The distribution of pension wealth in Europe

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Pension Challenges and Opportunities
International Pension Research Association Conference
Paris, 26 June 2020

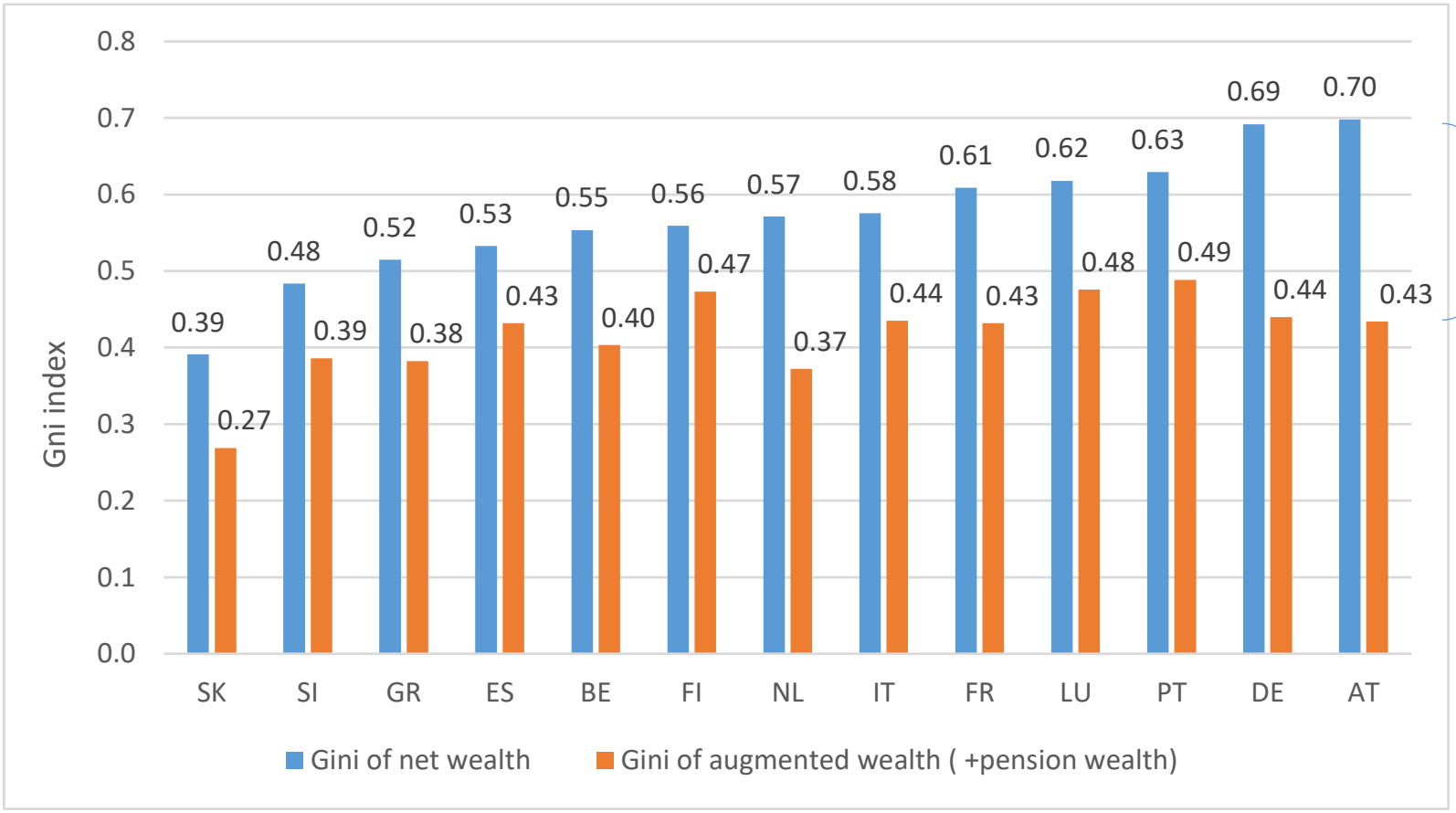
Motivation and goals

- Study the distribution of pension wealth (PW) in Europe, comparatively and over time
- Answer the question whether, and to what extent, life expectancy inequalities affect the distribution of PW
- What is the role of voluntary pension plans on the distribution of PW?
- What are the main predictors for PW inequality?
- Private wealth + PW = 'augmented wealth'. So, studying the distribution of PW contributes to the growing literature assessing wealth inequality
- Large evidence on the 'crowding-out' effect of public pensions on private savings; so, the level and distribution of pensions affect the size and distribution of private and augmented wealth

Motivation and goals

Gini indices of net wealth and 'augmented wealth'

(Household, Finance and Consumption Survey (HFCS) 2010, households aged 65-84)



Source: Cowell, Nolan, Olivera & van Kerm (2017)

Data

1) European Union Statistics on Income and Living Conditions Survey (EU-SILC)
   - 26 countries with information in reference income years 2006 and 2014
   - Sample restricted to households with at least one pensioner aged 60-79
   - Additionally, a household is removed from the sample if the pensioner or his/her spouse is 80+ (age is top-coded at 80)
   - Sample size: 124,486 households (58,482 in 2006; 66,004 in 2014)

2) Database of Human Capital of the Wittgenstein Centre for Demography and Global Human Capital (WIC data) (*version 1*)
   - Distribution of educational attainment (6 levels: no education, primary, incomplete primary, lower secondary, upper secondary and tertiary) by 5-year age groups, 5-calendar years from 1970 to 2100, sex and country

Pension wealth

$$A_z = \sum_{t=0}^{M-z} \frac{p_{z,z+t}}{(1+r)^t} \qquad (1)$$

$$A_{z,y} = A_z + \theta \sum_{t=0}^{M-y} \frac{q_{y,y+t}\left(1-p_{z,z+t}\right)}{(1+r)^t} \qquad (2)$$

$$W_z = A_{z,y} P \qquad (3)$$

A_z : annuity price, amount of capital, in present value, to finance a monetary unit of life pension for a single person at age *z*

$p_{z,z+t}$: probability of survival from age *z* to *z + t*

M : maximum survival age (=110)

r : discount interest rate (=2%)

y : age of pensioner's spouse

$q_{y,y+t}$: probability of survival from age *y* to *y + t*

θ : % of pension that a spouse will receive upon the death of the pensioner

P : annual pension

Pension definitions

- Pension classification as in EU-SILC:
  - Obligatory pensions (old age, survivor and disability). The scheme can vary from country to country. It can be, for example, based on PAYG or occupational plans
  - Pensions from individual private pension plans* (voluntary)
- The goal of the EU-SILC classification is to show differences between mandatory and voluntary pensions
- The main analysis of pension wealth is based on obligatory pensions
- But, voluntary pensions are also added for further analysis of total pension wealth (obligatory + voluntary pensions)

* These pensions "refer to pensions and annuities received, during the income reference period, in the form of interest or dividend income from individual private insurance plans, i.e. fully organised schemes where contributions are at the discretion of the contributor independently of their employers or government." (Eurostat 2013: p321)

Life tables by SES

- Elicit survival estimates with WIC data
- The procedure consists in 'extracting' the number of individuals of a specific cohort-sex-country-education group across the projection years and regress a Gompertz function for the number of survival individuals (l_x) where age (x) is the predictor:

$$l_x = ke^{-e^{(s-cx)}}$$

- *For example, individuals aged 60-64 in 2015 of a given educational level are observed in 1980 when they were aged 25-29, in 1985 when aged 30-34, and so on. They are observed in 2020 when they will be 65-69, in 2025 when they will be 70-74, etc. All these points are* l_x
- The estimated parameters *k, s* and *c* allow to compute life tables by cohort, sex, country and educational level (primary, secondary, tertiary)

The role of life expectancy inequalities on pension wealth inequality

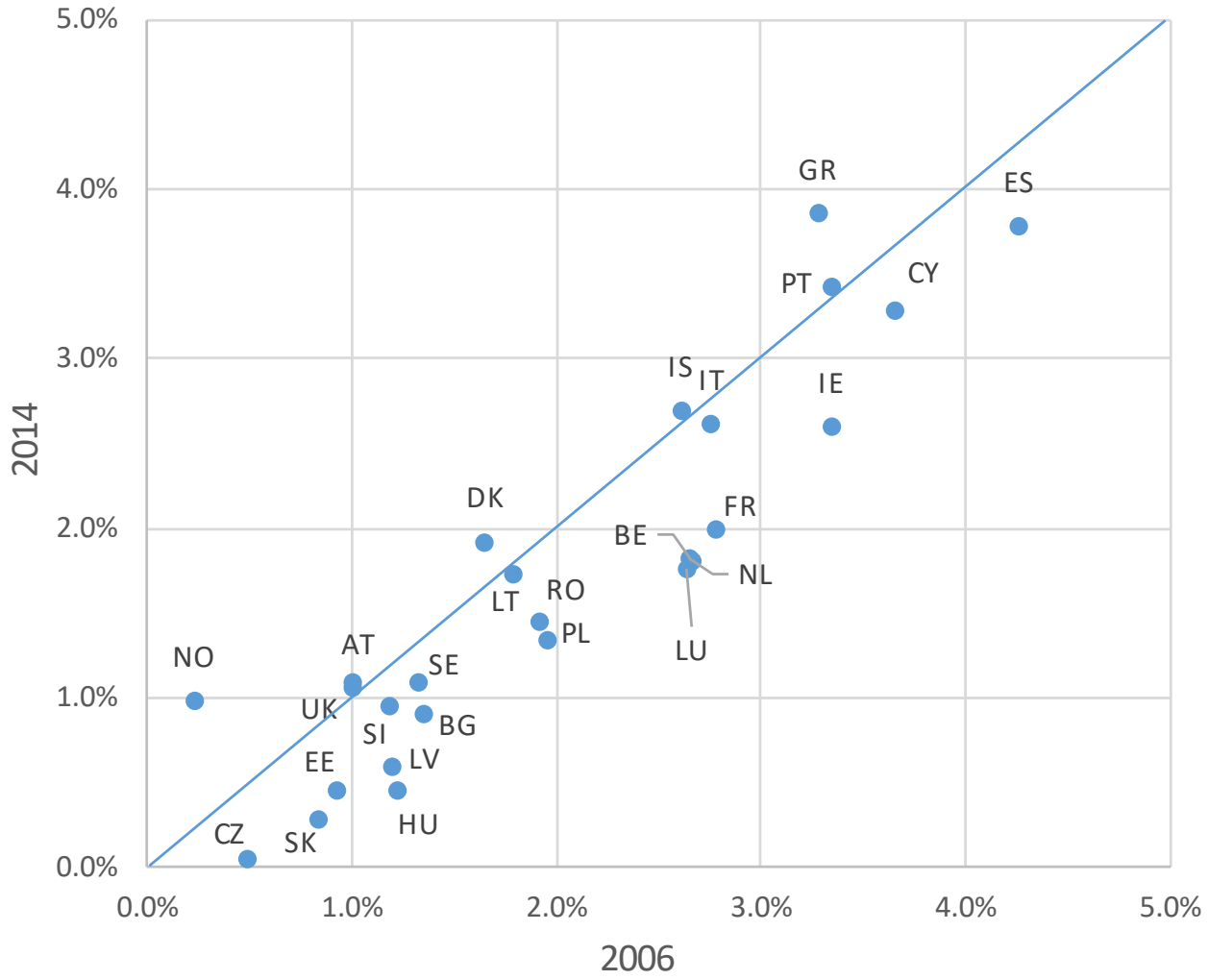
- It is assessed by comparing the distribution of PW computed with SES-mortality and a counterfactual distribution of PW that does not utilize SES-mortality
- This counterfactual distribution uses life tables estimated for the 'average individual' without distinguishing by educational level
- The degree of inequality of the distribution of pension wealth is measured with the Gini index

Gini indices of pension wealth

Country	2006			2014			% change 2014-2006	
	no SES mortality	with SES mortality	% change	no SES mortality	with SES mortality	% change	no SES mortality	with SES mortality
Austria	0.372	0.375	1.0%	0.361	0.365	1.1%	-2.8%	-2.7%
Belgium	0.355	0.364	2.7%	0.339	0.345	1.8%	-4.3%	-5.1%
Bulgaria	0.338	0.343	1.4%	0.339	0.343	0.9%	0.3%	-0.1%
Cyprus	0.502	0.521	**3.6%**	0.476	0.492	**3.3%**	-5.2%	-5.6%
Czech Rep	0.268	0.269	0.5%	0.267	0.267	0.0%	-0.1%	-0.5%
Denmark	0.330	0.335	1.6%	0.350	0.356	1.9%	6.0%	6.3%
Estonia	0.267	0.269	0.9%	0.259	0.261	0.5%	-2.7%	-3.1%
France	0.362	0.372	2.8%	0.326	0.333	2.0%	-9.8%	-10.4%
Greece	0.422	0.436	**3.3%**	0.357	0.370	**3.9%**	-15.5%	-15.1%
Hungary	0.305	0.309	1.2%	0.322	0.323	0.5%	5.5%	4.7%
Iceland	0.345	0.354	2.6%	0.326	0.334	2.7%	-5.6%	-5.5%
Ireland	0.366	0.378	**3.3%**	0.384	0.393	2.6%	4.8%	4.0%
Italy	0.389	0.400	2.8%	0.383	0.393	2.6%	-1.7%	-1.8%
Latvia	0.291	0.295	1.2%	0.378	0.381	0.6%	29.9%	29.1%
Lithuania	0.297	0.302	1.8%	0.308	0.313	1.7%	3.7%	3.7%
Luxembourg	0.317	0.326	2.6%	0.342	0.348	1.8%	7.6%	6.7%
Netherlands	0.360	0.370	2.6%	0.375	0.381	1.8%	4.0%	3.2%
Norway	0.304	0.305	0.2%	0.296	0.299	1.0%	-2.6%	-1.8%
Poland	0.346	0.353	2.0%	0.333	0.337	1.3%	-3.9%	-4.5%
Portugal	0.525	0.542	**3.3%**	0.489	0.506	**3.4%**	-6.9%	-6.8%
Romania	0.399	0.407	1.9%	0.384	0.389	1.4%	-3.8%	-4.2%
Slovakia	0.290	0.292	0.8%	0.267	0.267	0.3%	-8.0%	-8.5%
Slovenia	0.363	0.368	1.2%	0.340	0.343	1.0%	-6.4%	-6.6%
Spain	0.369	0.385	**4.3%**	0.361	0.375	**3.8%**	-2.2%	-2.7%
Sweden	0.331	0.335	1.3%	0.365	0.369	1.1%	10.4%	10.2%
UK	0.403	0.407	1.0%	0.404	0.408	1.1%	0.4%	0.4%
Average	0.354	0.362	2.0%	0.351	0.357	1.7%	-0.3%	-0.6%
Avg pos changes							7.3%	7.6%
Avg neg changes							-5.1%	-5.0%

Effects of SES mortality on the Gini of pension wealth

The values in this figure correspond to the percentage variation between the Gini indices computed with and without SES specific mortality for each year ((Gini_ses)/Gini-1)



Increased in NO, DK, GR.
Slightly in UK, AT, IS, PT

Gini indices of pension wealth and total pension wealth (including voluntary pension plans)

Country	2006			2014			% change 2014-2006	
	obligatory pension wealth	total pension wealth	% change	obligatory pension wealth	total pension wealth	% change	obligatory pension wealth	total pension wealth
Austria	0.375	0.380	1.1%	0.365	0.374	2.3%	-2.7%	-1.6%
Belgium	0.364	0.366	0.5%	0.345	0.348	0.8%	-5.1%	-4.9%
Bulgaria	0.343	0.343	0.0%	0.343	0.342	0.0%	-0.1%	-0.2%
Cyprus	0.521	0.519	-0.4%	0.492	0.494	0.5%	-5.6%	-4.7%
Czech Rep	0.269	0.270	0.4%	0.267	0.269	0.7%	-0.5%	-0.2%
Denmark	0.335	0.335	0.0%	0.356	0.356	0.0%	6.3%	6.3%
Estonia	0.269	0.269	0.0%	0.261	0.263	0.9%	-3.1%	-2.2%
France	0.372	0.372	0.0%	0.333	0.333	0.0%	-10.4%	-10.4%
Greece	0.436	0.436	0.1%	0.370	0.371	0.0%	-15.1%	-15.1%
Hungary	0.309	0.309	0.1%	0.323	0.323	0.0%	4.7%	4.6%
Iceland	0.354	0.354	0.0%	0.334	0.334	0.0%	-5.5%	-5.5%
Ireland	0.378	0.381	0.6%	0.393	0.397	0.8%	4.0%	4.2%
Italy	0.400	0.402	0.5%	0.393	0.393	0.0%	-1.8%	-2.3%
Latvia	0.295	0.295	0.0%	0.381	0.381	0.1%	29.1%	29.2%
Lithuania	0.302	0.302	-0.1%	0.313	0.314	0.2%	3.7%	3.9%
Luxembourg	0.326	0.326	0.1%	0.348	0.348	0.1%	6.7%	6.8%
Netherlands	0.370	0.371	0.3%	0.381	0.382	0.2%	3.2%	3.1%
Norway	0.305	0.308	1.1%	0.299	0.302	0.9%	-1.8%	-2.0%
Poland	0.353	0.353	0.0%	0.337	0.337	0.0%	-4.5%	-4.5%
Portugal	0.542	0.543	0.0%	0.506	0.511	1.0%	-6.8%	-5.9%
Romania	0.407	0.407	0.0%	0.389	0.389	0.0%	-4.2%	-4.2%
Slovakia	0.292	0.293	0.2%	0.267	0.268	0.1%	-8.5%	-8.6%
Slovenia	0.368	0.368	0.0%	0.343	0.344	0.2%	-6.6%	-6.5%
Spain	0.385	0.394	**2.2%**	0.375	0.396	**5.8%**	-2.7%	0.7%
Sweden	0.335	0.352	**5.2%**	0.369	0.380	**2.9%**	10.2%	7.8%
UK	0.407	0.408	0.2%	0.408	0.408	0.0%	0.4%	0.2%
Average	0.362	0.364	0.5%	0.357	0.360	0.7%	-0.6%	-0.5%
Avg pos changes							7.6%	6.7%
Avg neg changes							-5.0%	-4.9%

Elasticity of the Gini index of pension wealth with respect to pensions (decomposition by source)

Country	2006	2014	diff 2014-2006
Austria	0.018%	0.069%	0.051%
Belgium	-0.056%	-0.024%	0.031%
Bulgaria	-0.040%	0.060%	0.100%
Cyprus	0.014%	0.074%	0.060%
Czech Republic	-0.130%	-0.052%	0.078%
Denmark	0.074%	0.106%	0.032%
Estonia	-0.120%	-0.046%	0.074%
France	0.048%	0.099%	0.051%
Greece	0.019%	-0.020%	-0.039%
Hungary	-0.085%	0.002%	0.086%
Iceland	0.143%	0.143%	0.000%
Ireland	0.017%	0.082%	0.065%
Italy	0.037%	0.072%	0.035%
Latvia	-0.076%	0.058%	0.134%
Lithuania	-0.040%	-0.006%	0.035%
Luxembourg	-0.081%	0.033%	0.114%
Netherlands	0.026%	0.114%	0.088%
Norway	0.030%	0.075%	0.045%
Poland	-0.059%	-0.015%	0.044%
Portugal	0.056%	0.079%	0.023%
Romania	0.036%	0.009%	-0.027%
Slovakia	-0.170%	-0.088%	0.082%
Slovenia	-0.021%	0.011%	0.032%
Spain	0.014%	0.059%	0.045%
Sweden	0.045%	0.117%	0.071%
United Kingdom	0.154%	0.165%	0.012%

Note: The Gini elasticity measures the effect of an increase of 1% in pensions on the Gini index of pension wealth. The procedure utilises obligatory pension wealth computed with SES life tables in logs.

- There are 2 sources considered: pensions and annuity prices
- The Gini elasticity measures the effect of an increase of 1% in pensions on the Gini index of pension wealth, i.e. whether pensions have an inequality decreasing or increasing effect on pension wealth inequality
- This elasticity has increased in 24 countries over the period
- The Gini of annuity prices has decreased and attenuated the inequality of pension wealth

Predictors of pension wealth inequality

- Re-centered Influence Function (RIF) Regressions
  - Evaluate the impact of covariates on statistics of interest, or what covariates are associated with large 'influence'
  - The RIF at *y* gives the influence on *υ(F)* of an infinitesimal increase in the density of the data at *y*
  - Regression coefficients reveal how much the average influence of observations vary with *X* (holding other covariates constant)
  - Let *υ*(*F*) be a statistic of interest (a functional) calculated in distribution *F*, e.g. the mean, the median, a percentile, the Gini, etc.
  - The *influence function* of *υ* is a function of *y* and *F* and is defined as:

$$\mathrm{IF}(y;\nu,F)=\lim_{\epsilon\to 0}\frac{\nu((1-\epsilon)F+\epsilon\Delta_y)-\nu(F)}{\epsilon}$$

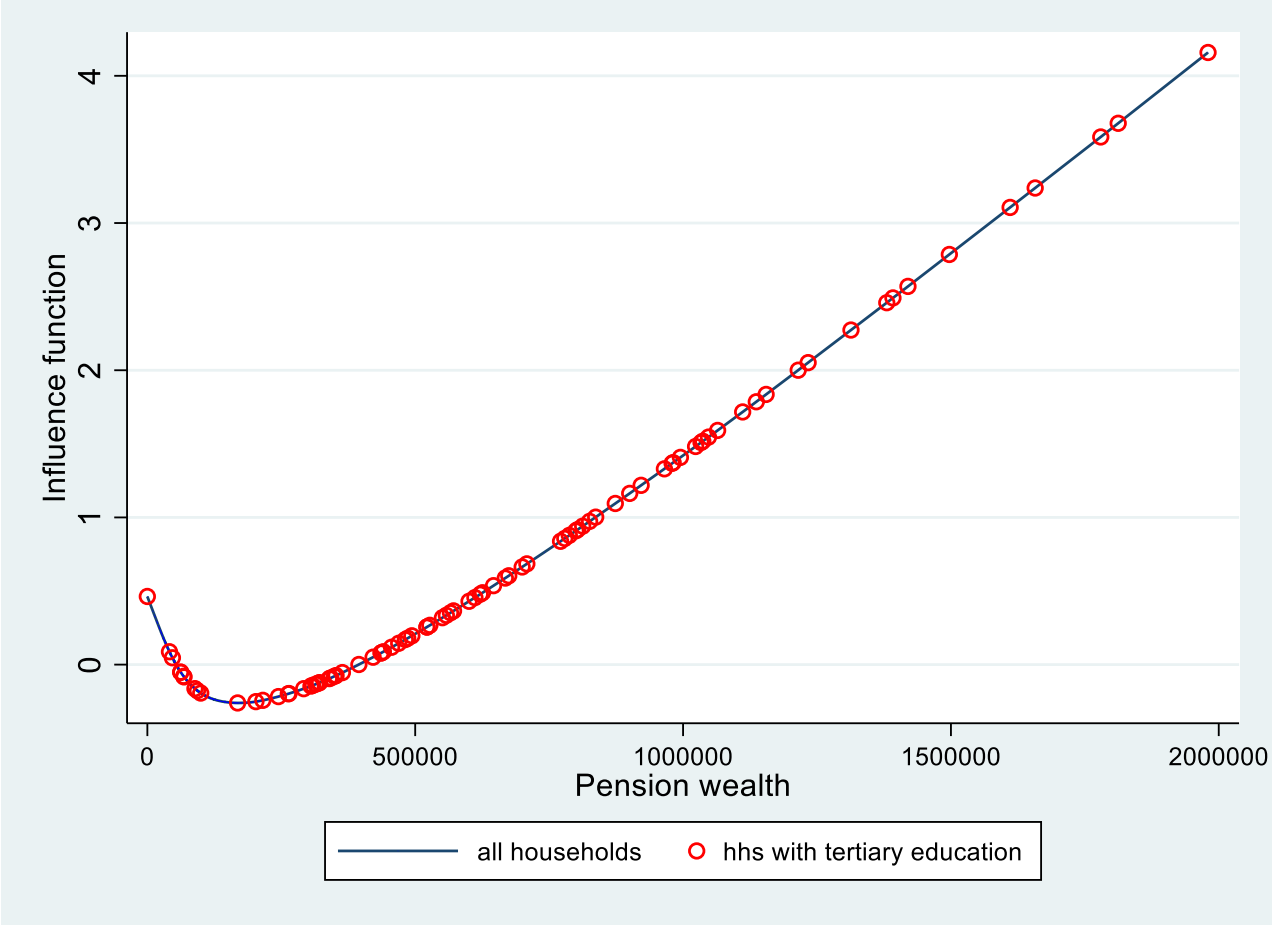
  - The IF captures the effect on (*F*) of an infinitesimal 'contamination' of *F* at point mass *y*

Predictors of pension wealth inequality

- First, obtain the IF values of each household for pension wealth (Gini index) and, after, regress ***X*** on these values
- Run regressions separately for each country and year
- Covariates:
  - Age groups: 60-64; 65-69; 70-74; 75-79 (ref)
  - Household types: single male pensioner; single female pensioner; both spouses are pensioners; only one pensioner within the couple (ref)
  - Educational level: primary (ref); secondary; tertiary
- The coefficients are divided by Gini/100 and reported in %
- So, "*an increase of 1% in **X** is associated with a change of …% in the Gini*"

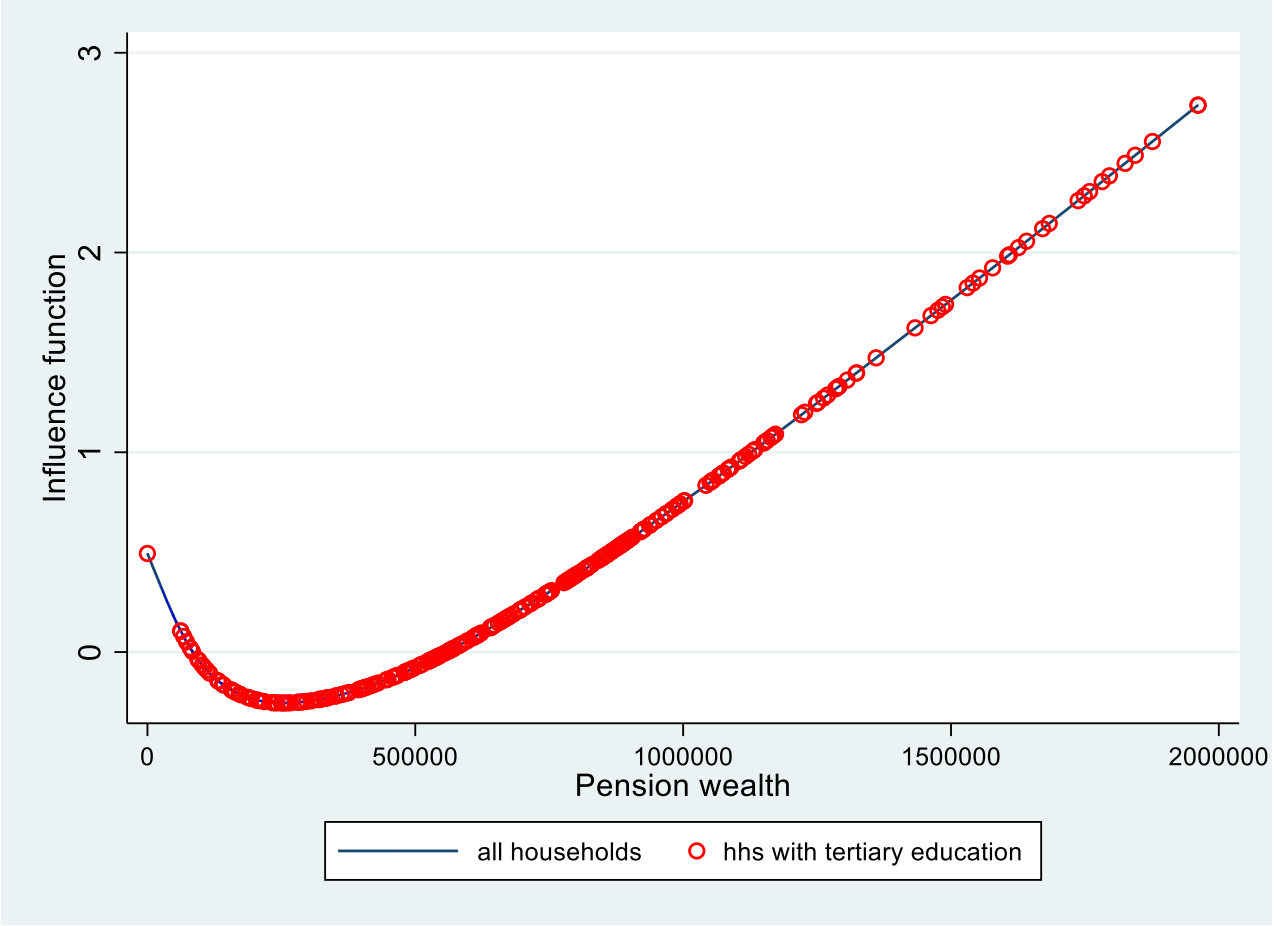
GINI-RIF of pension wealth inequality

- Portugal, 2006



GINI-RIF of pension wealth inequality

- Portugal, 2014



Predictors of pension wealth inequality

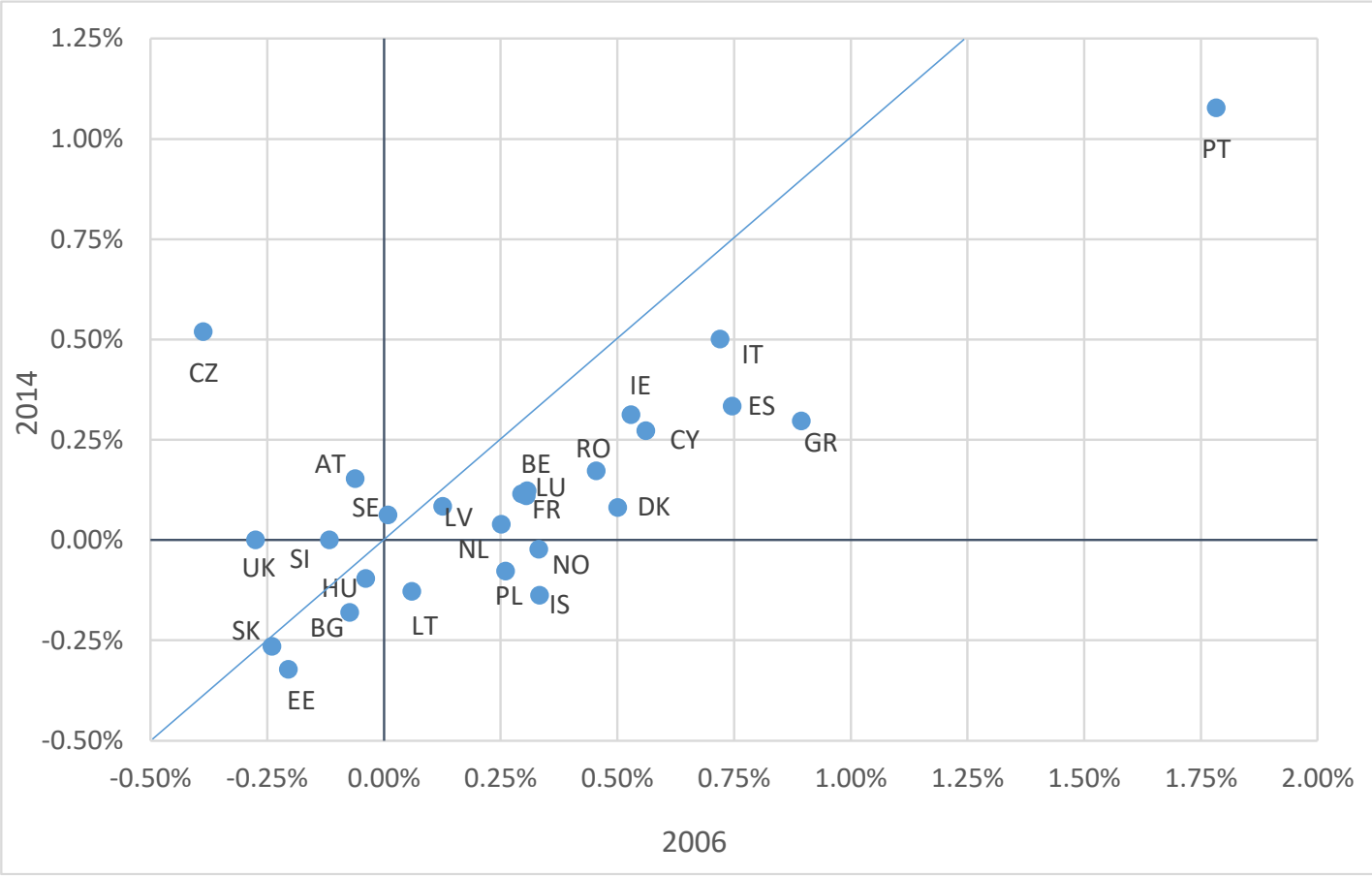
Gini RIF regression coefficients for 'obligatory pension wealth' for some countries

	2006			2014		
	AT	BE	CZ	AT	BE	CY
age 60-64	-0.074***	-0.010	-0.069***	-0.030*	-0.057***	0.058
	(0.016)	(0.023)	(0.008)	(0.017)	(0.016)	(0.044)
age 65-69	-0.062***	-0.045***	-0.094***	-0.038**	-0.009	-0.036*
	(0.016)	(0.016)	(0.006)	(0.015)	(0.018)	(0.020)
age 70-74	-0.069***	-0.057***	-0.090***	-0.044***	-0.048***	-0.047***
	(0.015)	(0.016)	(0.006)	(0.014)	(0.014)	(0.018)
single male pensioner	0.065***	0.099***	0.161***	0.045**	0.118***	0.136**
	(0.019)	(0.017)	(0.015)	(0.020)	(0.028)	(0.068)
single female pensioner	0.109***	0.056***	0.097***	0.095***	0.087***	0.075***
	(0.016)	(0.013)	(0.013)	(0.017)	(0.016)	(0.025)
spouses both pensioners	0.036**	0.152***	0.014	-0.008	0.056***	0.017
	(0.018)	(0.027)	(0.013)	(0.019)	(0.021)	(0.033)
secondary education	-0.109***	-0.034***	-0.109***	-0.031	-0.044***	-0.018
	(0.040)	(0.012)	(0.042)	(0.040)	(0.011)	(0.018)
tertiary education	-0.023	0.111***	-0.104**	0.056	0.038*	0.134***
	(0.045)	(0.022)	(0.044)	(0.042)	(0.020)	(0.032)
constant	0.460***	0.316***	0.385***	0.366***	0.320***	0.444***
	(0.043)	(0.016)	(0.044)	(0.044)	(0.018)	(0.033)
observations	1961	1353	3381	1816	1521	1302
R2	0.054	0.104	0.218	0.057	0.052	0.057

*** p<0.01 ** p<0.05 * p<0.10. Each row contains the coefficients of OLS regressions by country. The dependent variable is the Influence Function (IF) of each household in the Gini index of pension wealth. The reference variable for age groups is 'age 75-79', for education is 'primary education' and for household types is 'only one pensioner within the couple'. Pension wealth only includes obligatory pensions and is computed with SES life tables.

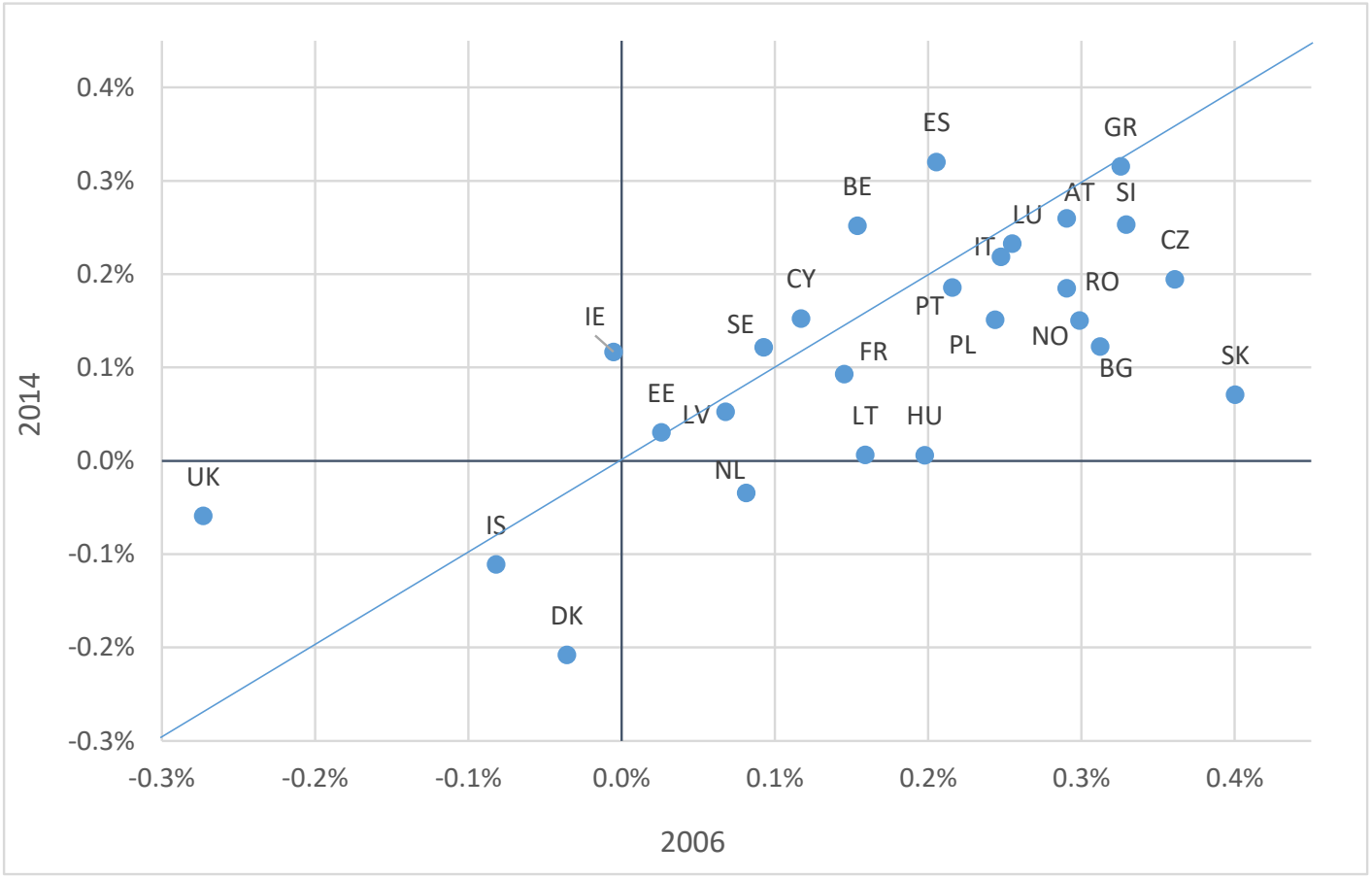
Effects of tertiary education on PW inequality

- Figure shows Gini-RIF coefficients/Gini/100 in %. It uses SES mortality
- In 19(18) countries, this predictor is positive in 2006(2014)
- In most countries, the importance of this predictor has reduced over time



Effects of being ‘female single pensioner’ on pension wealth inequality

- In 22(22) countries, this predictor is positive in 2006(2014)
- In most countries, the importance of this predictor has reduced over time



% variation of Gini indices (Gini_SES/Gini -1) of obligatory pension wealth by different discount rates

Country	2006			2014		
	r=1%	r=2% (baseline)	r=3%	r=1%	r=2% (baseline)	r=3%
Spain	4.34	4.26	4.15	3.83	3.79	3.72
Cyprus	3.86	3.65	3.44	3.51	3.28	3.07
Portugal	3.53	3.34	3.16	3.67	3.42	3.20
Ireland	3.51	3.34	3.17	2.80	2.60	2.42
Greece	3.47	3.28	3.10	4.09	3.86	3.63
France	2.93	2.77	2.61	2.16	2.00	1.86
Italy	2.90	2.75	2.61	2.75	2.62	2.45
Belgium	2.80	2.66	2.52	1.94	1.80	1.67
Netherlands	2.80	2.65	2.50	1.96	1.83	1.71
Luxembourg	2.76	2.63	2.49	1.90	1.77	1.64
Iceland	2.77	2.60	2.45	2.77	2.69	2.61
Poland	2.05	1.96	1.86	1.44	1.35	1.26
Romania	2.01	1.91	1.81	1.52	1.44	1.37
Lithuania	1.90	1.79	1.68	1.87	1.73	1.60
Denmark	1.77	1.64	1.53	2.02	1.92	1.83
Bulgaria	1.43	1.35	1.27	0.99	0.91	0.72
Sweden	1.40	1.32	1.25	1.18	1.10	1.02
Hungary	1.23	1.22	1.28	0.42	0.46	0.49
Latvia	1.27	1.19	1.12	0.64	0.59	0.54
Slovenia	1.27	1.17	1.08	1.04	0.96	0.88
United Kingdom	1.08	0.99	0.92	1.16	1.06	0.96
Austria	1.07	0.99	0.92	1.19	1.09	1.00
Estonia	0.97	0.92	0.88	0.48	0.45	0.43
Slovakia	0.90	0.83	0.76	0.35	0.28	0.22
Czech Republic	0.40	0.48	0.56	-0.01	0.05	0.13
Norway	-0.06	0.22	0.11	1.09	0.98	0.89

Concluding remarks

- The inclusion if life expectancy inequalities increases the estimates of inequality of pension wealth in all countries
- The effect of life expectancy inequalities has fallen in most of the countries (19 out of 26) over the analysed period. The change has been small where this effect has increased (AT, DK, GR, IS, NO, PT, UK)
- Voluntary pension plans increases pension wealth inequality, although it is sizeable only for Austria, Spain and Sweden
- There is a reduction in the influence of tertiary education and households with a single female pensioner on inequality
- Thee Gini index of pensions has increased over the period while the Gini index of annuity prices has decreased and attenuated this inequality increasing effect