DETERMINANTS OF INVESTMENT IN TANGIBLE AND INTANGIBLE FIXED ASSETS.

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- INVESTMENT IN INTANGIBLE ASSETS
  - It is generally accepted that investment in intangible assets has a significant impact on business productivity and corporate growth. In recent years, investment in intangible assets is becoming increasingly important, partly as result of digitalisation.

- WHAT WE DO
  - We use micro data to find the firm characteristics that shape investment in tangible and intangible assets, as well as their main funding sources.

- Administrative dataset on firm-level characteristics taken from the Central Balance Sheet Database from Banco de España.

  - Contains the main entries of the firm's balance sheet and income statement, year of foundation, sector of activity and average employment.

  - Yearly data, from 2001 to 2017.

  - Final data set ≈ 10M obs.

  - Investment is compiled, mainly, from stock data. Flows are based on the difference of two subsequent periods' stocks, adjusted by amortization and depreciation, profits and losses from the sale of fixed assets, and other adjustments.

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- Intangible assets include:

  - *Software and databases*

  - *Research, development and innovation (R + D + i)*

  - *Activities to generate ownership and user rights,…*

  - *Economic competencies*

- "R + D + I" are incurred expenses, in the scientific and technical field, to introduce improvements and innovations in order to promote a more efficient use of resources available.

- OLS regressions of investment on:
    - firm age, size (log of total assets), leverage, squared leverage, return on assets (ROA).
    - Dependent variables: investment in R&D, investment in intangible fixed assets and investment in tangible fixed assets, in all cases divided by total assets.

- All regressions include industry-year dummies to control for the business cycle and industry-specific developments such as technological shocks.

- In addition:
    - linear probability models for investment>0.

VARIABLES	(1) rd	(2) investment intangibles	(3) investment_tangibles
age	0.0009	-0.0370***	-1.2010***
	(0.0013)	(0.0005)	(0.0056)
size (t-1)	0.0028***	0.0028***	-0.0737***
	(0.0005)	(0.0002)	(0.0023)
leverage (t-1)	0.0009***	0.0021***	0.0283***
	(0.0001)	(0.0000)	(0.0004)
ROA (t-1)	0.0003***	0.0006***	0.0420***
	(0.0001)	(0.0000)	(0.0003)
squared leverage (t-1)	-0.0000***	-0.0000***	-0.0004***
	(0.0000)	(0.0000)	(0.0000)
Industry-year dummies	YES	YES	YES
Observations	62,276	6,748,875	6,748,875
R-squared	0.2079	0.0626	0.0757

Table 3: firm characteristics correlated with positive investment.

The dependent variable is a dummy for positive investment in R&D in column (1), for positive investment in intangibles in column (2) and for positive investment in tangible fixed assets in column (3). Sample period: 2001-2017. All estimations by OLS. Specifications include industry-year dummies. Cluster-robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

VARIABLES	(1) rd>0	(2) investment intangibles>0	(3) investment tangibles>0
age	0.0078*	-0.0135***	-0.0415***
	(0.0045)	(0.0003)	(0.0004)
size (t-1)	0.0250***	0.0311***	0.0635***
	(0.0019)	(0.0002)	(0.0002)
leverage (t-1)	0.0033***	0.0018***	0.0033***
	(0.0003)	(0.0000)	(0.0000)
ROA (t-1)	0.0006**	0.0001***	0.0030***
	(0.0003)	(0.0000)	(0.0000)
squared leverage (t-1)	-0.0000***	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)
Industry-year dummies	YES	YES	YES
Observations	62,276	6,748,875	6,748,875
R-squared	0.1905	0.0816	0.1207

- $I_{i,t=}\beta_1 I_{i,t-1} + \beta_2 I_{i,t-1}^2 + \beta_3 Sales_{i,t} + \beta_4 CashFlow_{i,t} + \beta_5 StockIssues_{i,t} + \beta_6 \Delta CashHoldings_{i,t} + \beta_7 FinancialDebt_{i,t} + d_t + \alpha_i + v_{i,t}$

- System GMM estimator [Arellano and Bover, 1995; Blundell and Bond, 1998]:

  - lagged levels dated t-3 and t-4 as instruments for the equation in differences and lagged differences dated t-2 as instruments for the equation in levels.

  - we treat all right-hand side variables as potentially endogenous.

- To make the different regressions comparable, we limit all estimations to firms with non-missing information on R&D.

- Firms with investment in R&D / intangible fixed assets / tangible fixed assets equal to zero in all years are excluded from the sample.

CAUSAL EVIDENCE
DYNAMIC INVESTMENT REGRESSIONS

	(1)	(2)	(3)
VARIABLES	rd	intangibles	tangibles
Y (t-1)	0.9212***	0.6017***	0.5653***
	(0.2646)	(0.1182)	(0.1068)
Y^2 (t-1)	-0.2879	-0.0420	-0.1884
	(0.2645)	(0.1218)	(0.1209)
sales (t)	-0.0211***	-0.0278	0.0486
	(0.0059)	(0.0362)	(0.0325)
cashflow (t)	0.0263***	0.1167***	0.0831**
	(0.0067)	(0.0342)	(0.0347)
stock_issues (t)	0.0160***	0.0174	0.0880**
	(0.0061)	(0.0427)	(0.0438)
D.cash_holdings (t)	-0.0222***	-0.0003	0.0702
	(0.0062)	(0.0527)	(0.0436)
financial_debt (t)	0.0248***	0.0647	0.1018**
	(0.0064)	(0.0545)	(0.0514)
Year dummies	YES	YES	YES
m1 (p-value)	0.000	0.000	0.000
m2 (p-value)	0.000	0.000	0.037
Hansen (p-value)	0.138	0.107	0.309
Observations	28,410	55,322	59,793

- Firm characteristics shape investment in tangible and intangible assets.
  - Younger and more profitable firms tend to invest more in all asset types.
  - In the case of size: larger firms invest more in R&D and intangibles but less in tangible fixed assets.
  - Concave relationship between leverage and investment.

- Different funding sources matter for different investment types.
  - Cashflow is the most important source of funding for intangibles and R&D.
  - Whereas financial debt is the most important funding source for tangible fixed assets.

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THANK YOU

Table 1: descriptive statistics

Panel A: ALL FIRMS

Variable	Obs	Mean	Std. Dev.	Min	Max
rd	100,538	0.03	0.11	-0.02	0.45
investment intangibles	10,176,700	0.17	0.63	-0.31	2.61
investment tangibles	10,176,700	3.79	8.04	-1.45	30.23
age	10,242,548	10.66	9.09	0.00	1,002.00
log(age+1)	10,242,548	2.13	0.89	0.00	6.91
total assets	10,176,700	2.31	104.75	0.00	76,904.23
size	10,176,700	5.33	1.84	-4.61	18.16
leverage	10,176,700	21.67	28.61	0.00	91.60
cashflow	10,176,312	1.97	14.99	-40.07	29.04

Panel B: ONLY FIRMS WITH NON-MISSING INFORMATION ON R&D

Variable	Obs	Mean	Std. Dev.	Min	Max
rd	100,538	0.03	0.11	-0.02	0.45
investment intangibles	100,538	0.24	0.65	-0.31	2.61
investment tangibles	100,538	3.15	5.07	-1.45	30.23
sales	100,538	143.21	103.21	0.00	478.08
cashflow	100,538	6.46	8.99	-40.07	29.04
stock_issues	100,538	0.05	0.23	-0.11	0.99
D.cash holdings	100,538	0.38	7.09	-27.40	34.73
financial debt	100,538	0.17	7.75	-13.65	17.70