

Does financial literacy reduce wealth inequality?
Quantile regression evidence from 14 European
countries.

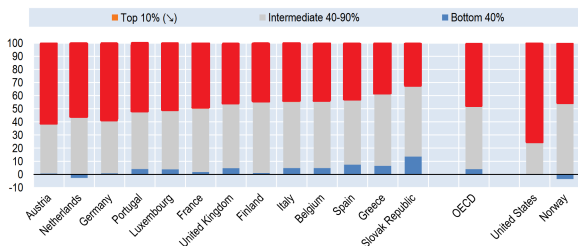
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Motivation I

- Wealth distribution appears to be extremely skewed and with a long right tail:
 - ✓ The top 10% holds 50% of total wealth in the OECD countries;
 - ✓ The next richest 50% hold almost the entire other half, while the 40% least wealthy own little over 3%.



Source: 2017 OECD Report "The Socio-economic Divide in Europe"

- ✓ Within Europe, there are marked differences among countries:
 - ⇒ Wealth is most concentrated at the top of the distribution in Austria, Germany and the Netherlands.

Motivation II

What are the causes behind wealth inequality?

- Four main mechanisms:
 - ✓ Heterogeneity in **lifetime earnings** (Modigliani, F. and Brumberg (1954));
 - ✓ Motives for **precautionary savings** (Deaton (1992));
 - ✓ **Intergenerational transfers** (see e.g. Davies (1982));
 - ✓ **Governmental transfers** (Hubbard et al. (1995)).
- A more recent wave of papers has focused on:
 - ✓ **Time preferences and risk aversion** (Cagetti (2003));
 - ✓ **Household composition** (Attanasio et al. (1999); Scholz et al. (2006));
 - ✓ **Medical expenses and life expectancies** (De Nardi et al. (2011));

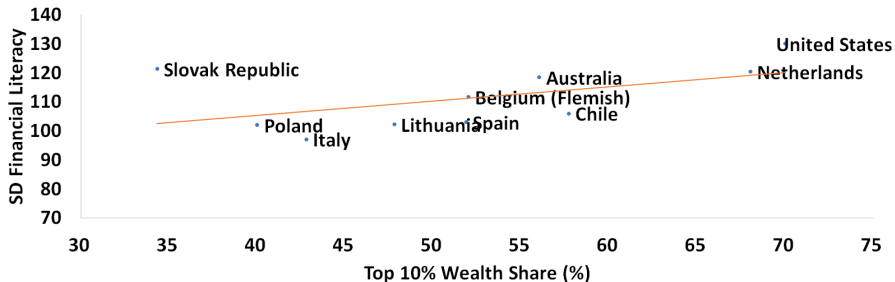
Motivation III

What is the role of financial literacy on wealth inequality?

- Lusardi et al. (2017) develop a multi-period life-cycle model and show that:
 - ✓ **Differences in financial knowledge** can account for **30–40%** of U.S. wealth inequality.
 - ✓ Interventions to **close the gap** by providing **targeted financial literacy** may reduce wealth inequality.

Motivation IV

Figure 1: Top 10% Net Wealth Share and Deviations in Financial Literacy Scores Within OECD Countries



Source: PISA SD Financial Literacy Scores and OECD Wealth Data (2015)

Contribution to the Literature

This study contributes to the growing body of empirical research on financial literacy and its important implications for welfare.

- Empirical research has focused on the effect of financial literacy on wealth accumulation:
 - ✓ Financial knowledge is strongly positively related to **wealth accumulation** (see e.g. Behrman et al. (2012); van Rooij et al. (2012)).
 - ✓ The evidence is based on **mean regression estimates**.

Focus:

- (a) **Heterogeneous effects** of financial literacy Vs mean estimates?
- (b) The effect of financial literacy on **wealth inequality** Vs wealth accumulation?

Research Questions

Research Questions:

- [Q1] How the effects of financial literacy vary across the wealth distribution and who benefit the most?
- [Q2] Can financial literacy help reducing overall wealth inequality?
- [Q3] To what extent these effects differ across different European countries?

Summary

- The paper uses SHARE data from the 2013 wave to examine the heterogeneous effects of financial literacy on the wealth distribution and its importance for wealth inequality.
- I use UQR and IV estimation techniques, accounting for country fixed effects.
- I find that financial literacy:
 - ✓ **Increases** the level of wealth holdings **across all quantiles**;
 - ✓ But it has **substantially higher returns at the lower quantiles** of the wealth distribution.
- The findings suggest that:
 - ✓ Those who **benefit most** from additional financial knowledge are **individuals at the lower quantiles of wealth**;
 - ✓ As more individuals become financially literate, **overall wealth inequality decreases**.

The SHARE Dataset

- The analysis is based on cross-sectional data from the 2013 wave of the Survey of Health, Ageing and Retirement in Europe (SHARE).
- The analysis includes 14 European countries (Israel is excluded).

Country	#Respondents	Percent
Austria	4,560	6.66
Belgium	5,792	8.47
Czech Republic	5,866	8.57
Denmark	4,279	6.25
Estonia	6,083	8.89
France	4,650	6.80
Germany	5,783	8.45
Israel	2,794	4.08
Italy	4,902	7.16
Luxembourg	1,610	2.35
Netherlands	4,253	6.22
Slovenia	3,010	4.40
Spain	6,976	10.20
Sweden	4,745	6.94
Switzerland	3,116	4.55
<i>Total</i>	68,419	100.00

- The final sample varies between 56,000 and 53,000 observations, based on the specification.

Key Variables Definitions

- **The dependent variable**, “*Net Household Wealth*” is defined as follows:

$$\text{Net Household Wealth} = \text{Financial Assets} + \text{Real Assets} - \text{Liabilities}$$

- **The key independent variable** is financial literacy and is calculated as the the number of correct responses on the following 4 questions:

	Definition
Numeracy	”If the chance of getting a disease is 10% how many people out of 1,000 would be expected to get the disease?”
Sales Discount 1	”In a sale, a shop is selling all items at half price. Before the sale, a sofa costs 300 euro. How much will it cost in the sale?”
Sales Discount 2	”A second hand car dealer is selling a car for 6,000 euro. This is two-thirds of what it costs new. How much did the car cost new?”
Compound Interest	”You have 2,000 euro in an account, which earns 10% interest each year. How much would you have at the end of two years?”

Control Variables and Instruments

Other Controls:

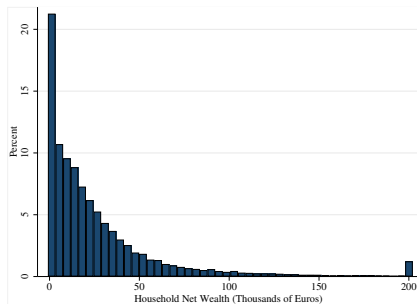
- Exogenous Indicators:
 - ✓ Age, Gender, Years of Education, No of inherited Items (Value 5000 or more)
- Personality Traits:
 - ✓ Financial Risk Tolerance
 - ✓ Long-Term planning horizon
 - ✓ Depression
- Demographic Characteristics:
 - ✓ No of Children
 - ✓ Marital, Health & Job Status
 - ✓ Total Household Income

Candidate 1st Stage Instruments:

- Age-related variables: maths & language performance, books/ rooms/ people in the residence at age of 10.
- Family Background: father's & mother's education.

Net Household Wealth

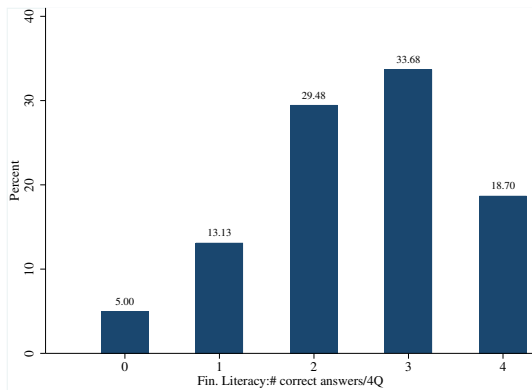
Figure 2: Distribution of Net Household Wealth.



Net Household Wealth					
Percentiles		Smallest			
1%	201.45		1.08		
5%	3,300.00		1.15		
10%	12,067.58		1.33		
25%	65,017.24		1.69	Obs	54,628
50%	179,177.40			Mean	295,866.20
			Largest	Std. Dev.	36,8513.50
75%	370,000.00	2,021,931.00		Variance	1.36E+11
90%	703,549.10	2,021,931.00		Skewness	2.54
95%	1,042,000.00	2,021,931.00		Kurtosis	10.52
99%	2,021,931.00	2,021,931.00			

Financial Literacy

Figure 3: Distribution of financial literacy responses.



T-test

Table 1: Mean differences between FL_High and FL_Low.

	FL_High (1)	FL_Low (2)	T-test (3)
Average Net Household Wealth	342,342.78	244,729.40	31.19***
1st Quantile of Net Household Wealth: [0 – 25]	15.47%	21.32%	-17.75***
2nd Quantile of Net Household Wealth: (25 – 50]	22.23%	26.78%	-12.38***
3rd Quantile of Net Household Wealth: (50 – 75]	26.33%	28.16%	-4.8***
4th Quantile of Net Household Wealth: (75 – 100]	35.97%	23.74%	31.4***

Descriptive Statistics

Table 2: Descriptive Statistics

Variables	Mean	SD	Min	Max
<i>I. Exogenous Indicators</i>				
Male	44.34%	(0.50)	0	1
Age	65.91	(10.03)	30	100
Years of education	11.21	(4.35)	0	25
Number of inherited items (value 5000 or more)	0.17	(0.49)	0	5
<i>II. Personality Traits</i>				
Financial risk taking	25.85%	(0.44)	0	1
Long-term planning horizon	42.19%	(0.49)	0	1
Depression scale	2.30	(2.18)	0	12
<i>III. Demographic Characteristics</i>				
Number of children	2.14	(1.30)	0	15
Marital Status: Married	73.81%	(0.44)	0	1
>: Single	5.38%	(0.23)	0	1
>: Divorced	8.15%	(0.27)	0	1
>: Widowed	12.66%	(0.33)	0	1
Health Status: Excellent	8.88%	(0.28)	0	1
>: Very Good	18.55%	(0.39)	0	1
>: Good	37.91%	(0.49)	0	1
>: Fair	26.02%	(0.44)	0	1
>: Poor	8.64%	(0.28)	0	1
Job Status: Retired	56.39%	(0.50)	0	1
>: Employed or self-employed	28.84%	(0.45)	0	1
>: Unemployed	2.65%	(0.16)	0	1
>: Permanently sick/disabled	2.93%	(0.17)	0	1
>: Homemaker	8.19%	(0.27)	0	1
>: Other	1.01%	(0.10)	0	1
Total household income	46,176.08	(82114.85)	2,160.00	1,200,000.00
# Observations	54,628			

The wealth equation

I consider the following equation to be estimated (Behrman et al. (2012)):

$$\ln(w_i) = \alpha_0 + \beta_{FL}FL_i + \alpha_1C_i + \alpha_2E_i + \phi_c + u_i, \quad (1)$$

where

- $\ln(w_i)$: natural logarithm of net household wealth
- FL_i : financial literacy index
- C_i : vector of observed characteristics
- E_i : vector of unobserved individual characteristics
- ϕ_i : country fixed effects
- u_i : error term

I estimate this via an Unconditional Quantile Regression and we compare the results with OLS.

What about endogeneity?

It is widely acknowledged that financial literacy is endogenous to wealth $\Rightarrow \hat{\beta}_{FL}$ might not be consistent.

Therefore, we define:

$$FL_i = \eta_0 + \eta_1 C_i + \eta_2 E_i + \eta_3 Z_i + v_i, \quad (2)$$

where,

- C_i : vector of observed individual characteristics
- E_i : unobserved individual characteristics
- Z_i : set of variables which affect financial literacy but do not directly affect wealth
- v_i : error term

To infer causality, we use an IV-Generalized Quantile Regression approach and we compare the results with 2SLS.

Estimation Method

Unconditional Quantile Regression (UQR)

- The method was introduced by Firpo et al. (2009).
- This methodology yields coefficients **for each** τ^{th} **quantile** of the distribution of the outcome variable, as follows:

$$Q_{\tau}(Y) = X\beta(\tau) + \epsilon, \quad (3)$$

where, β is the UQR estimator for $q = \tau$ and X is a vector of independent variables.

- This tells us how financial literacy affects the **entire distribution** of wealth, and not only its mean.

Estimation Method

- $\beta(\tau)$ can be interpreted as the marginal effect of a covariate on the τ^{th} quantile of the unconditional distribution of wealth, **regardless of the included covariates:**

$$\beta(\tau) = \partial F_Y(y) / \partial x \quad (4)$$

- Therefore, by using UQR we can study:
 - ✓ How does financial literacy affect the level of wealth holdings **within** each quantile of the wealth distribution.
 - ✓ How much do these effects vary **between** different quantiles of the wealth distribution.

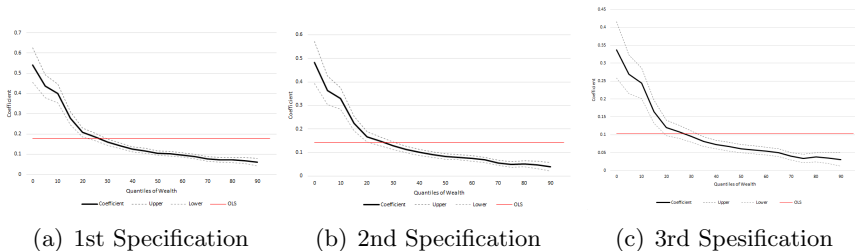
Baseline Regression I

Table 3: Financial Literacy and Net Household Wealth: OLS and UQR estimates.

MODELS VARIABLES	OLS	UQR		
	(1)	$\tau=10$ (2)	$\tau=50$ (3)	$\tau=90$ (4)
Panel A: Exogenous Indicators (1st Specification)				
Fin. Literacy:# correct answers/4Q	0.177*** [0.008]	0.436*** [0.029]	0.116*** [0.006]	0.068*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.1784	0.0508	0.2015	0.1479
# Observations	56,370	56,370	56,370	56,370
Panel B: Exogenous Indicators & Personality Traits (2nd Specification)				
Fin. Literacy:#correct answers/4Q	0.143*** [0.008]	0.364*** [0.031]	0.092*** [0.006]	0.047*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.2047	0.0627	0.2171	0.1577
# Observations	54,966	54,966	54,966	54,966
Panel C: Exogenous Indicators, Personality Traits & Demographic Characteristics (3rd Specification)				
Fin. Literacy:#correct answers/4Q	0.103*** [0.007]	0.269*** [0.027]	0.067*** [0.006]	0.035*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.2695	0.0998	0.2562	0.1775
# Observations	54,636	54,636	54,636	54,636

UQR - Graphical Illustration of the results

Figure 4: Financial literacy effects, UQR estimates



(a) 1st Specification

(b) 2nd Specification

(c) 3rd Specification

Decomposing the financial literacy effect

- **The "within-effect"**: How does financial literacy affect the level of wealth holdings within each quantile of the wealth distribution?

MODELS	OLS	UQR		
VARIABLES	(1)	$\tau=10$ (2)	$\tau=50$ (3)	$\tau=90$ (4)
Panel A: Exogenous Indicators (1st Specification)				
Fin. Literacy:# correct answers/4Q	0.177*** [0.008]	0.436*** [0.029]	0.116*** [0.006]	0.068*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.1784	0.0508	0.2015	0.1479
# Observations	56,370	56,370	56,370	56,370
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Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.2047	0.0627	0.2171	0.1577
# Observations	54,966	54,966	54,966	54,966
Panel C: Exogenous Indicators, Personality Traits & Demographic Characteristics (3rd Specification)				
Fin. Literacy:#correct answers/4Q	0.103*** [0.007]	0.269*** [0.027]	0.067*** [0.006]	0.035*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo-)R ²	0.2695	0.0998	0.2562	0.1775
# Observations	54,636	54,636	54,636	54,636

An increase in financial literacy increases wealth holdings:

- ✓ by about 27% at the lowest quantile of wealth ($\tau=10$).
- ✓ by about 7% at the median ($\tau=50$).
- ✓ by 3,5% , at top quantiles ($\tau=90$).

Decomposing the financial literacy effect

- **The "between-effect":** How does financial literacy affect wealth inequality, i.e. the dispersion of wealth between different quantiles?

MODELS	OLS	UQR		
VARIABLES	(1)	$\tau=10$ (2)	$\tau=50$ (3)	$\tau=90$ (4)
Panel A: Exogenous Indicators (1st Specification)				
Fin. Literacy:# correct answers/4Q	0.177*** [0.008]	0.436*** [0.029]	0.116*** [0.006]	0.068*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo)-R ²	0.1784	0.0508	0.2015	0.1479
# Observations	56,370	56,370	56,370	56,370
Panel B: Exogenous Indicators & Personality Traits (2nd Specification)				
Fin. Literacy:#correct answers/4Q	0.143*** [0.008]	0.364*** [0.031]	0.092*** [0.006]	0.047*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo)-R ²	0.2047	0.0627	0.2171	0.1577
# Observations	54,966	54,966	54,966	54,966
Panel C: Exogenous Indicators, Personality Traits & Demographic Characteristics (3rd Specification)				
Fin. Literacy:#correct answers/4Q	0.103*** [0.007]	0.269*** [0.027]	0.067*** [0.006]	0.035*** [0.008]
Country Fixed Effects	YES	YES	YES	YES
(Pseudo)-R ²	0.2695	0.0998	0.2562	0.1775
# Observations	54,636	54,636	54,636	54,636

Increasing financial literacy across the board:

- ✓ decreases the "90-50 gap" by 0.067-0.035 = 3.2%.
- ✓ decreases the "50-10 gap" by 0.269-0.067 = 20.2%.

Instrumental Variable Analysis

Table 4: Financial Literacy and Net Household Wealth: 2SLS and IV-GQR estimates.

MODELS	2SLS	IV-GQR		
		$\tau=10$	$\tau=50$	$\tau=90$
VARIABLES	(1)	(2)	(3)	(4)
Panel A: Exogenous Indicators				
Fin. Literacy:#correct answers/4Q	0.492*** [0.038]	1.029*** [0.035]	0.358*** [0.017]	0.319*** [0.016]
Country Fixed Effects	YES	YES	YES	YES
# Observations	55,156	55,156	55,156	55,156
F-statistic of excluded instruments	1035.69***			
Kleibergen-Paap (LM statistic)	1948.519***			
Hansen J statistic	0.001			
Endogeneity test	76.641***			

Instrumental Variable Analysis

Table 5: Financial Literacy and Net Household Wealth: 2SLS and IV-GQR estimates.

MODELS	2SLS	IV-GQR		
	(1)	$\tau=10$ (2)	$\tau=50$ (3)	$\tau=90$ (4)
Panel B: Exogenous Indicators & Personality Traits				
Fin. Literacy:#correct answers/4Q	0.397*** [0.039]	0.873*** [0.042]	0.293*** [0.025]	0.255*** [0.009]
Country Fixed Effects	YES	YES	YES	YES
# Observations	53,885	53,885	53,885	53,885
F-statistic of excluded instruments	980.27***			
Kleibergen-Paap (LM statistic)	1846.438***			
Hansen J statistic	0.022			
Endogeneity test	46.819***			

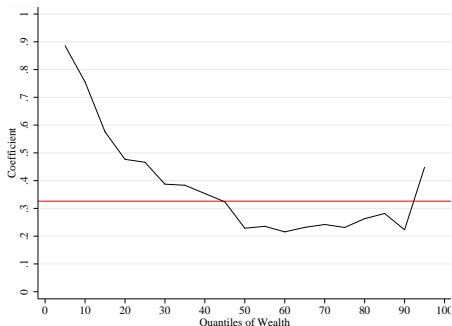
Instrumental Variable Analysis

Table 6: Financial Literacy and Net Household Wealth: 2SLS and IV-GQR estimates.

MODELS	2SLS	IV-GQR		
		$\tau=10$	$\tau=50$	$\tau=90$
VARIABLES	(1)	(2)	(3)	(4)
Panel C: Exogenous Indicators, Personality Traits & Demographic Characteristics				
Fin. Literacy:#correct answers/4Q	0.326*** [0.038]	0.759*** [0.046]	0.229*** [0.019]	0.224*** [0.016]
Country Fixed Effects	YES	YES	YES	YES
# Observations	53,559	53,559	53,559	53,559
F-statistic of excluded instruments	946.94***			
Kleibergen-Paap (LM statistic)	1787.899***			
Hansen J statistic	1.344			
Endogeneity test	38.427***			

IV-GQR - Graphical Illustration of the results

Figure 5: Financial literacy effects, IV-GQR estimates - 3rd Specification.



The effect of financial literacy:

- ✓ is big in the lower tail of the unconditional wealth distribution (about 76%).
- ✓ decreases to 40% at $\tau=30$, 23% at the median, to hit a low of 21.6 % at $\tau=60$.
- ✓ it increases slightly again at the upper tail, ranging between 24% and 26%.
- ✓ it reduces the 50-10 wealth gap by about 50%

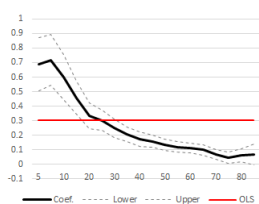
Potential Interpretation

A potential explanation of the results is based on Mwabu and Schultz (1996) and is the following:

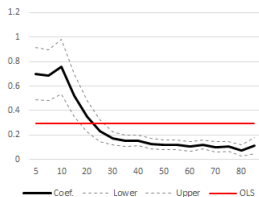
- We can interpret the quantile index as a measure of unobserved ability.
- If ability and financial literacy are **substitutes** \Rightarrow marginal effects of financial literacy decrease with ability and financial literacy **contributes relatively more to low ability individuals.**
- If ability and financial literacy are **complements** \Rightarrow financial literacy has an additional indirect effect that results to **higher returns for the more able individuals.**

An important detail is the way we measure financial literacy \Rightarrow basic financial knowledge rather than sophisticated financial knowledge.

By-country Analysis I



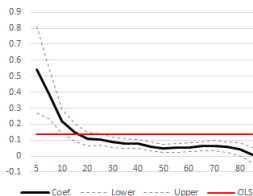
(a) Germany



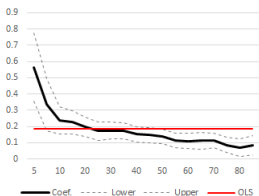
(b) Netherlands



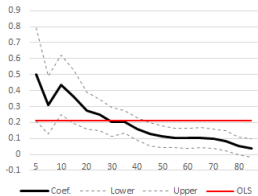
(c) Austria



(d) Belgium

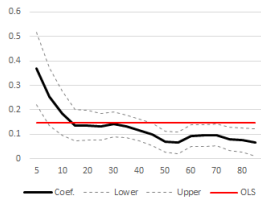


(e) Denmark

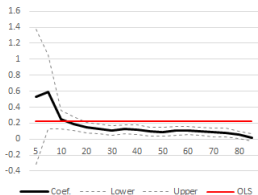


(f) Switzerland

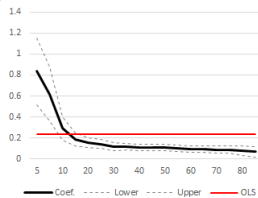
By-country Analysis II



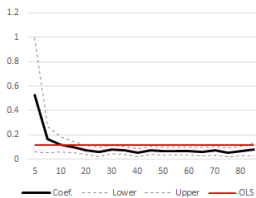
(g) Sweden



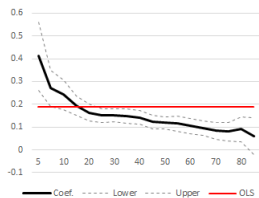
(h) Luxembourg



(i) France

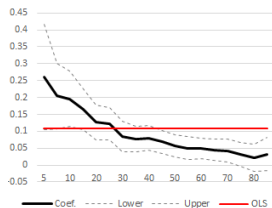


(j) Italy

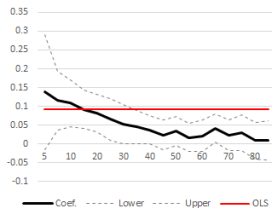


(k) Spain

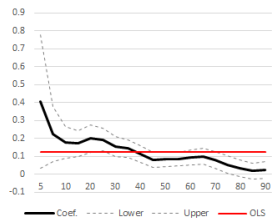
By-country Analysis III



(l) Czech Republic



(m) Slovenia



(n) Estonia

Concluding Remarks

- The effect of financial literacy on the distribution of wealth is significantly **heterogeneous**.
 - ✓ Financial literacy has significantly **higher effects at lower quantiles** of the wealth distribution, which drop gradually as we move across the wealth distribution.
- Financial literacy can **reduce wealth inequality**.
 - ✓ Improvements in financial knowledge can decrease the "50-10 wealth gap" by almost 50%.

Policy Implications:

- **Targeted and subsidized access** to these groups of individuals who can benefit most from acquisition of financial knowledge.

Extensions

- What is the mechanism? - Analyze the relationship for different components of wealth.
- What drives the results? - Look at the effect of each financial literacy question separately.
- Counterfactual analysis.

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