Financial Literacy, Mathematics Performance and Publicly Subsidised Schools in Spain

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    - Simultaneous Hierarchical Model (SHM) to take into account jointly the potential simultaneous relationship between the production of mathematical and financial skills and the hierarchical nature of the data supplied by the (PISA).

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  - Analysis on the internal process through which individuals develop economic and financial skills (determinants of financial literacy). Financial culture as an **output** of school and external influences

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  - Hypothesis 1: Mathematical skills are the main predictor of financial abilities
    - Theoretical basis: Spanish 15 years old students have not received any specific learning in finance in their schools. So their skills in this field necessarily must come from external factors (family context, social networks, personal interest,...) or from other skills acquired in school. Mathematics is the most directly related subject with financial literacy such as evaluated in PISA

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School ownership $\Longrightarrow$ Mathematics performance $\Longrightarrow$ Financial literacy

Determinants of the probability of attending to a PSPS

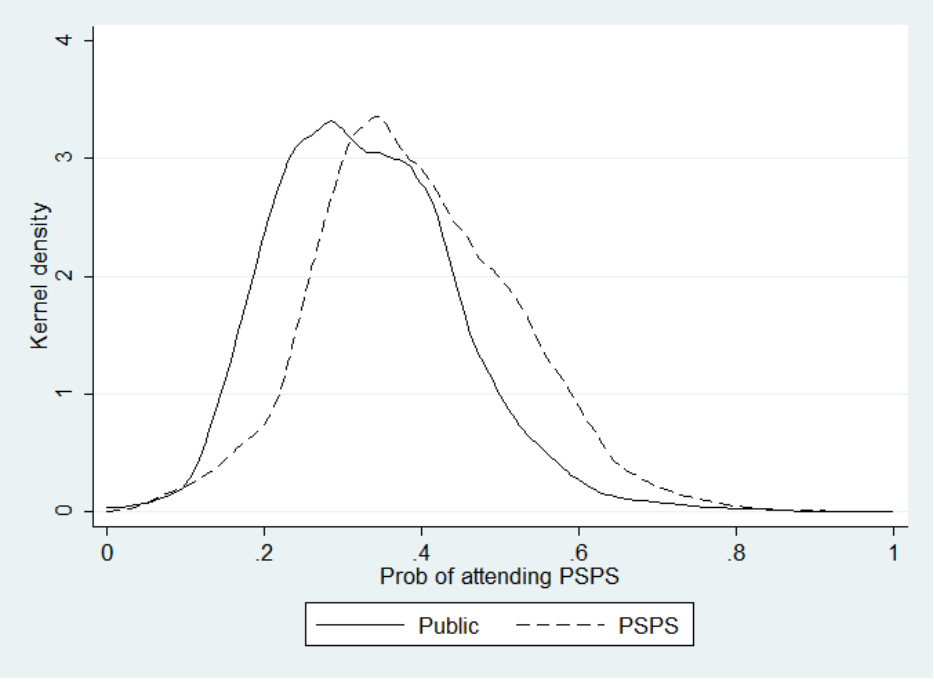
Variable	Coefficient		Standard error	P>|z|
Gender (girls)	-0.09	***	0.01	0.00
Immigrant	-0.39	***	0.02	0.00
Occupation of father (ISEI)	0.01	***	0.00	0.00
Education of mother (years of study)	0.08	***	0.00	0.00
Possessions (objects of art)	-0.06	***	0.01	0.00
Possessions (dishwashers)	0.05	***	0.01	0.00
Possessions (pay TV)	0.24	***	0.01	0.00
Number of televisions	0.21	***	0.01	0.00
Number of computers	-0.12	***	0.01	0.00
Number of bathrooms	0.01	*	0.01	0.06
Number of books (ref. 0-10 books)				
11-25 books	-0.64	***	0.03	0.00
26-100 books	-0.38	***	0.03	0.00
101-200 books	-0.03		0.03	0.19
201-500 books	-0.27	***	0.03	0.00
Over 500 books	-1.00	***	0.03	0.00
Constant	-2.22	***	0.05	0.00
N=471, % correctly predicted probabilities =58.02%				

Matching

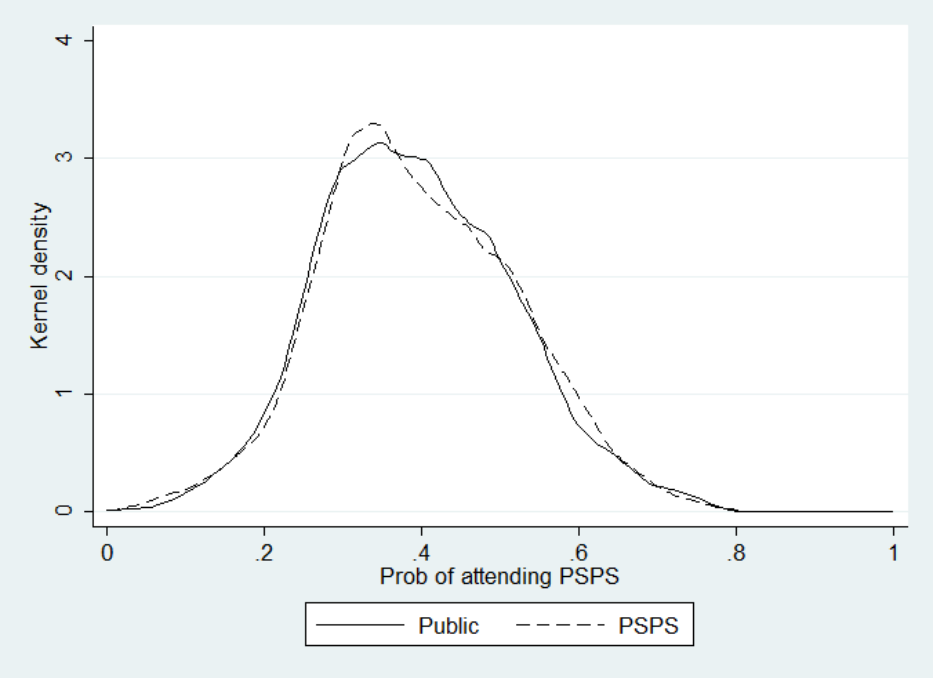
- Epanechnikov kernel matching with a bandwidth of 0.06

Propensity score distribution by school type

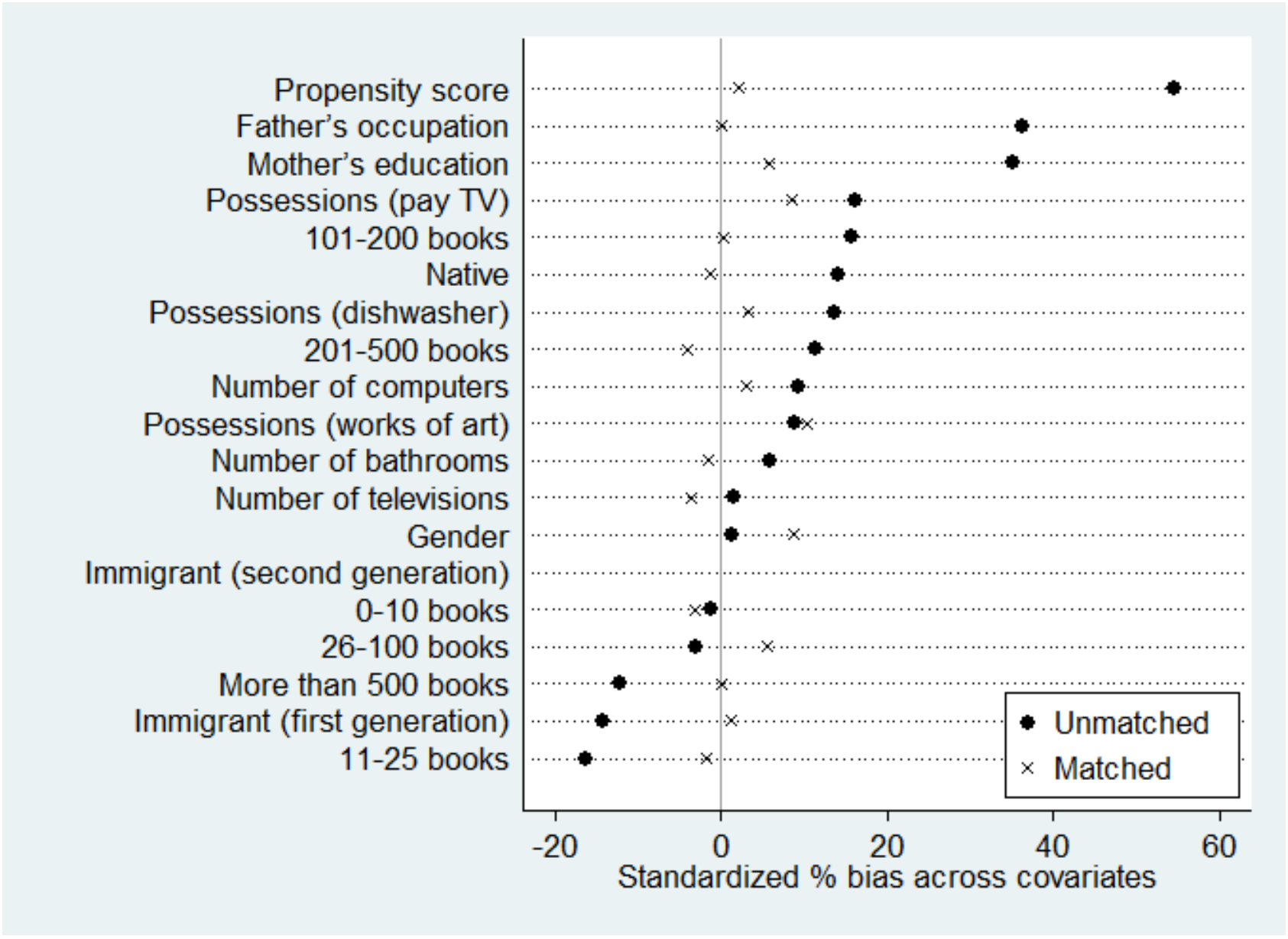
Unmatched sample



Matched sample



- Bias reduction for the propensity score and for explanatory variables



Simultaneous equation model with only math and financial skills as predictors

	Dependent variable			
Independent variable	Finan. perform.		Math perform.	
Math performance	0.863	***		
	0.041			
Financial performance			1.052	**
			0.047	
Observations	350		350	
R2	0.68		0.69	
Hausman test	11.28		25.05	
Hausman test (p-value)	0.001		0.000	

Hausman test value indicates that there is an overlap in the production of the two types of cognitive skills examined

Intra-class correlation, percentage of variance explained and pseudo R^2 in SHM

	Math competencies		Financial competencies	
	Null model	Complete model	Null model	Complete model
Schools	1672.6	995.2	748.5	337.2
Students	5357.1	3090.1	5357.1	3156.0
Total	7029.7	4085.4	6105.6	3493.2
Intra-class correlation (ICC)	23.8%	24.4%	12.3%	9.7%
% of total variance explained by the variables		41.9%		42.8%
% of level 1 variance (students) explained by the variables		42.3%		41.1%
% of level 2 variance (schools) explained by the variables		40.5%		55.0%
Pseudo-R^2*		39.8%		32.1%

*Calculation based on the reduction of squared prediction errors (Snijders & Bosker, 1994)

	Math comp. (1st stage)				Financial comp. (2nd stage)			
Variables	Coeff.		SE	t-ratio	Coeff.		SE	t-ratio
Level 1 (students)								
Gender (female)	-20.19	**	8.34	-2.42	12.68	**	6.55	1.94
Father's occupation	0.26		0.17	1.51				
Highest occupational status of parents					0.38	**	0.17	2.18
Mother's education (years of study)	1.86	*	1.06	1.76	-2.85	***	0.87	-3.27
Over 200 books	16.86		10.53	1.60	-2.51		7.65	-0.33
Native	4.73		16.56	0.29	-8.55		11.82	-0.72
Math motivation	4.37		3.89	1.12				
Self-efficacy in mathematics	20.81	***	5.27	3.95				
Repeater	-88.32	***	10.48	-8.43	-7.48		13.24	-0.56
Math scores					0.88	***	0.11	8.28
Level 2 (schools)								
Constant	517.64	***	19.92	25.99	508.66	***	17.09	29.76
Financial education not available	-2.94		9.47	-0.31	-4.57		8.25	-0.55
Private school	-5.14		9.92	-0.52	-7.45		6.31	-1.18
Infrastructure quality	8.79		6.06	1.45				

*Standard errors calculated based on Gujarati (2004)

1st stage results (Math skills determinants)

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- Positive effect of "self-efficacy in mathematics" $\Rightarrow$ incorporate non-cognitive aspects into educational math programs

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- Positive effect of mother's education

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Constant	517.64	***	19.92	25.99	508.66	***	17.09	29.76
Financial education not available	-2.94		9.47	-0.31	-4.57		8.25	-0.55
Private school	-5.14		9.92	-0.52	-7.45		6.31	-1.18
Infrastructure quality	8.79		6.06	1.45				

*Standard errors calculated based on Gujarati (2004)

1st stage results (Math skills determinants)

- Girls perform worse than boys in maths

	Math comp. (1st stage)				Financial comp. (2nd stage)			
Variables	Coeff.		SE	t-ratio	Coeff.		SE	t-ratio
Level 1 (students)								
Gender (female)	-20.19	**	8.34	-2.42	12.68	**	6.55	1.94
Father's occupation	0.26		0.17	1.51				
Highest occupational status of parents					0.38	**	0.17	2.18
Mother's education (years of study)	1.86	*	1.06	1.76	-2.85	***	0.87	-3.27
Over 200 books	16.86		10.53	1.60	-2.51		7.65	-0.33
Native	4.73		16.56	0.29	-8.55		11.82	-0.72
Math motivation	4.37		3.89	1.12				
Self-efficacy in mathematics	20.81	***	5.27	3.95				
Repeater	-88.32	***	10.48	-8.43	-7.48		13.24	-0.56
Math scores					0.88	***	0.11	8.28
Level 2 (schools)								
Constant	517.64	***	19.92	25.99	508.66	***	17.09	29.76
Financial education not available	-2.94		9.47	-0.31	-4.57		8.25	-0.55
Private school	-5.14		9.92	-0.52	-7.45		6.31	-1.18
Infrastructure quality	8.79		6.06	1.45				

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1st stage results (Math skills determinants)

- No significant effects at level 2 variables $\Rightarrow$ No support for H2

	Math comp. (1st stage)				Financial comp. (2nd stage)			
Variables	Coeff.		SE	t-ratio	Coeff.		SE	t-ratio
Level 1 (students)								
Gender (female)	-20.19	**	8.34	-2.42	12.68	**	6.55	1.94
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2st stage results (Financial skills determinants)

	Math comp. (1st stage)				Financial comp. (2nd stage)			
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Infrastructure quality	8.79		6.06	1.45				

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2st stage results (Financial skills determinants)

- Strong positive effect of math skills on financial performance $\Rightarrow$ Support for H1

	Math comp. (1st stage)				Financial comp. (2nd stage)			
Variables	Coeff.		SE	t-ratio	Coeff.		SE	t-ratio
Level 1 (students)								
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2st stage results (Financial skills determinants)

- Positive effect of parents occupation

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2st stage results (Financial skills determinants)

- Negative effect of mother's education, affecting through a double way (through maths and autonomously)

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2st stage results (Financial skills determinants)

- Attending a school that offers financial education is not relevant $\Rightarrow$ Should financial courses be introduced in the official curriculum of secondary education?

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  - The development of financial abilities is mediated by mathematical skills (support of H1)

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  - School ownership (public versus private) does not display any effect on either the financial of math performance of Spanish students (greater management autonomy does not lead to better educational outcomes)
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  - How to improve financial literacy of Spanish students: Adding explicit economic subjects to the secondary education curriculum or including financial competencies in the mathematics syllabus?
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- Educational Policy Implications:
  - How to improve financial literacy of Spanish students: Adding explicit economic subjects to the secondary education curriculum or including financial competencies in the mathematics syllabus?
  - Course repetition or enhancing school support programs?
  - How to allocate public resources: Public schools or PSPS?

Thanks for your attention

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