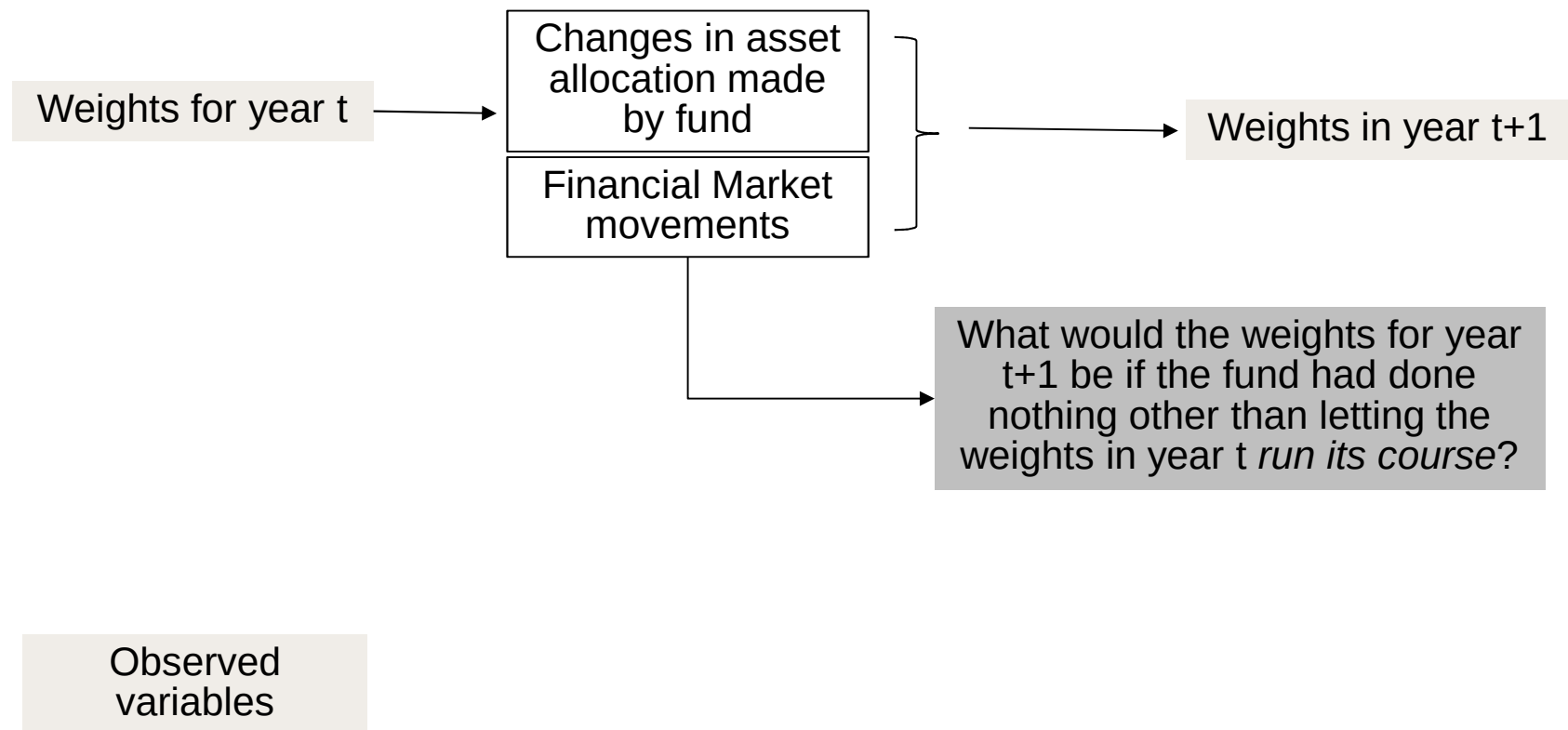
$$\varepsilon_{it} = \delta_{c(i)} + \tau_{T(i)} + \eta_t + \vartheta_{it} \tag{6}$$

$$\varepsilon_{it} = \alpha_i + \eta_t + \vartheta_{it} \tag{7}$$

$c(i)$ and $T(i)$ are functions mapping fund i to its country, and to its type, respectively.

Methodology

Intuition of the Procyclicality Measure



Methodology

Definition of the Procyclicality Measure

$$PC_{it}^j = \begin{cases} 1 & \text{if } \text{sign}(\text{netbuy}_{it}^j) = \text{sign}(r_t^{\text{Mkt}}) \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

$$\text{netbuy}_{it}^j = w_{it}^j - w_{it-1}^j \frac{1 + \widehat{r}_{it}^j}{1 + r_{it}^T} \quad (2)$$

- Net buyings of fund i in asset class j is measured as the **difference** between the **actual weights** of the funds and the estimated funds' **would-be** risky asset weights
- A fund is considered procyclical if it increases its asset allocation to risky assets in response to high performances that year (and the reverse)

Methodology

Procyclicality of Equity Investment

- We estimate the following logit regression model

$$\begin{aligned}
 P[PC_{it}^a = 1] = F_L(\beta_1 QIR_{it} + \beta_2 AssetVal_{it} + \beta_3 LDR_{it} + \beta_4 LiabRecog_{it} \\
 + \beta_5 Funding_{it} + \beta_6 RBCR_{it} + \beta_7 Recovery_{it} \\
 + \beta_8 Maturity_{it} + \beta_9 Inf Indx_{it} + \beta_{10} Size_{it} \\
 + \varepsilon_{it})
 \end{aligned}
 \tag{8}$$

$F_L(z) = \frac{1}{1+e^{-z}}$ is the cumulative distribution function of a logistic distribution

Fixed Effects

$$\varepsilon_{it} = \delta_{c(i)} + \tau_{T(i)} + \eta_t + \vartheta_{it}$$

$c(i)$ and $T(i)$ are functions mapping fund i to its country, and to its type, respectively.

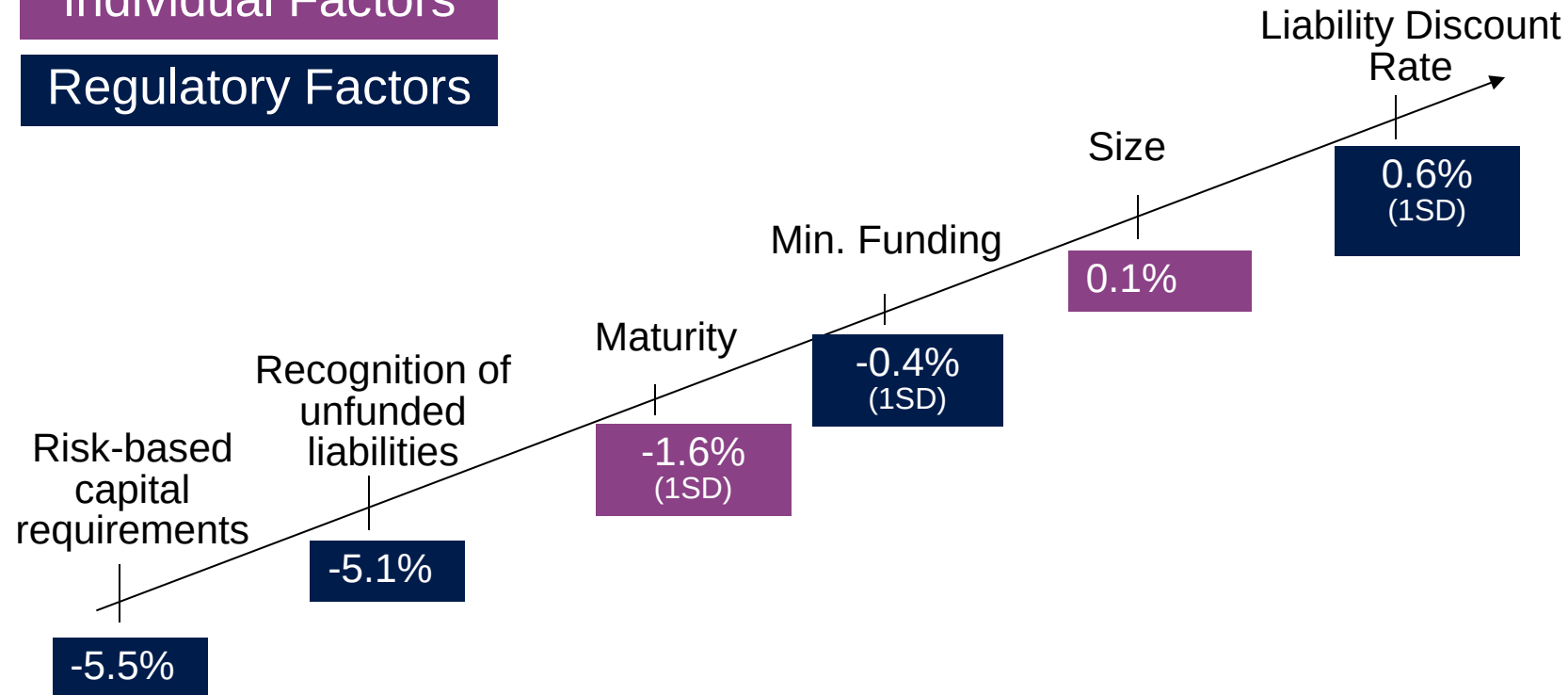
Results: Allocation to Risky Assets – Fund & Year FE

	Dependent variable:			
	Percentage Allocation to			
	Risky Assets	Equities	Risky FI	Alt
Quantitative Investment Restrictions	0.027*** (0.008)	-0.012* (0.007)	0.014*** (0.002)	0.025*** (0.009)
Asset Valuation	1.580 (1.260)	1.970 (1.400)	1.250** (0.489)	-1.630 (1.580)
Liability Discount Rate	0.486*** (0.124)	-0.038 (0.181)	0.015 (0.033)	0.509*** (0.132)
Recognition of Unfunded Liabilities	-5.070*** (0.898)	-2.640** (1.250)	-0.134 (0.114)	-2.290** (1.010)
Minimum Funding Requirements	-0.025** (0.011)	0.014 (0.015)	-0.019* (0.011)	-0.020** (0.010)
Risk-based Capital Requirements	-5.530*** (1.640)	-1.610 (1.280)	-0.873 (0.546)	-3.050*** (0.758)
Recovery Period	0.121*** (0.026)	0.213*** (0.056)	0.002 (0.011)	-0.094** (0.047)
Maturity	-0.087*** (0.018)	-0.092*** (0.019)	-0.001 (0.004)	0.006 (0.015)
Inflation Indexation	0.007 (0.006)	-0.005 (0.007)	0.003 (0.003)	0.010** (0.004)
Size	0.106*** (0.026)	0.007 (0.022)	0.018*** (0.003)	0.081*** (0.017)
Adjusted R-squared	0.081	0.043	0.026	0.030
Nobs.	4059	4059	4059	4059
Significance: *0.1, **0.05, ***0.01				

Results: Allocation to Risky Assets

Individual Factors

Regulatory Factors



Institutional Factor

Our ability to investigate this aspect is restricted due to data limitations.

Though the category of funds protected by an external guarantee fund, on average, invests more in risky assets.

Results: Risky Asset Allocation

- Regulatory factors have much more economic impact than individual characteristics
 - **Reduction** in risky asset allocation by up to **5%**
- **Risk-based capital requirements** have the largest impact
 - **Reduction in overall risky asset weights**
 - **Positive impact on alternatives** (i.e., private equity, real estate) and risky fixed income (i.e., high yield)
- Recognition of unfunded liabilities comes as the second largest impact
- Individual characteristics have a relatively smaller, but nevertheless statistically significant impact

Results: Procyclicality

	Dependent variable:			
	Percentage Allocation to			
	Risky Assets	Equities	Risky FI	Alt
Quantitative Investment Restrictions	0.014*** (0.003)	0.019*** (0.003)	0.003 (0.004)	-0.002 (0.002)
Asset Valuation	0.138 (0.546)	0.720 (0.698)	-0.784 (0.704)	-1.230** (0.501)
Liability Discount Rate	-0.146*** (0.050)	-0.096* (0.058)	-0.160*** (0.053)	-0.029 (0.043)
Recognition of Unfunded Liabilities	-0.056 (0.247)	0.181 (0.326)	-0.353 (0.284)	-0.245 (0.235)
Minimum Funding Requirements	0.001 (0.003)	0.000 (0.004)	0.007* (0.004)	0.007** (0.003)
Risk-based Capital Requirements	-0.660 (0.560)	-2.010** (0.828)	-0.835* (0.454)	-0.706* (0.408)
Recovery Period	0.028** (0.012)	0.027* (0.015)	0.021 (0.013)	-0.002 (0.011)
Maturity	-0.002 (0.002)	-0.003 (0.003)	-0.001 (0.003)	-0.006*** (0.002)
Inflation Indexation	-0.001 (0.001)	-0.001 (0.001)	0.003* (0.001)	0.004*** (0.001)
Size	0.000 (0.002)	0.000 (0.003)	0.011*** (0.002)	0.003* (0.002)
Adjusted R-squared	0.288	0.407	0.198	0.120
Nobs.	4059	4059	4059	4059
Significance: *0.1, **0.05, ***0.01				

Results: Procyclicality

- **Quantitative investment restrictions** encourage procyclicality on unconstrained asset classes
- Counterintuitively, **risk-based regulation is not associated to procyclical** behavior
 - Result may be driven by the temporary regulatory slackening during the last crisis in the Netherlands (extension of recovery period, suspension of pension indexation or reduction in nominal pensions, higher contribution rates allowed, etc.)

Conclusion

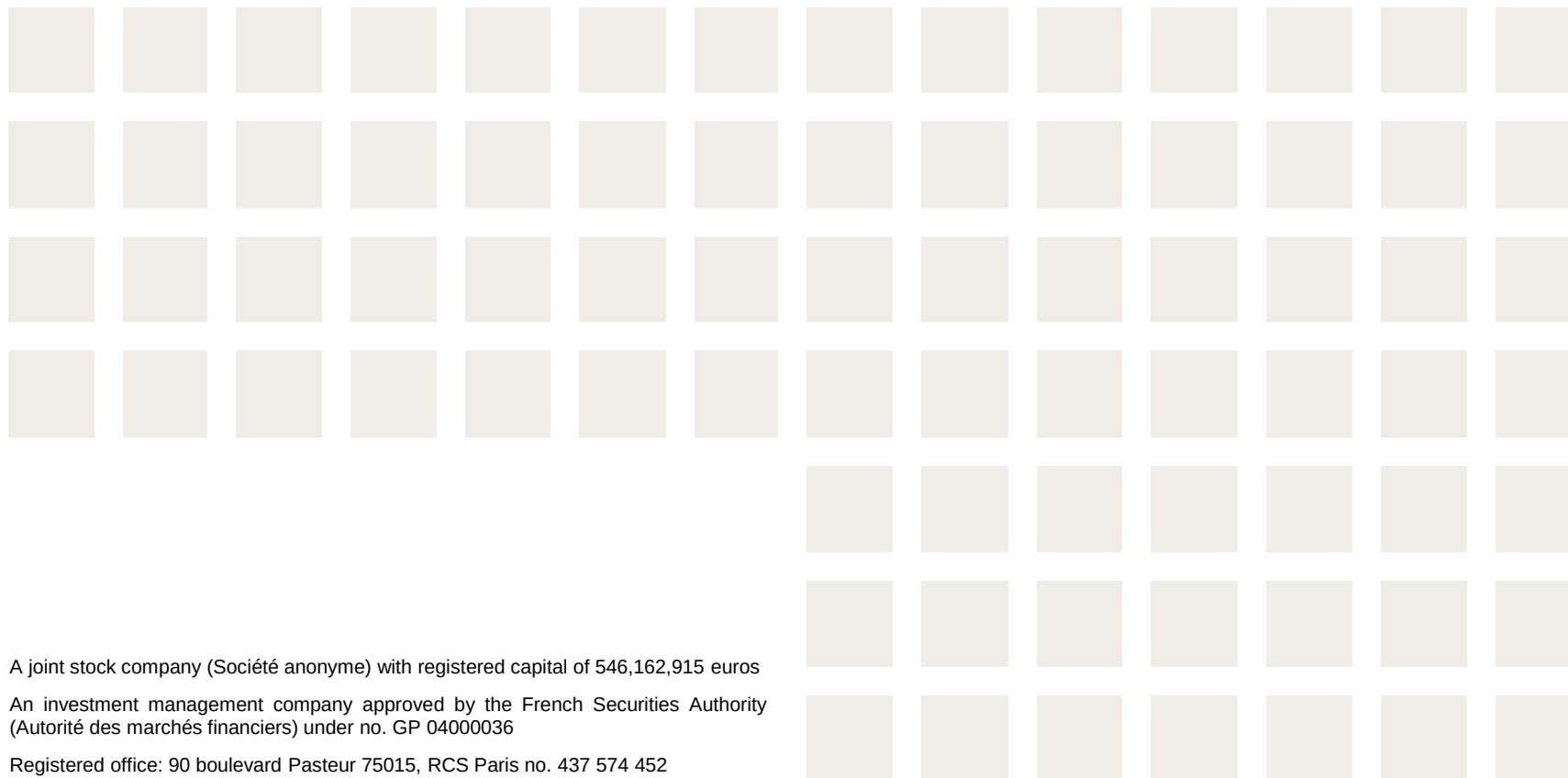
- Our objective: quantify the importance of regulatory factors on top of individual / structural characteristics of the funds
- Regulation plays a crucial role in pension funds' asset allocation choices, compared to institutional / individual funds' variables
- All regulatory measures and in particular risk-based capital requirements and liabilities recognition **decreased the overall risky asset allocation**
- **Reduction of overall risky assets**, but risk-based regulations led to an **increase in commodities and private equity**

Conclusion

- We find evidence of some indications of procyclicality, more pronounced during financial crises
- Counterintuitively, we do not find that risk-based regulation induced more procyclical behavior
 - Unique to the Netherlands: the DNB authorized numerous waivers to the standing regulation during the subprime crisis (especially extension of the recovery period) to assist pension funds
 - This argues for a « dynamic » setting of regulatory rules?

Amundi

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