

Disparities in pension financing in Europe: Economic and financial consequences

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Motivation

- **Problematic:** Economic and financial consequences of ageing in the 3 main European countries (France, Germany, UK) \Rightarrow differences in the timing of ageing, in the pension schemes and in the reforms implemented
- **Framework:** Computable general equilibrium model with overlapping generations of heterogeneous agents
- **Originality:** comparison between different assumptions concerning economic openness:
 - Small Open economy
 - Closed economy
 - Financial union
- **Temporal horizon:** 2000-2050

Literature

Partial equilibrium models:

- **Accounting models:** Bac, Bonnet, Bontout and Cornilleau (2003), COR (2001,2006), Auerbach, Kotlikoff and Leibfritz (1999)
- **Micro simulation models:** Destinie (1999)

General equilibrium models:

- **Closed economy:** Auerbach and Kotlikoff (1987)
- **Open economy:** Börsch-Supan, Ludwig and Winter (2004), Ingenué (2005), Fehr, Jokisch and Kotlikoff (2003)

General structure of the model

- Structure halfway between pure accounting models and general equilibrium models \Rightarrow model with capital accumulation and exogenous saving behaviors (Blanchet, 1992)
- 3 types of players: heterogeneous individuals, one representative firm, different superannuation funds
- Structural unemployment based on a WS-PS approach (d'Autume and Quinet, 2001) \Rightarrow Long term unemployment values: 6% (Fr), 5.6% (Ger), 4% (Uk)
- Backward looking expectations
- Detail description of the different pension schemes running in each country as well as integration of the most recent reforms

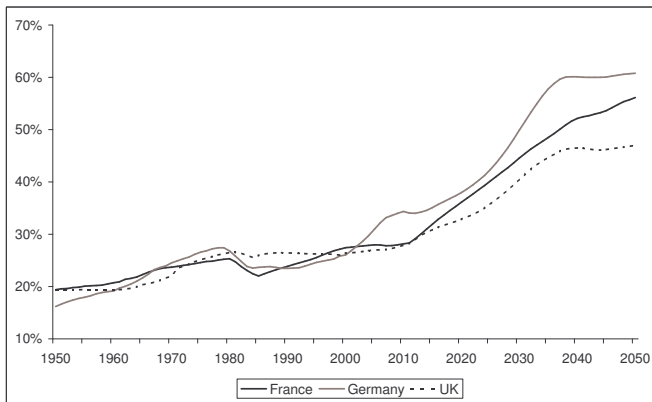
PART 1

DESCRIPTION OF THE MODEL

The demographic bloc (exogenous)

- Individuals are characterized by their date of birth (1894-2049), gender and professional status (executives, non executives and civil servants)
- Past evolution (1946-1999): historical official statistics
- Projections (2000-2050): Bac and Chateau (2003) based on Eurostat target values and the components projection method (fertility rates, life expectancy and net migratory flows)
- Nobody works before 16 and after 75. Activity rates are exogenous and we assume a rise in participation rates of elder workers

Figure: Old Age Dependency Ratio: 65+/20-64



- Ageing is a phenomenon common to the 3 countries
- Differences in the extend and the timing of ageing
- Differences in the causes of ageing

The production sector

- One representative firm produces a single good used for consumption and capital accumulation
- Cobb-Douglas production function (labor and physical capital) with constant returns to scale:

$$Y_t = K_{t-1}^\alpha (\Gamma_t N_t)^{1-\alpha}$$

- The representative firm behaves competitively on the factor markets and maximizes profits:

$$PROF_t = Y_t - (r_t + \delta)K_{t-1} - w_t N_t$$

- Interest rate and wages are thus endogenously determined on the capital and the labor market

Individual behavior

- Individual of class (g,s,c) are represented at each period by a representative agent who is simultaneously employed, unemployed and inactive
- Each representative individual receives an average wage:

$$w_{rep}(t, g, s, c) = a_j w(t) \text{profil}_w(t, g, s, c) (1 - \theta_{cho}(t, g, s, c)) \theta_{act}(t, g, s, c)$$

- Current consumption depends on the net current available income and on the wealth accumulated:

$$c = (1 - s) (1 - \tilde{\tau}) [r(t)A(t - 1) + Inc] + c_A A(t - 1)$$

- Saving rates are exogenous and only age dependant \Rightarrow it allows to reproduce a correct wealth accumulation profile

Individual income ($\text{Inc}(t,g,s,c)$)

- Before D_2 , agents are inactive and represent a cost for their parents in term of consumption
- Between D_2 and r_a , individuals only perceive their average earned income and pay their pension contributions
- Between r_a and $D_2 + D$, they both receive labor income and pre-retirement income
- Between $D_2 + D$ and 75, they both receive labor income and pension benefits
- After 75, they only receive pension benefits and don't pay any pension contributions

PART 2

THE PENSION SCHEMES

Table: Social security payments in 2000

	Billion of euros	Percentage of GDP
France		
General Regime "rb"	79,3	5,6%
Complementary Schemes "rc"	46,4	3,3%
Civil Servants Schemes "rf"	51,3	3,6%
Pre-Retirement	8,1	0,6%
Total	185,1	13,1%
Germany		
Private Sector Pensions "grv"	196,4	9,7%
Civil Servants Schemes "rf"	43,1	2,1%
Pre-retirement	0,5	0,0%
Total	240,0	11,8%
UK		
Basic State Pension "bsp"	47,8	3,5%
Second State pension "serps"	7,0	0,5%
Pre-Retirement	8,8	0,6%
Income Support (MIG)	11,7	0,9%
Private occupational pension funds	36,9	2,7%
Public occupational pension funds	23,2	1,7%
Total	135,4	9,9%

Sources: Mesnard (2001b), OECD (2001), Department for Work and pension, Government Actuary's department

The French pension system (1)

Civil Servants:

- Pension at age of retirement is proportional to the last wage:

$$P_L = \pi("rf") \cdot w_{rep}(t-1) \text{Min}(D_1, D)(1 - dec("rf")) \text{Max}(0, \text{Min}(\bar{a} - a, D_1 - D))$$

- Pension are upgraded on inflation (Fillon Reform, 2003)

General regime:

- Pension at age of retirement is proportional to a reference wage perceived during the $An(g)$ last year and limited by the SS ceiling

$$P_L = W_R(\pi("rb") - dec("rb")) \text{Max}(0, \text{Min}(65 - a, D_1 - D)) \cdot \text{Min}\left(1, \frac{D}{pro}\right)$$

- Pension are upgraded on inflation (Balladur reform, 1993)

The French pension system (2)

Complementary Schemes (Notional account):

- Two types of points rather than 2 types of funds (Arrco and Agirc) depending on the part of wage below and above the SS ceiling
- Purchase price and points values are based on historical data from complementary funds until 2003 and then indexed on prices
- Points values and contribution rates are different according to the professional status
- Pension is proportional to the number of points accumulated. A penalty is applied in case of anticipated suspension of activity

The German pension system (1)

Private sector pensions (GRV):

- Pension benefits are proportional to lifetime contributions capped at twice the average earning:

$$P_L = \frac{\pi}{45} W_{base} \cdot (1 - \tau - \tau_{fict}) \cdot Pt_{ac} \cdot [(1 - dec) \cdot \text{Max}(0, 65 - D - D_2)]$$

- Complex indexation formula based on gross wages evolution (inflation + 1% in the model) modified by the actual contribution rate and a fictitious contribution rate
- Application of the Riester reform (2001):
 - Increase in the contribution rate (20% in 2020 and 22% in 2030)
 - Slight cut in the average replacement rate (70% in 2000 to 67% in 2030)
 - Introduction of a fictitious contribution rate to be invested in private pension



The German pension system (2)

Civil service pension:

- Civil servants are exempted from GRV and don't pay any explicit contributions. They receive a pension proportional to their last gross wage:

$$P_L(t) = \pi(t) \cdot w_{rep}(t-1) \cdot \text{Min}(45, D)$$

- 3 main differences compared to GRV:
 - 1 Gross wage / Net wage
 - 2 No ceiling
 - 3 Last wage / lifetime average
- Pensions are indexed on gross earnings (inflation + 1% in the model)

The British pension system (1):

Basic State Pension (BSP):

- Flat-rate contributory benefit payable to people aged over state pension age (60/65):

$$P_L = \frac{D_{car}}{0.9Anw} BSP$$

- BSP pension is indexed on inflation except in 2001 and 2002

State Earnings-Related Pension Scheme (SERPS):

- Created in 1978 so as to provide one quarter of earnings (progressive reduction to 20%) during the best 20 years (lifetime earnings now)
- Serps pension is based on average working life earnings:

$$P_L = \pi \cdot \frac{D_{car}}{0.9Anw} \cdot W_R \cdot \zeta_{in}$$

The British pension system (2):

State Earnings-Related Pension Scheme (SERPS):

- Serps pensions are up-rated in line with prices
- Civil servants aren't concerned by Serps pensions
- Reformed in 2002 and replaced by the State Second Pension (S2P) which is more generous for low earners

Private pensions (funded):

- Ability of employees to opt out of SERPS for occupational pension funds
- Defined benefit rule:

$$P_L = \pi (w_{rep}(\tilde{t}) - \beta LEL) \cdot \min(0.9Anw, D) \cdot \zeta_{out}$$

- 2 types of pension funds are considered: distinction between private and public employees

Equilibrium conditions

Superannuation funds equilibrium:

- Equilibrium is specific for each superannuation fund
- PAYG funds are equilibrated in 2000. Then, different scenarios are considered:
 - 1 debt financing (benchmark)
 - 2 replacement rates adjustment
 - 3 contribution rates adjustment
- British occupational pension funds must be funded at each date: assets must cover the value of accrued pension rights.

Equilibrium conditions

Financial market equilibrium:

- **Small open economy:** exogenous interest rate fixed at the world level + perfect capital mobility:

$$K(t) = A(t) - Debt(t) + B(t) \text{ and } r = r^*$$

- **Closed economy:** the national capital market must be balanced at the country level

$$K(t) = A(t) - Debt(t) \text{ and } r = \text{endogenous}$$

- **Financial union:** perfect capital mobility in the EU3 but no capital mobility with the rest of the world

$$\sum_{i=Fr, Ger, Uk} K^i = \sum_{i=Fr, Ger, Uk} (A(t) - Debt(t)) \text{ and } r = \text{endogenous}$$

PART 3

RESULTS

Table: Benchmark scenario: Small open economy

	2001	2010	2020	2030	2040	2050
France						
GDP growth rate (in %)	2,14	2,20	1,50	1,25	1,41	1,34
Annual capital growth (in %)	3,84	2,42	1,65	1,25	1,39	1,33
Annual labour force growth (in %)	0,37	0,45	-0,19	-0,34	-0,18	-0,26
Public pension payments (in % of GDP)	12,2	12,5	13,7	15,7	17,1	17,8
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	-0,2	0,1	7,8	41,1	104,1	178,8
Net replacement rate	64,6	63,0	59,2	55,6	53,7	52,9
Relative consumption of retirees	1,10	1,02	0,96	0,93	0,91	0,90
Capital property rate (in %)	1,01	0,97	0,96	0,95	0,86	0,71
Germany						
GDP growth rate (in %)	0,99	1,96	1,16	0,74	1,46	0,95
Annual capital growth (in %)	3,10	2,10	1,22	0,73	1,54	0,96
Annual labour force growth (in %)	-0,39	0,12	-0,62	-0,98	-0,34	-0,79
Public pension payments (in % of GDP)	11,8	12,5	13,9	16,2	17,5	18,0
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	0,0	6,4	20,5	53,7	112,6	184,2
Net replacement rate	67,5	61,1	59,3	61,0	64,8	65,2
Relative consumption of retirees	0,95	0,85	0,79	0,79	0,82	0,83
Capital property rate (in %)	1,01	0,91	0,87	0,85	0,75	0,60
UK						
GDP growth rate (in %)	2,30	2,49	1,67	1,25	1,70	1,50
Annual capital growth (in %)	3,39	2,71	1,80	1,23	1,67	1,52
Annual labour force growth (in %)	-0,11	0,54	-0,21	-0,53	-0,08	-0,32
Public pension payments (in % of GDP)	5,0	5,0	4,8	5,1	5,0	4,4
Pension funds payments (in % of GDP)	4,5	4,9	5,4	7,0	8,4	8,7
Debt of public pension schemes (in % of GDP)	0,2	3,9	7,6	15,5	30,6	44,4
Net replacement rate	62,8	62,6	60,9	59,8	57,9	55,6
Relative consumption of retirees	0,80	0,76	0,71	0,70	0,67	0,65
Capital property rate (in %)	1,01	0,92	0,87	0,87	0,79	0,68

Source: Author calculations

Figure: Capital flows (in % of regional GDP): Benchmark scenario - Small open economy

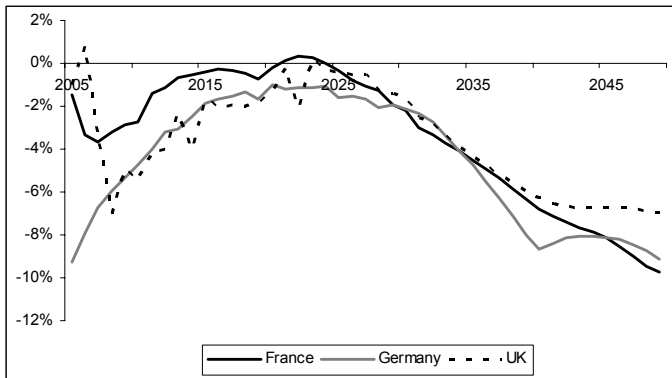


Table: Benchmark scenario: Closed economy

	2001	2010	2020	2030	2040	2050
France						
GDP growth rate (in %)	2.25	1.83	1.37	0.74	-0.36	-5.19
Annual capital growth (in %)	1.76	1.75	1.41	0.36	-1.62	-9.03
Annual labour force growth (in %)	-0.01	0.27	-0.25	-0.62	-1.16	-4.28
Public pension payments (in % of GDP)	12.2	12.7	14.0	16.3	19.5	26.0
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	-0.3	0.1	10.4	50.2	145.4	392.1
Net replacement rate	64.6	63.9	60.6	57.6	60.1	73.8
Relative consumption of retirees	1.10	1.04	0.99	0.97	1.02	1.25
Interest rate (in %)	3.70	3.81	3.86	3.96	4.68	6.79
Germany						
GDP growth rate (in %)	1.00	1.22	0.75	-0.27	-3.50	-
Annual capital growth (in %)	0.62	0.76	0.49	-0.99	-6.49	-
Annual labour force growth (in %)	-1.00	-0.24	-0.83	-1.54	-3.31	-
Public pension payments (in % of GDP)	11.8	13.1	15.1	18.3	23.7	-
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	-0.1	8.8	35.3	99.6	291.9	-
Net replacement rate	67.5	64.1	63.6	65.8	78.5	-
Relative consumption of retirees	0.80	0.74	0.72	0.73	0.86	-
Interest rate (in %)	3.86	4.27	4.59	5.00	6.80	-
UK						
GDP growth rate (in %)	2.30	1.81	1.65	1.21	1.10	0.83
Annual capital growth (in %)	1.19	1.49	1.72	1.17	0.61	0.36
Annual labour force growth (in %)	-0.87	0.21	-0.20	-0.56	-0.40	-0.66
Public pension payments (in % of GDP)	5.0	5.2	5.2	5.4	5.5	5.1
Pension funds payments (in % of GDP)	4.5	5.1	5.6	7.0	8.5	9.1
Debt of public pension schemes (in % of GDP)	0.2	4.6	11.4	23.5	47.2	77.9
Net replacement rate	62.2	65.1	64.1	60.8	59.9	59.8
Relative consumption of retirees	0.80	0.79	0.75	0.72	0.71	0.71
Interest rate (in %)	4.04	4.32	4.49	4.39	4.67	5.11

Source: Author calculations

Table: Benchmark scenario: Financial area

	2001	2010	2020	2030	2040	2050
France						
GDP growth rate (in %)	2.08	1.53	1.25	0.74	-0.31	-4.11
Annual capital growth (in %)	1.47	1.19	1.19	0.39	-1.54	-7.32
Annual labour force growth (in %)	0.26	0.14	-0.30	-0.63	-1.13	-3.62
Public pension payments (in % of GDP)	12.8	13.3	14.6	16.7	19.7	25.4
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	-0.2	0.0	10.4	49.9	146.6	392.2
Net replacement rate	67.9	67.0	63.3	59.2	61.2	72.8
Relative consumption of retirees	1.10	1.04	1.00	0.97	1.03	1.23
Interest rate (in %)	3.93	4.22	4.42	4.56	5.34	7.32
Capital property rate (in %)	1.01	1.04	1.09	1.10	1.10	1.01
Germany						
GDP growth rate (in %)	0.98	1.45	1.00	0.27	-0.46	-4.32
Annual capital growth (in %)	0.38	1.11	0.94	-0.08	-1.68	-7.50
Annual labour force growth (in %)	-1.18	-0.09	-0.69	-1.24	-1.43	-3.99
Public pension payments (in % of GDP)	11.7	13.0	14.7	17.3	20.1	25.7
Pension funds payments (in % of GDP)	-	-	-	-	-	-
Debt of public pension schemes (in % of GDP)	-0.1	8.8	32.7	85.3	201.6	504.9
Net replacement rate	67.1	63.3	62.3	63.5	70.4	81.0
Relative consumption of retirees	0.95	0.88	0.83	0.84	0.92	1.05
Interest rate (in %)	3.86	4.15	4.34	4.48	5.25	7.20
Capital property rate (in %)	1.01	1.00	0.99	0.95	0.87	0.58
UK						
GDP growth rate (in %)	2.27	1.81	1.45	0.79	0.09	-3.68
Annual capital growth (in %)	1.67	1.47	1.38	0.44	-1.13	-6.86
Annual labour force growth (in %)	-0.87	0.21	-0.31	-0.78	-0.94	-3.42
Public pension payments (in % of GDP)	4.9	5.1	5.1	5.6	6.0	6.5
Pension funds payments (in % of GDP)	4.3	5.0	5.6	7.1	8.9	11.0
Debt of public pension schemes (in % of GDP)	0.2	4.1	10.1	21.4	46.4	103.2
Net replacement rate	60.2	62.8	63.2	61.8	63.5	72.8
Relative consumption of retirees	0.80	0.79	0.76	0.74	0.77	0.87
Interest rate (in %)	3.79	4.07	4.26	4.40	5.15	7.07
Capital property rate (in %)	1.01	1.02	1.01	1.04	1.13	1.47

Source: Author calculations

Figure: Capital flows (in % of regional GDP): Benchmark scenario - Financial area

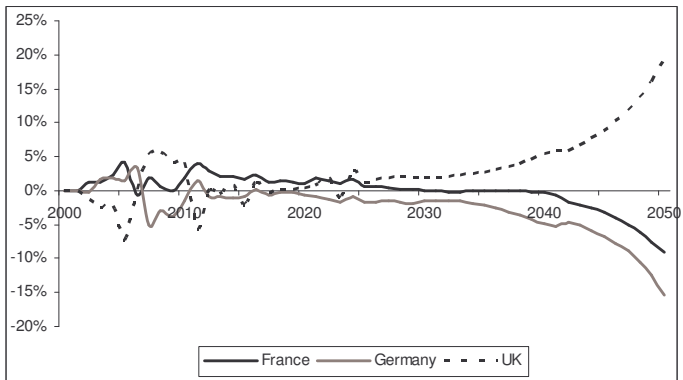


Figure: Public pension schemes deficit (change in % points of GDP compared to the benchmark)

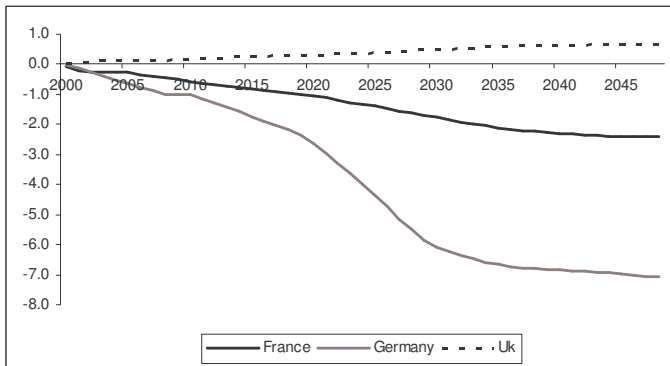


Figure: Net replacement rate (average net pension/average net income)

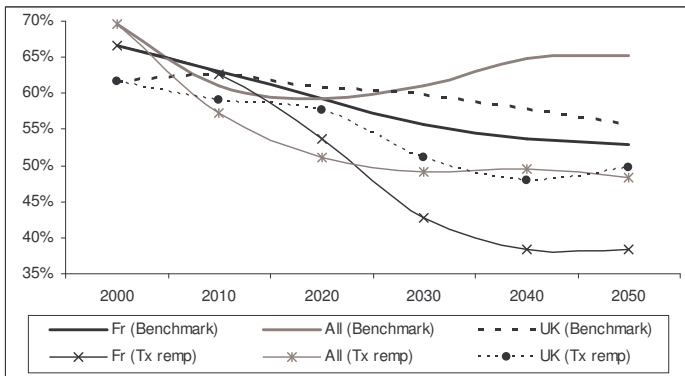
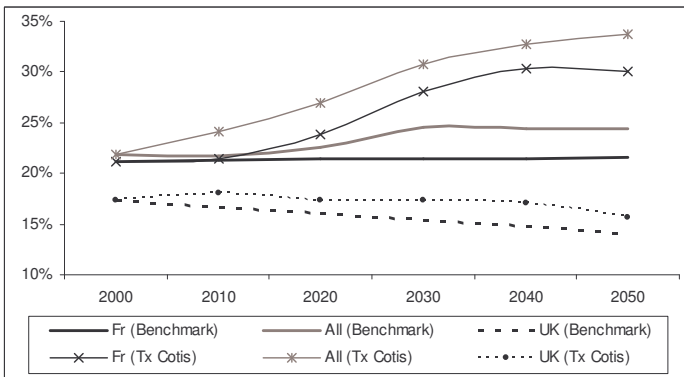


Figure: Average contribution rate to the pension schemes



Conclusion

- Model halfway between accounting models and general equilibrium models so as to present a quantitative analysis of the impact of ageing in the 3 largest European countries
- The macroeconomic equilibrium highly depends on the openness level of the economy
- Large PAYG schemes in France and Germany are unsustainable if no reforms are implemented
- Results are sensitive to the assumptions of the global factor productivity and the behaviors of agents concerning their labor market participation
- Limit: exogenous saving behaviors