

# Main Determinants of Profit Sharing Policy in the French Life Insurance Industry

Pierre-Emmanuel Darpeix

Paris School of Economics (PSE)  
and Autorité de Contrôle Prudentiel et de Résolution (ACPR)  
[pierre-emmanuel.darpeix@acpr.banque-france.fr](mailto:pierre-emmanuel.darpeix@acpr.banque-france.fr)

With F. Borel-Mathurin (PSE, ACPR), Q. Guibert (ISFA, ACPR), S. Loisel (ISFA)

June, 9th 2015, IAA Colloquium, Oslo

*The views expressed in this paper are those of the authors and do not necessarily reflect those of the ACPR.*

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data
- 4 Methodology
- 5 Empirical results
- 6 Conclusion

# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data
- 4 Methodology
- 5 Empirical results
- 6 Conclusion

## Introduction and context

- Participation strategy for the euro-denominated savings contracts (with profit participation) only seldom studied in France.
- Life insurance markets less "standardized" than P&C markets.
- Large heterogeneity in savings contracts across countries (e.g. minimum guaranteed rates or legal framework).
- In France: very low guaranteed rates relative to other European countries → the participation strategy is all the more important.

## General wisdom

For most authors, participation strategies depend not only on present and past performances of the insurer's strategic asset allocation (e.g. Bacinello (2001)), but also:

- on policyholders' expectations: performance and regularity (e.g. Planchet and Thérond (2007); Milhaud *et al.* (2010)),
- on insurance portfolio characteristics,
- on the insurer's ability to smooth its financial results (e.g. Grosen and Løchte Jørgensen (2000), Bauer *et al.* (2006)),
- on other insurers' behavior (see Dutang *et al.* (2013) in P&C),
- and on the set of substitute savings products available on the market.

## General wisdom

However, almost all authors address these issues with an *a priori* assumption on the profit sharing management rules (mainly for valuation purposes). Clear lack of empirical literature on participation behaviors both in France and elsewhere.

Interest for the supervisor:

- Crucial to understand participation strategies in order to pin down potential vulnerabilities for insurers which would face too stringent a constraint and could not honor their liabilities or face competition.
- Essential to fulfill the consumer protection mission

# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework**
- 3 Data
- 4 Methodology
- 5 Empirical results
- 6 Conclusion

## French context: Two types of legal reserves

- The **profit sharing reserve** (*Provision pour participation aux bénéfices* – PPB) where profits can be stored for later release (before 8 years);
- The various **asset reserves**, set to balance the historic value accounting:
  - The *Provision pour risque d'exigibilité* – PRE to deal with unrealized losses at the portfolio level;
  - The *Provision pour dépréciation durable* – PDD to deal with unrealized losses at the individual asset level;
  - The *Réserve de capitalisation* – RC, that stores the gains and losses realized on the various bond selling operations.



## French context: Contracts

- Our study focuses on individual euro-denominated contracts with profit participation:
  - Saving products with guaranteed capital,
  - With a legal profit sharing mechanism at the fund level,
  - With (optionally) minimal participation rates guaranteed on an annual basis.

→ In the end, insurers have much leeway in the way they allocate participation, both temporally and across the different contracts.

## Our paper

- The literature sheds light on potential drivers of participation rates.
- We compile the first panel data set at the entity level to test a formalized set of assumptions drawn from the theory and from practitioners' common wisdom.
- We follow a classical empirical strategy with econometric regressions, robustness checks and time-stability checks.

# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data**
- 4 Methodology
- 5 Empirical results
- 6 Conclusion

## Raw data

- We constructed a brand new data set from the annual supervisory reports (*Dossiers Annuels*)
- These prudential reports are composed of:
  - general information on the undertakings,
  - detailed accounting documents,
  - prudential information on various topics: credit, reinsurance, solvency, reserves etc.
- To the best of our knowledge, this is the first database of this kind to be exploited for empirical research on life insurers' profit sharing policies.

## Raw data

Raw accounting/prudential data extracted on yearly basis for each reporting undertaking.

- **Time period:** 15 years between 1999 and 2013.
- **Type of undertakings:** medium and big life insurers (Insurance Code and Mutual Insurance Code).
- **Type of products:** individual euro-denominated life insurance products with profit participation in France.
- **Variable of interest:** undertaking's average participation rate  $r_i$  computed at aggregated level. Focus on the spread with the French safe asset:

$$r_{i,t} = \frac{\text{Total Revalorization Amount}_i}{\text{Yearly Average Mathematical Reserves}_i}; \rho_{i,t} = r_{i,t} - r_t^{\text{OAT}}$$

## Potential drivers

**Aggregated indicators** for each insurer regrouped by category.

Category	Variables
<b>Soundness and resilience controls</b>	Coverage ratio
	UCGLs
	Profit Sharing Reserves (level and variation)
<b>Size controls</b>	Log of the mathematical reserves
	Dummy for the smallest undertakings
<b>ALM controls</b>	Asset returns
	Realized capital gains
	Share of equity in total assets
	Financial margin
<b>Reserving controls</b>	PDD ( <i>Provision pour risque d'exigibilité</i> )
	PRE ( <i>Provision pour dépréciation durable</i> )
<b>Policyholder behavior controls</b>	Collection rates
	Lapse rates

**Macroeconomic variables.** We examine yields on French govies, EUR/USD exchange rate, unemployment rate, GDP growth, ...

## Data selection

Elimination of undertakings or observations that appeared to be either reporting mistakes or clearly atypical, and correction of multiple obvious sign errors.

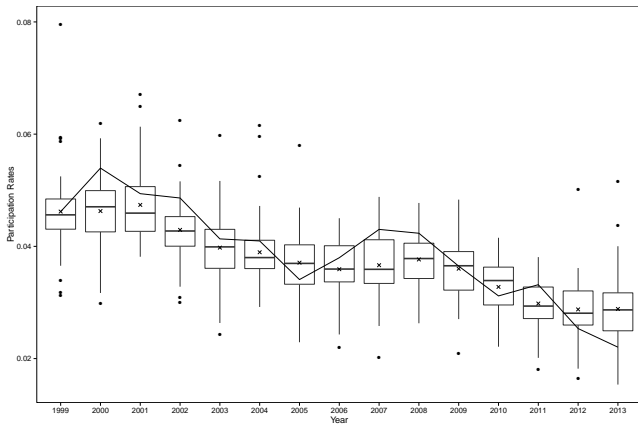
- Focus on undertakings ruled by the *Code des Assurances* but a couple of undertakings are ruled by the *Code de la Mutualité*
- **Mergers and acquisition.** Split the concerned entities into two (before and after the merge).
- **Missing values.** Essential raw information was often missing from the reporting templates.
- **Unbalanced panel of 89 insurers over 15 years.** Each year, between 51 and 71 undertakings are observed (936 obs and 31 entities observed over the entire period).

## Summary statistics

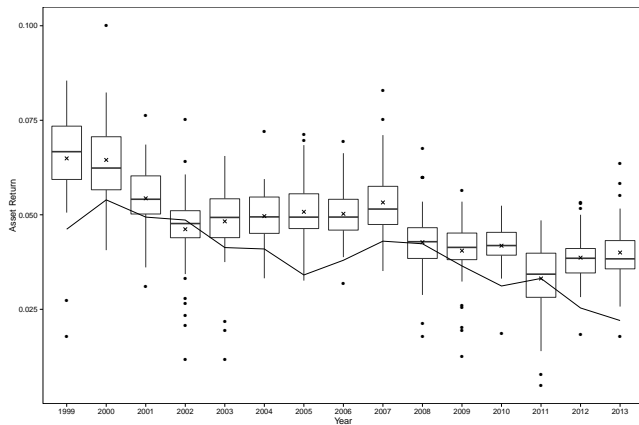
Year	Number of insurers	Mathematical reserves	Market coverage
1999	51	286,204	75%
2000	53	316,619	78%
2001	58	372,163	81%
2002	61	407,306	81%
2003	65	490,645	90%
2004	66	591,073	94%
2005	71	653,596	94%
2006	67	712,401	95%
2007	65	712,401	87%
2008	66	844,864	96%
2009	64	906,835	96%
2010	64	993,370	97%
2011	62	1,027,407	98%
2012	64	1,056,795	99%
2013	59	1,051,076	96%



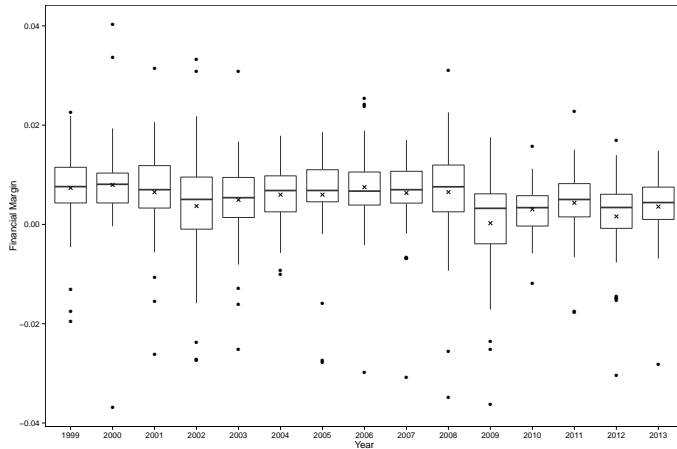
## Participation rate and 10Y-French govies



## Return on assets and 10Y-French govies



# Financial margin



# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data
- 4 Methodology**
- 5 Empirical results
- 6 Conclusion

## Rationale

- Insurers aim at maximizing their future profits over a specific time-horizon, under solvency and regulatory constraints (standard optimization problem).
- Life insurers can
  - 1 use the PPB reserves to smooth future incomes
  - 2 and be encouraged to keep the more profitable contracts within the portfolio.
- Using this simple statement, we should assume that:
  - 1 their participation rate acts as an aggregate control variable,
  - 2 a trade-off nevertheless exists between giving participation immediately and endowing the PPB.

To challenge this analysis we used two models:

- a baseline model with a target participation rate.
- and a dynamic model assuming time-dependent target rates.

## Baseline models

Graphical analysis and practitioners' common wisdom

→ We assume a common reference (OAT-10Y) for all insurers  $i$ .

$$\rho_{i,t} = \beta^\top \mathbf{x}_{i,t} + \mu_i + \varepsilon_{i,t}, \quad (1)$$

- $\rho_{i,t} = r_{i,t} - r_t^{OAT}$ : participation rate spread;
  - $r_{i,t}$ : participation rate at the end of year  $t$  for insurer  $i$
  - $r_t^{OAT}$ : OAT-10Y rate
- $\mathbf{x}_{i,t}$ : vector of specific control variables
- $\mu_i$ : the insurer's fixed effect.
- $\varepsilon_{i,t}$ : a random disturbance term of mean 0.

A **dynamic panel model** can also be specified:

$$\rho_{i,t} = \gamma \rho_{i,t-1} + \delta^\top \mathbf{x}_{i,t} + \nu_i + \epsilon_{i,t}. \quad (2)$$

# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data
- 4 Methodology
- 5 Empirical results**
- 6 Conclusion

## Estimation with the baseline model

	<i>Participation Rate Spread <math>\rho_{i,t}</math></i>							
	Model 1		Model 2		Model 3		Model 4	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Asset Return – OAT-10Y	0.205*** (0.025)	0.205*** (0.027)	0.168*** (0.023)	0.136*** (0.023)	0.194*** (0.023)	0.133*** (0.022)	0.193*** (0.023)	0.129*** (0.022)
OAT-10Y			-0.337*** (0.026)	-0.365*** (0.026)	-0.343*** (0.025)	-0.389*** (0.025)	-0.349*** (0.025)	-0.421*** (0.024)
Lapse Rate					-0.070*** (0.007)	-0.083*** (0.009)	-0.069*** (0.007)	-0.089*** (0.009)
PPB Ratio (BoY)							0.011 (0.008)	0.063*** (0.020)
Constant	-0.003*** (0.000)	-0.003*** (0.000)	0.010*** (0.001)	0.011*** (0.001)	0.014*** (0.001)	0.017*** (0.001)	0.014*** (0.001)	0.017*** (0.001)
Nobs	936	936	936	936	936	936	936	936
F statistic	66	59	118	155	121	135	91	125
$R^2$	0.13	0.45	0.26	0.57	0.33	0.61	0.33	0.62
Adjusted $R^2$	0.13	0.39	0.26	0.53	0.33	0.57	0.33	0.58

Note: This table contains the estimated parameters and their robust standard errors in parentheses (White) for the static models, with both pooled-OLS and fixed effects (FE) specifications. The constants correspond to the mean of fixed effects for FE models. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.



## Main findings of the parsimonious static model

- The phenomenon is rather well described by a parsimonious fixed effect model that includes:
  - insurers' financial out-performances (low level of pass-through)
  - level of the OAT-10Y (negative impact, cf. definition of  $\rho$ .)
  - lapse rates (negative and quantitatively small!)
  - levels of the profit sharing reserves (marginally positive)
- Discussion on timing and endogeneity:
  - participation is determined at the end of the year
  - the PPB is observed at the beginning of the year
  - lapses, financial performances and the level of the OAT are averaged over the year.
- Little room for an omitted variable bias, yet a few complementary variables come out as statistically significant under FE (UCGL, RC, Share of equity).

# Estimation with the dynamic model

	<i>Participation Rate Spread <math>\rho_{i,t}</math></i>											
	Autocorrelation		Model 9		Model 10		Model 11		Model 12		Model 4	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Lag of Participation Rate Spread	0.581*** (0.041)	0.343*** (0.053)	0.508*** (0.038)	0.250*** (0.050)	0.469*** (0.035)	0.179*** (0.046)	0.424*** (0.036)	0.157*** (0.046)	0.426*** (0.036)	0.161*** (0.044)		
Asset Return – OAT-10Y			0.139*** (0.020)	0.208*** (0.029)	0.093*** (0.018)	0.117*** (0.025)	0.121*** (0.019)	0.116*** (0.024)	0.120*** (0.019)	0.110*** (0.024)	0.193*** (0.023)	0.129*** (0.022)
OAT-10Y					-0.295*** (0.022)	-0.346*** (0.023)	-0.301*** (0.021)	-0.368*** (0.023)	-0.310*** (0.022)	-0.403*** (0.023)	-0.349*** (0.025)	-0.421*** (0.024)
Lapse Rate							-0.047*** (0.006)	-0.068*** (0.009)	-0.045*** (0.006)	-0.074*** (0.009)	-0.069*** (0.007)	-0.089*** (0.009)
PPB Ratio (BoY)									0.018** (0.008)	0.064*** (0.021)	0.011 (0.008)	0.063*** (0.020)
Constant	-0.000* (0.000)	-0.001 (0.000)	-0.002*** (0.000)	-0.003*** (0.000)	0.010*** (0.001)	0.011*** (0.001)	0.013*** (0.001)	0.016*** (0.001)	0.012*** (0.001)	0.016*** (0.001)	0.014*** (0.001)	0.017*** (0.001)
Nobs	842	842	842	842	842	842	842	842	842	842	936	936
F statistic	203	42	135	45	169	119	152	103	124	111	91	125
R <sup>2</sup>	0.34	0.46	0.39	0.53	0.49	0.63	0.52	0.65	0.53	0.67	0.33	0.62
Adjusted R <sup>2</sup>	0.34	0.39	0.39	0.47	0.49	0.59	0.52	0.61	0.52	0.62	0.33	0.58

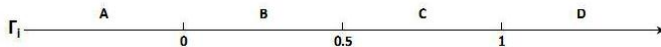
Note: This table contains the estimated parameters and their robust standard errors in parentheses (White) for the dynamic models, with both pooled-OLS and fixed effects (FE) specifications. Model 9 captures the participation rate spread dynamic and Models 10-12 consider the effect of additional variables. The results obtained with Model 4 are displayed for comparison purpose. The constants correspond to the mean of fixed effects for FE models. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

## Heterogeneity of undertakings: Clustering

We use the following statistic:

$$\Gamma_i = \bar{\rho}_i - \frac{\sigma_i^{\rho}}{\sqrt{N_i}}$$

And we define 4 groups based on the value of  $\Gamma_i$



	Panel A	Panel B	Panel C	Panel D
Mean	-0.00492***	-0.00140***	-0.00194***	-0.000153
	(0.00074)	(0.00042)	(0.00046)	(0.00046)

Note: This table contains the estimated average participation rate spread for each performance subgroups (Panels A-D) with their robust standard errors in parentheses (White). \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

# Heterogeneity of undertakings: Clustering

	<i>Participation Rate Spread <math>\rho_{i,t}</math></i>											
	Model 4 - Entire set		Model 4 - Panel A		Model 4 - Panel B		Model 4 - Panel C		Model 4 - Panel B&C		Model 4 - Panel D	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Asset Return and OAT-10Y	0.193 (0.023)***	0.129 (0.022)***	0.226 (0.054)***	0.152 (0.054)***	0.236 (0.055)***	0.213 (0.048)***	0.066 (0.037)*	0.056 (0.033)*	0.116*** (0.031)	0.116*** (0.029)	0.078 (0.047)	0.093 (0.043)**
OAT-10Y	-0.349 (0.025)***	-0.421 (0.024)***	-0.327 (0.075)***	-0.521 (0.073)***	-0.344 (0.048)***	-0.370 (0.046)***	-0.449 (0.046)***	-0.438 (0.043)***	-0.414*** (0.032)	-0.426*** (0.031)	-0.281 (0.048)***	-0.362 (0.050)***
Lapse Rate	-0.069 (0.007)***	-0.089 (0.009)***	-0.024 (0.030)	-0.041 (0.039)	-0.088 (0.014)***	-0.132 (0.016)***	-0.076 (0.012)***	-0.037 (0.020)*	-0.085*** (0.009)	-0.084*** (0.013)	-0.085 (0.012)***	-0.097 (0.014)***
PPB Ratio	0.011 (0.008)	0.063 (0.020)***	0.035 (0.012)***	0.071 (0.041)*	0.014 (0.014)	0.056 (0.030)*	0.022 (0.019)	0.033 (0.042)	0.016 (0.012)	0.054** (0.027)	-0.015 (0.018)	0.073 (0.038)*
Constant	0.014 (0.001)***	0.017 (0.001)***	0.009 (0.003)***	0.016 (0.003)***	0.015 (0.002)***	0.018 (0.002)***	0.019 (0.002)***	0.016 (0.002)***	0.018*** (0.001)	0.018*** (0.002)	0.015 (0.002)***	0.017 (0.002)***
Nobs	936	936	160	160	285	285	252	252	537	537	239	239
F statistic	91	125	13	27	48	64	36	33	79	88	22	26
$R^2$	0.33	0.62	0.36	0.70	0.40	0.64	0.30	0.49	0.34	0.55	0.33	0.65
Adjusted $R^2$	0.33	0.58	0.34	0.65	0.40	0.60	0.29	0.43	0.33	0.50	0.32	0.61

Note: This table contains the estimated parameters and their robust standard errors in parentheses (White) for Model 4, with both pooled-OLS and fixed effects (FE) specifications over the performance subgroups. The constant correspond to the mean of fixed effects for FE models. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01.

# Plan

- 1 Introduction and Motivation
- 2 French regulatory and contractual framework
- 3 Data
- 4 Methodology
- 5 Empirical results
- 6 Conclusion**

## Conclusion

Our econometric analyses show interesting results:

- Driving role of the French govies,
  - Low pass-through from financial performances to participation,
  - On average over the period, even the group of out-performers distributed less than the OAT-10Y,
  - Lapses surprisingly do not come out as a strong driver of participation, which raises questions on the micro-level management of lapses, heterogeneity of contracts and French financial literacy,
  - Riskier portfolios associated with lower participation,
- + Graphical exemplification of margin smoothing rather than participation smoothing for several firms.

## Conclusion

Other angles could be used in a near future:  
We need more granular data to investigate some points further  
(profit sharing within the portfolio of the undertaking, competitive  
aspects of participation).

# References I

- Bacinello, A. (2001). Fair pricing of life insurance participating policies with a minimum interest rate guaranteed. *ASTIN Bulletin*, **31**(2), 275–297.
- Bauer, D., Kiesel, R., Kling, A., and Ruß, J. (2006). Risk-neutral valuation of participating life insurance contracts. *Insurance: Mathematics and Economics*, **39**(2), 171–183.
- Dutang, C., Albrecher, H., and Loisel, S. (2013). Competition among non-life insurers under solvency constraints: A game-theoretic approach. *European Journal of Operational Research*, **231**(3), 702–711.
- Grosen, A. and Løchte Jørgensen, P. (2000). Fair valuation of life insurance liabilities: The impact of interest rate guarantees, surrender options, and bonus policies. *Insurance: Mathematics and Economics*, **26**(1), 37–57.
- Milhaud, X., Gonon, M.-P., and Loisel, S. (2010). Les comportements de rachat en assurance vie en régime de croisière et en période de crise. *Risques*, **83**(83), 76–81.
- Planchet, F. and Thérond, P. E. (2007). *Mesure et gestion des risques d'assurance: Analyse critique des futurs référentiels prudentiel et d'information financière*. Assurance Audit Actuariat. Economica, Paris.