

**IS FIRM'S PRODUCTIVITY RELATED TO ITS
FINANCIAL STRUCTURE?
EVIDENCE FROM MICROECONOMIC DATA**

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MOTIVATIONS (1)

- Corporate finance theory shows that a firm's share of intangibles and its financial structure are related
- Innovative firms typically hold immaterial assets
- Hence, more innovative firms have different financial structures from less innovative ones
- Ultimately, differences in the propensity to innovate are likely to translate into different TFP levels
- Financial systems more capable of providing the type of funding used by innovative firms should be characterized by higher aggregate productivity

PLAN OF THE PRESENTATION

- Background
- Empirical model
- Data
- Empirical results
- Implications and conclusions

BACKGROUND (1): FINANCIAL STRUCTURE

- According to theories based on
 - bankruptcy costs
 - conflicts of interest between equity-holders and debt-holders
 - control rights

firms holding larger portions of immaterial assets have lower leverage

(Jensen and Meckling, 1976; Hart, 1995)

BACKGROUND (2): FINANCIAL STRUCTURE

- According to theories based on conflicts of interest between
 - managers and equity-holders
 - insiders and outsiders

equity financing is subject to severe underpricing in firms holding more intangibles, favoring the use of debt over equity financing

(Myers and Majluf, 1984)

EMPIRICAL MODEL (1)

- We investigate whether variations in leverage induce firms to change their propensity to innovate and, thus, their productivity
- Our basic specification is the following:

$$LTFP_{it} = a + \beta LEV_{it} + \gamma Z_{it} + \eta_i + \varepsilon_{it}$$

where:

- $LTFP_{it}$ is total factor productivity of firm i at time t
- LEV_{it} is leverage of firm i at time t
- Z_{it} is a set of controls
- η_i reflects the fixed latent variation of firms' characteristics and ε_{it} is a random i.i.d error

EMPIRICAL MODEL (2)

- A regression of TFP on leverage is clearly subject to endogeneity problems
- The equilibrium relationship implies that a firm with a certain leverage is bound to a given level of intangibles (and of TFP)
- At the same time, a firm wishing to innovate by increasing its immaterial assets is bound to change its leverage
- Causality may therefore run in both directions
- We identify variations in firms' financial structure induced by factors that do not affect productivity

EMPIRICAL MODEL (3)

- In practice we adopt an instrumental variable technique
- As instruments we use:
 - variables measuring the taxation components of each firm's user cost of capital
 - an indicator of regional financial development (Guiso et al., 2004)
- We do not include in the instruments set the whole variety of taxes and fiscal-related components in the user cost of capital because some of them turned out to be endogenous
- We employ taxes on firms' assets and, for within effect regressions only, tax exemptions

DATA

- Estimation is conducted on a representative sample of over 40,000 firms for the period 1982 – 1998, drawn from balance-sheet information compiled by the Company Account Data Service (CADS, Centrale dei Bilanci)
- TFP measures are based on a production function approach and controls for the endogeneity of inputs and for self-selection, following Olley and Pakes (1996) methodology
- Data on firm's taxation component of the user cost of capital are from De Mitri, Marchetti and Staderini (1998), and were kindly provided by the authors

Table 1
Descriptive statistics

Variable	N observations	Mean	Median	Standard deviation
Log(TFP)	240,836	2.400	2.403	0.573
Leverage	240,836	0.504	0.535	0.266
Tax on assets	193,706	0.003	0.000	0.005
Tax exemptions	193,706	0.002	0.000	0.009
Liquid assets	240,836	0.066	0.026	0.094
Immaterial assets	240,753	0.095	0.029	0.156
Cash-flow	240,836	0.144	0.146	0.213
Long-run bank debt	229,387	0.203	0.080	0.267
Short-run bank debt	223,698	0.754	0.885	0.304
Financial development	220,985	0.317	0.297	0.095

Table 2
The effect of leverage on firm's productivity
Panel data estimation

Dependent variable: $\log(TFP_{it})$	Between effects IV	Between effects IV	Fixed effects IV	Fixed effects IV
	Panel A	Panel B	Panel C	Panel D
Leverage _{it}	-1.332***(0.037)	-0.871***(0.033)	-0.154***(0.013)	-0.115***(0.012)
Immaterials _{it}		1.099***(0.019)		0.155***(0.007)
Cash-flow _{it}		0.571***(0.022)		0.396***(0.004)
Liquid assets _{it}		-0.096**(0.049)		0.314***(0.011)
Firm size 2		0.246***(0.010)		-0.008***(0.003)
Firm size 3		0.231***(0.010)		-0.012***(0.003)
Firm size 4		0.181***(0.010)		-0.005***(0.003)
Firm size 5		0.135***(0.010)		-0.013***(0.003)
Constant	3.357***(0.105)	2.778***(0.087)	2.579***(0.008)	2.480***(0.008)
Over-identifying restrictions	0.44 (p-value = 0.51)	0.24 (p-value = 0.63)	6.13 (p-value = 0.05)	4.55 (p-value= 0.47)
N. observations	27,029	27,024	177,679	177,629

ADDITIONAL TESTS

- We have extended our analysis along two parallel lines:
 1. we have tested whether the firm's financial structure is an explanatory factor for the intensity of firm's innovative activities
 2. we have verified whether there is a positive and statistically significant relationship between TFP and the extent of innovative activities

Table 3
The effect of leverage on firm's intensity of innovative activities
Panel data estimation

Dependent variable: $\ln\left(\frac{IMM_{it}}{1-IMM_{it}}\right)$	Between effects IV	Fixed effects IV
Leverage _{it}	-3.000***(0.194)	-0.174***(0.048)
Constant	-0.766***(0.130)	-2.001***(0.027)
Over-identifying restrictions	0.20 (p-value = 0.90)	4.98 (p-value = 0.08)
N. observations	28,480	177,228

Table 4
 Productivity and the firm's intensity of innovative activities
 Panel data estimation

Dependent variable: $\log(TFP_{it})$	Between effects	Fixed effects
Immaterials _{it}	0.922***(0.199)	0.111***(0.007)
Constant	2.301***(0.034)	2.543***(0.003)
N. observations	28,525	177,473

SAMPLE SPLITS

- We have considered two sample splits depending on:
 1. the share of short-run bank debt, that allows a stronger control of the firm
 2. the share of liquid assets, that can more easily be used by firms facing an unexpected profit opportunity

Table 5
 Non-linearity in the effect of leverage on productivity:
 The role of short-term bank debt
 Panel data estimation

Dependent variable: $\log(\text{TFP}_{it})$	Sub-samples: Firms with	
	more short term bank debt	less short term bank debt
	(a) Between effects IV	
Leverage _{it}	-1.213***(0.050)	-1.612***(0.057)
Constant	3.331***(0.156)	3.462***(0.137)
N. observations	15,134	11,895
	(b) Fixed effects IV	
Leverage _{it}	-0.124***(0.017)	-0.202***(0.022)
Constant	2.612***(0.011)	2.533***(0.013)
N. observations	104,460	73,219

Table 6
 Non-linearity in the effect of leverage on productivity:
 The role of liquid assets
 Panel data estimation

Dependent variable: $\log(\text{TFP}_{it})$	Sub-samples: Firms with	
	higher liquid assets	lower liquid assets
	(a) Between effects IV	
Leverage _{it}	-1.269***(0.054)	-1.307***(0.058)
Constant	3.425***(0.140)	3.262***(0.154)
N. observations	12,066	14,963
	(b) Fixed effects IV	
Leverage _{it}	-0.069***(0.021)	-0.163***(0.018)
Constant	2.593***(0.011)	2.549***(0.012)
N. observations	69,625	108,054

CONCLUSIONS (1)

- Exogenous changes in a firm's financial structure have substantial effects on its allocation of capital between material and immaterial assets
- Eventually, this shows up in different productivity levels
- In particular, we find:
 - a negative causal relationship from a firm's leverage to its share of intangibles
 - a positive relationship between the share of intangibles and a firm's productivity

CONCLUSIONS (2)

- Our results lend support to the theories of firms' financial structure based on
 - bankruptcy costs
 - conflicts of interest between equity-holders and debt-holders
 - control rights
- Our results suggest that interventions favoring market finance may indeed be beneficial for aggregate productivity
- This is likely to hold despite the role of reallocation of outputs and inputs across firms and within sectors
(Davis and Haltiwanger, 1999; Baily et al. 1992; Bartelsman and Doms, 2000)