

The cohort size-wage relationship in Europe

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Motivation

Changes in European workforce structures:

- ▶ Increasing shares of older workers
- ▶ Increases in the average level of education
- ▶ Differences in age-education structures in Europe

Identify causal effect on individual wages:

- ▶ Does cohort size have a negative effect on wages?
- ▶ Do cohort size effects differ between educational group?
- ▶ Do negative effects persist?

Limited evidence for Europe:

- ▶ Recent and comprehensive European data set
- ▶ Analysis at the individual level
- ▶ Different identification strategy

Theoretical background

Production function approach:

- ▶ Age-education-specific labour input
- ▶ Separate labour markets for differently educated workers
- ▶ Limited substitutability of differently aged workers within specific educational group

Educational categories:

- ▶ International Standard Classification of Education (ISCED)
- ▶ Lower secondary (ISCED 2), secondary (ISCED 3) and tertiary (ISCED 5)

Data (1)

European Union Statistics on Income and Living Conditions (EU-SILC):

- ▶ Individual- and household-level data
- ▶ 2007-2010
- ▶ 24 countries (21 used)
- ▶ (Un-)Employed males aged 20-45 (ISCED 2, 3) or 25-45 (ISCED 5)

Central explanatory variable:

- ▶ Cohort size variable captures age-education structure
- ▶ Relative size of age-education group in population with given educational level
- ▶ Weighted sum including two adjacent age groups

$$CS_{jekt} = \frac{\left(\frac{1}{9}\right)N_{(j-2)ekt} + \left(\frac{2}{9}\right)N_{(j-1)ekt} + \left(\frac{3}{9}\right)N_{jekt} + \left(\frac{2}{9}\right)N_{(j+1)ekt} + \left(\frac{1}{9}\right)N_{(j+2)ekt}}{N_{ekt}}$$

Empirical model

Empirical model:

$$\ln [w_{ijkt}] = \alpha_1 \ln [CS_{jkt}] + \alpha_2 \ln [CS_{jkt}] * Age_{jkt} + \alpha_3 \ln [CS_{jkt}] * Age_{jkt}^2 + \beta X_{ijkt} + u_{ijkt}$$

- ▶ Separate regressions for each of three educational groups
- ▶ Flexibility in the development of cohort size effects over age
- ▶ Fixed effects: Country, time, country-by-time, age-by-time and squared age-by-time

Marginal effects:

$$\frac{\partial \ln [w_{ijkt}]}{\partial \ln [CS_{jkt}]} = \alpha_1 + \alpha_2 * Age_{jkt} + \alpha_3 * Age_{jkt}^2$$

- ▶ Marginal effects are functions of cohort size coefficients and age

Identification strategy (1)

Endogeneity of cohort size variable due to individual self-selection:

- ▶ Into educational groups
- ▶ Into geographical units
- ▶ Ordinary Least Squares (OLS) estimates inconsistent

Instrumental Variables (IV) strategy employed to identify causal effects:

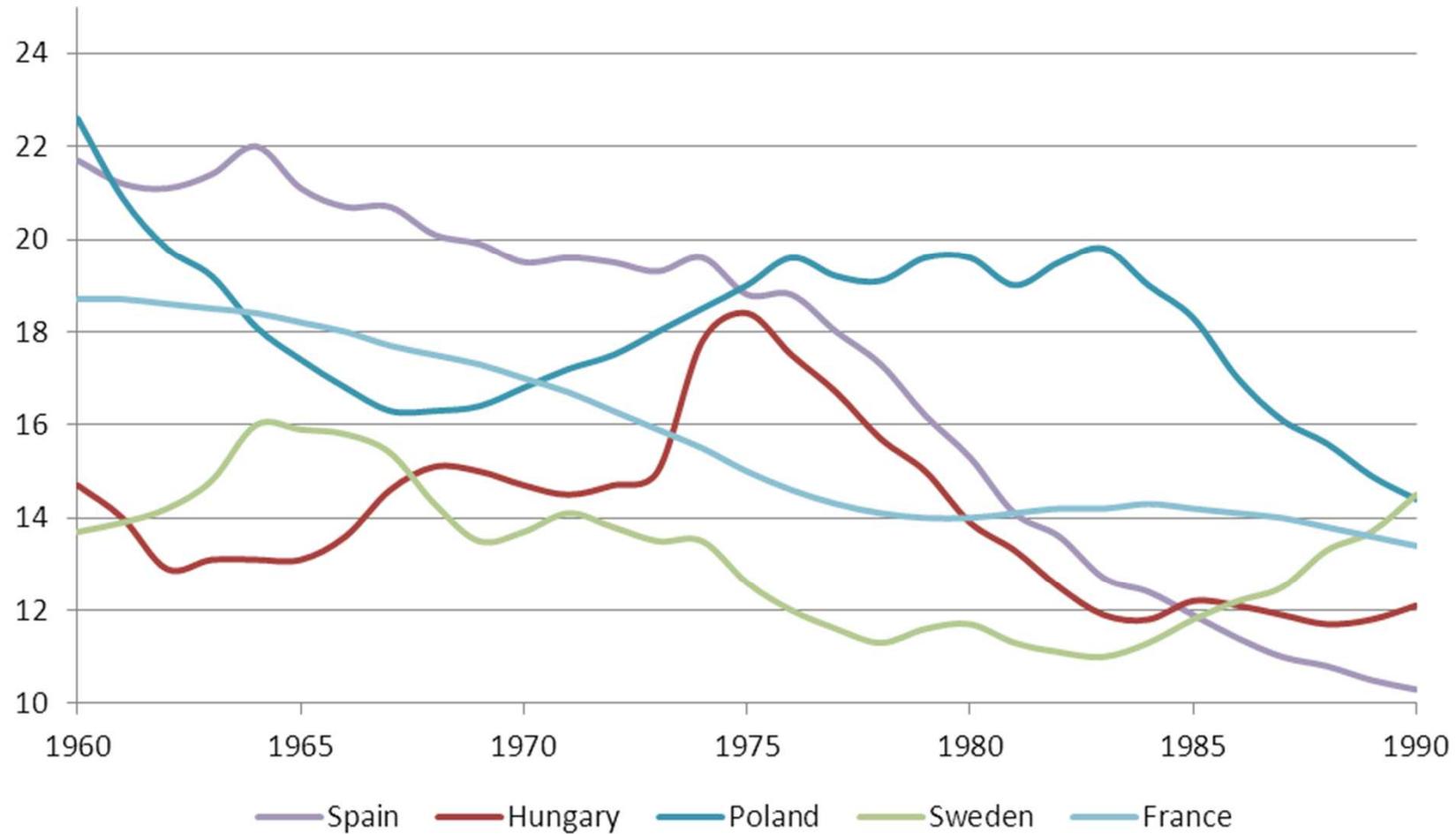
- ▶ Birth rate at the individual's year of birth used as instrument

Identification of cohort size effects exploits variation in the development of birth rates across European countries

Implications:

- ▶ Estimation of a model with individual fixed effects not feasible

Identification strategy (2)



Results (1)

Dependent Variable: <i>Ln[Wage]</i>	ISCED 2		ISCED 3		ISCED 5	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
<i>Ln[Cohort Size]</i>	0.101 (0.067)	0.135 (0.107)	0.321*** (0.064)	0.388** (0.160)	0.198** (0.085)	0.881*** (0.272)
<i>Ln[Cohort Size] X Age</i>	-0.033** (0.013)	-0.047** (0.019)	-0.095*** (0.011)	-0.158*** (0.020)	-0.029 (0.022)	-0.364*** (0.126)
<i>Ln[Cohort Size] X Age²</i>	0.002*** (0.001)	0.002 (0.001)	0.004*** (0.001)	0.008*** (0.001)	0.001 (0.001)	0.019*** (0.007)
N	15,520	15,520	50,829	50,829	24,853	24,853
R ²	0.642	0.641	0.780	0.779	0.670	0.657
Test of joint significance of cohort size variables	4.23***	8.70**	26.05***	72.86***	2.13*	10.82**
χ^2 -test for underidentification	-	294.30***	-	1419.35***	-	118.97***

Results:

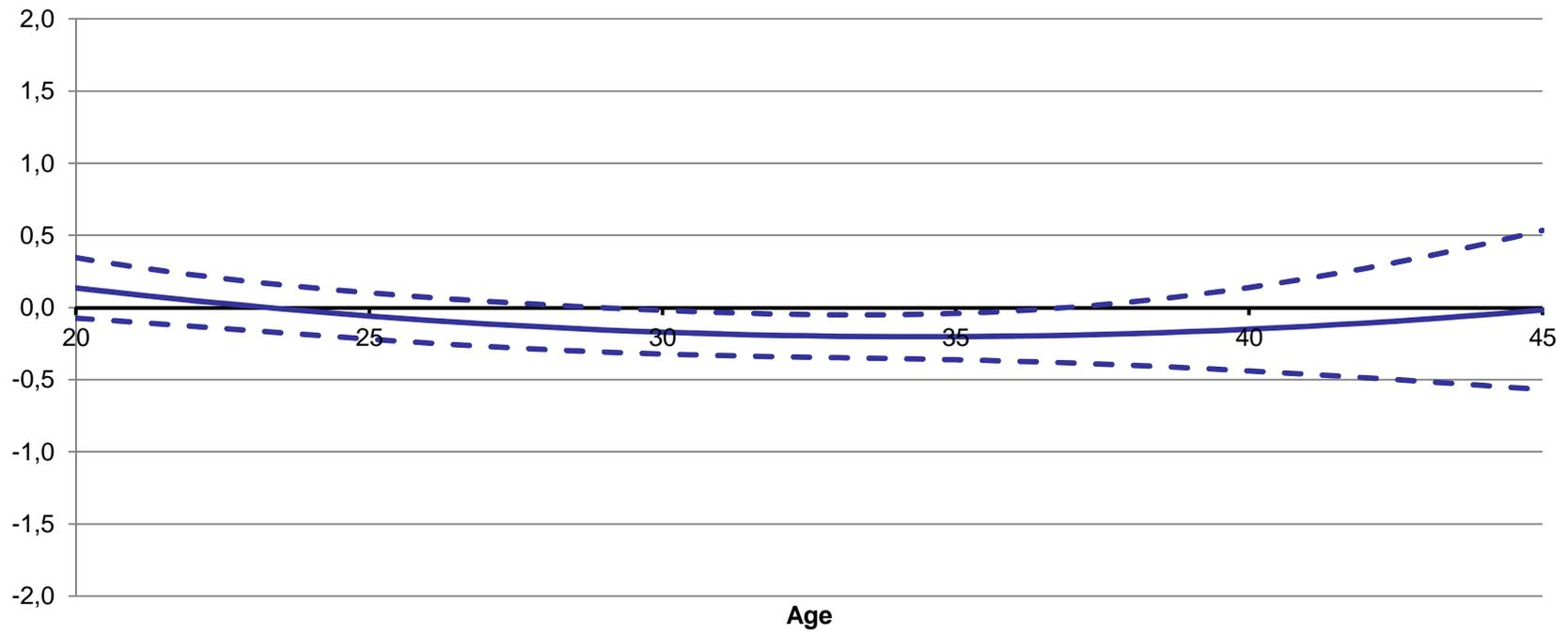
- ▶ Cohort-size variables significant determinants of individual wages

Weak instruments:

- ▶ Null hypothesis rejected that instruments are uncorrelated with endogenous regressors at each educational level

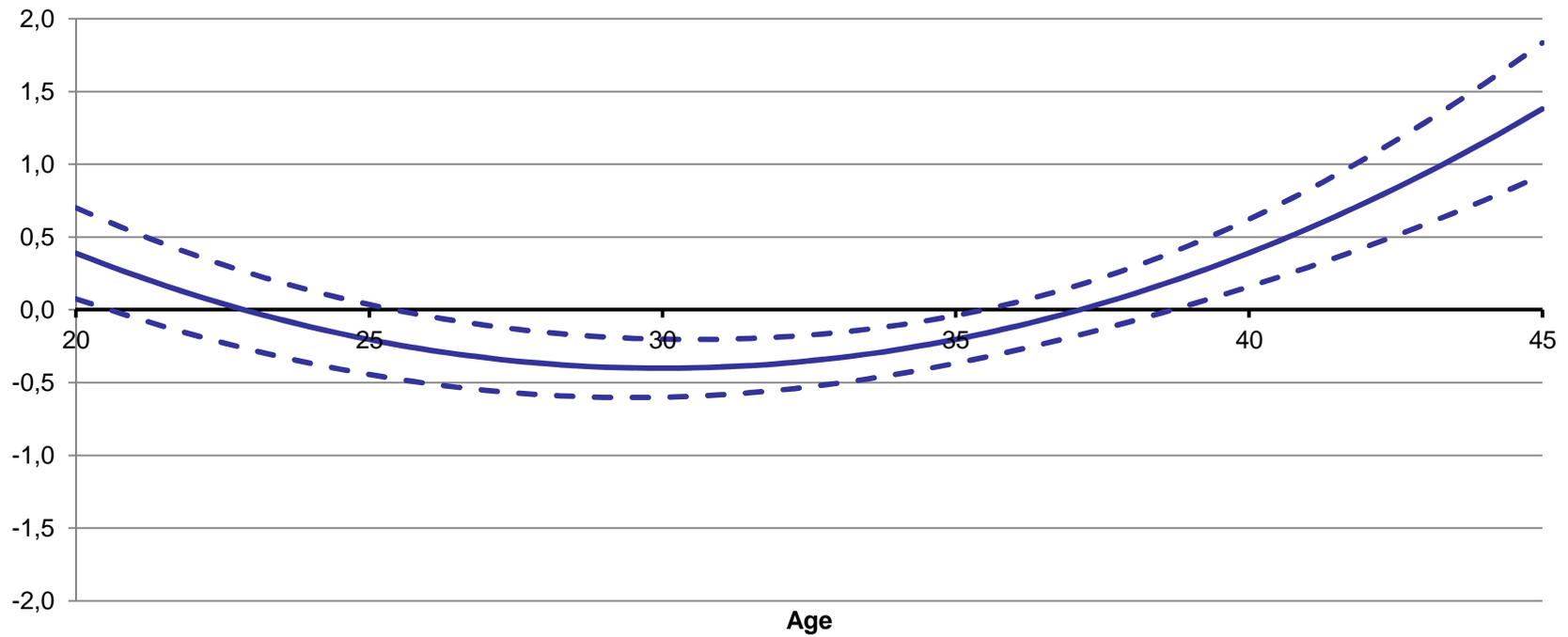
Results (2)

ISCED 2



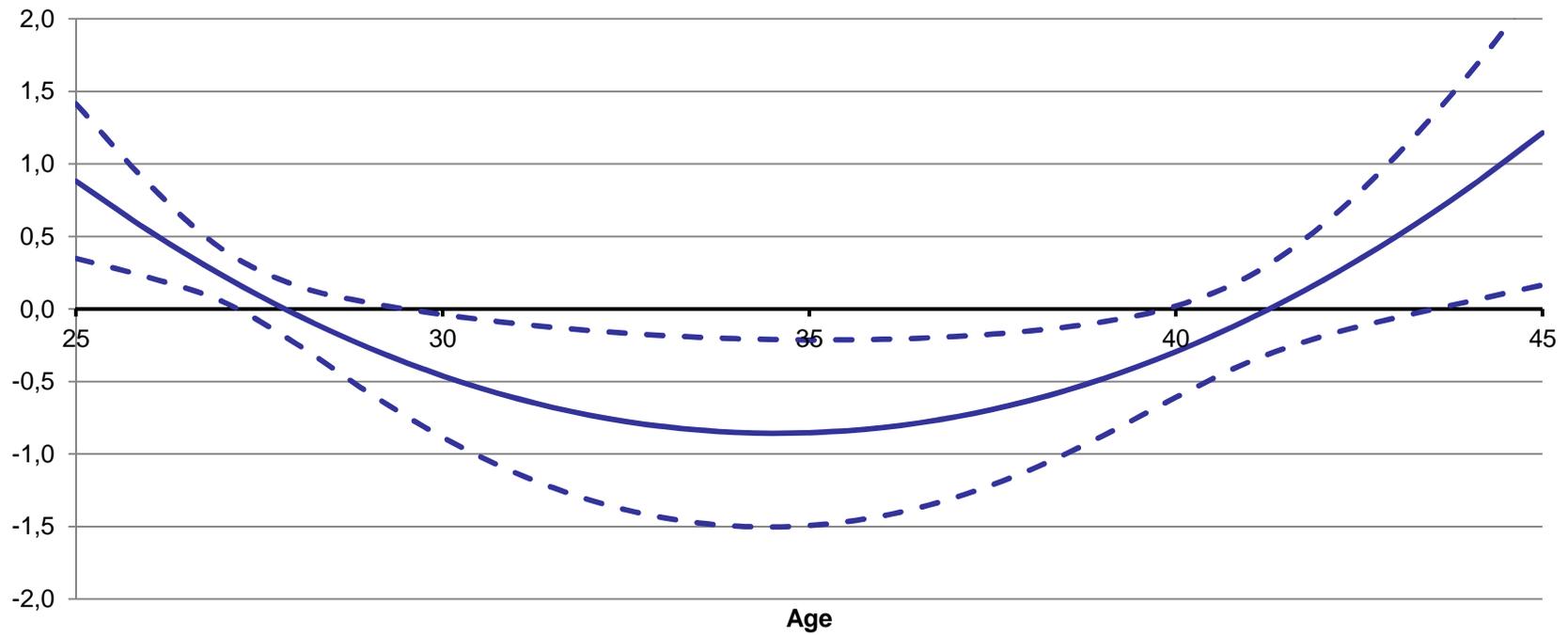
Results (3)

ISCED 3



Results (4)

ISCED 5



Results (5)

Marginal effects are non-linear functions of age

Profiles display similar U-shape across educational groups

Increase in cohort size associated with depressed wages

Point estimates of negative marginal cohort size effects largest for tertiary-educated individuals

Negative effects present but not persistent

Results (6)

Post-schooling human capital investment decisions:

- ▶ Wages of the highly-educated depressed more by cohort size than wages of less-qualified individuals
- ▶ Individuals in large cohorts therefore have an incentive to invest less in (post-schooling) human capital
- ▶ As a result, individuals in large cohorts have higher initial earnings but experience slower earnings growth

Labour markets are not fully flexible:

- ▶ Labour markets are not fully flexible: wages may be the result of union wage bargaining
- ▶ Older individuals are more likely to be members of unions and large unions have larger bargaining power

Conclusion

Causal effect of changes in workforce age-education structure across Europe on individual wages

IV estimation strategy that uses lagged birth rates as instruments and thus addresses individual self-selection in age-education cohorts

Results suggest that cohort size has a negative but non-persistent effect on male wages

Negative points estimates largest for the most educated individuals (consistent with existing literature)

Positive cohort size effects may result from labour markets that are not fully flexible

Empirical model (2)

Control variables:

- ▶ Individual-specific (married, part-time, self-employed, occupation)
- ▶ Age-specific (age and squared age)
- ▶ Country-specific (country dummies)
- ▶ Time-specific (time dummies)
- ▶ Age-by-time-specific (interaction of age and time dummies, interaction of squared age and time dummies)
- ▶ Country-by-time-specific (unemployment rate, interaction of country and time dummies)

Folie 16

DHWR2 Delete?

Combine theoretical framework and date sections.

Shorten

Duncan Roth; 09.09.2013