Financial frictions and intangible investment: Some lessons from the EIB Investment Survey

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Outline

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Motivation

- Intangible investment: key role for innovation and long-term growth
- Private and social returns of R&D are higher than those of physical capital (Hall et al. 2010)
- Intangible capital has been the main source of growth in the US from 1995 onwards (Corrado and Hulten 2010)

Motivation

- Intangible assets are difficult to finance with external funds
- Important information asymmetries due to uncertainty, lack of visibility and non-tradability
- Difficult to collaterize due to non-separability
- Banks are considered particularly ill-suited
- Most European economies have bank-based financial systems (EIB 2019)

Outline

Research Question and Contribution

- What are the precise effects of inadequate bank loan terms on intangible investment?

- Literature focuses on investment in R&D and do not differentiate the effects of the different loan terms

Contribution

- Differentiate the effects of the different loan terms (amount, cost, maturity and collateral) on investment in several types of intangibles (R&D, software, training and organizational capital)

Outline

Data and Sample

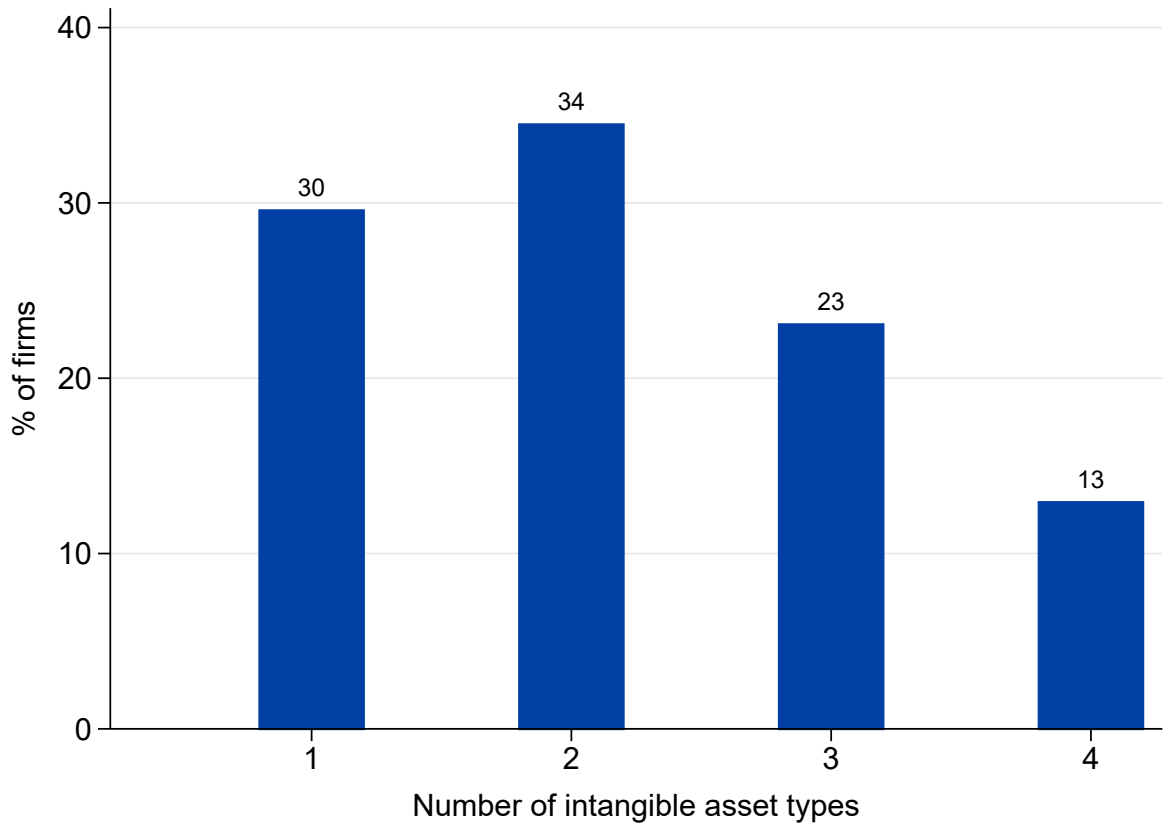
- EIBIS: Annual survey at the firm-level on investment and investment finance
- Survey answers are matched to financial statements from Orbis
- Representative across EU countries at the sector and firm's size group level (12 500 firms)

Sample

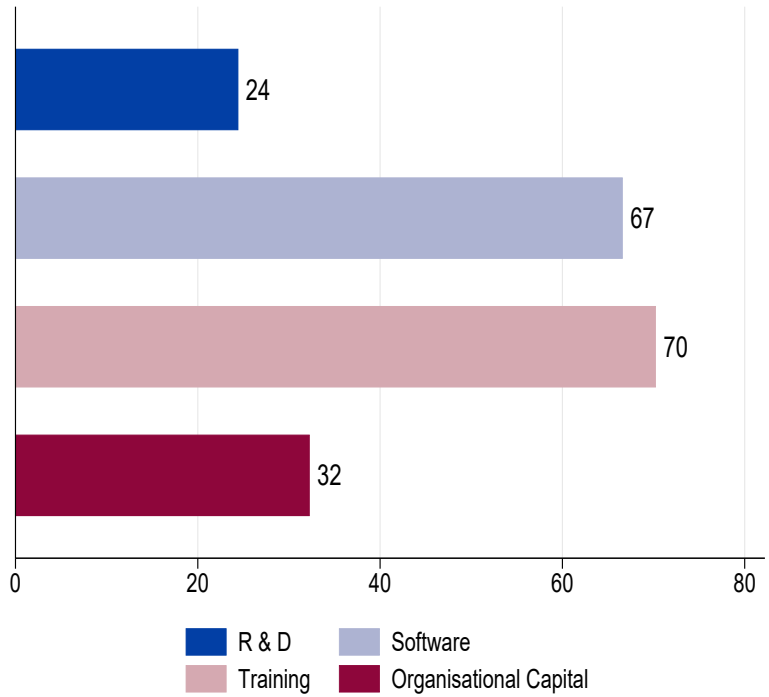
- Sample of firms that used bank financing for their most recent investment
- Period: 2015-2017

Stylized Facts: Intangible Investment

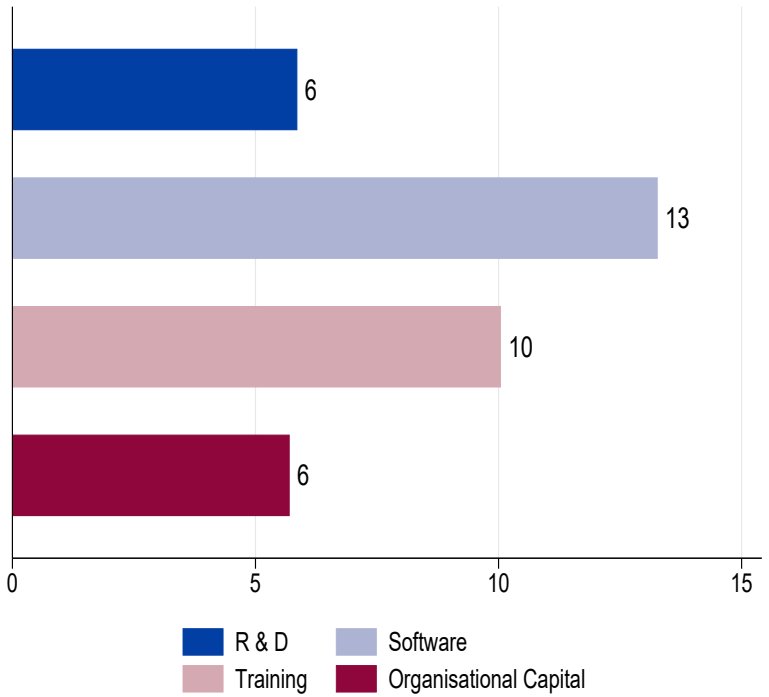
Figure: **Diversity of intangibles**



Stylized Facts: Intangible Investment



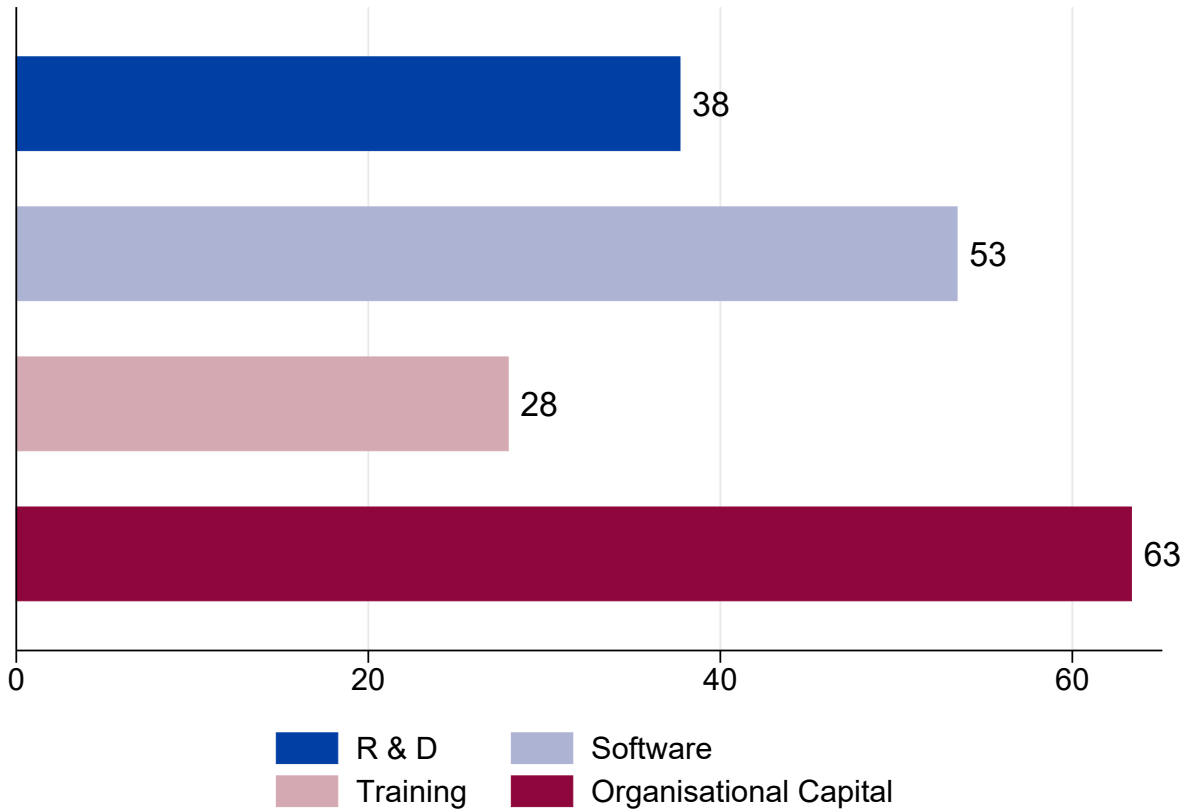
(a) % of firms



(b) Mean % invested

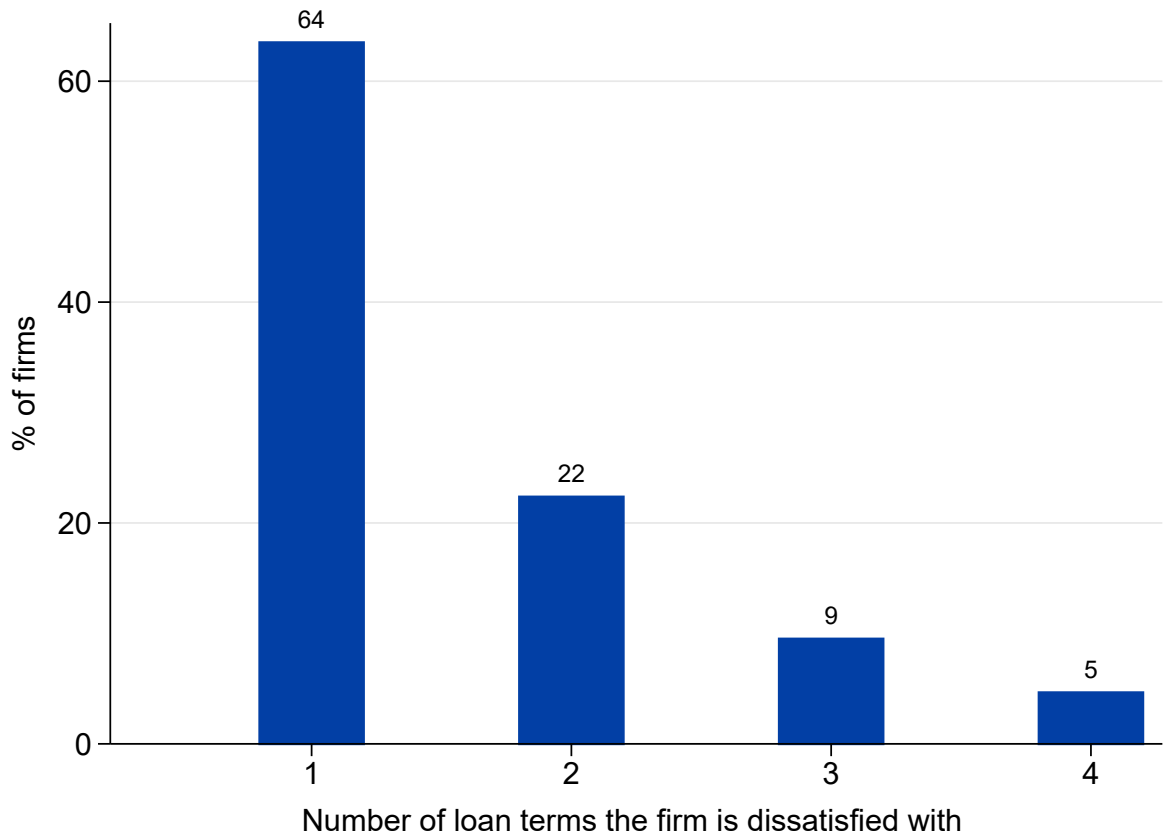
Stylized Facts: Importance of Bank Finance

Figure: **% intangible investment by firms using bank lending**



Stylized Facts: Loan Terms

Figure: **Dissatisfaction with loan terms**



Stylized Facts: Loan Terms

Table: **Correlation Matrix of Dissatisfaction Indicators**

	AmountD	CostD	MaturityD	CollateralD
AmountD	1			
CostD	0.0990***	1		
MaturityD	0.123***	-0.0348	1	
CollateralD	-0.0407	-0.335***	-0.0682**	1

Outline

Identification Strategy

- Need to address endogeneity of the loan conditions
- Whited and Wu's (2006) financial constraint index is used as an *instrument* for loan conditions:

$$WW_{it} = -0.091\, CF_{it} - 0.062\, DIVPOS_{it} + 0.021\, TLTD_{it} - 0.044\, LNTA_{it} + 0.102\, ISG_{it} - 0.035\, SG_{it}$$

- Mancusi and Vezzulli (2014) and Savignac (2008) use similar identification strategies

Empirical Models

- Bivariate probit model to investigate the impact of inadequate bank loan terms on the decision to invest in intangbiles
- IV Tobit model to measure the effects of inadequate bank loan terms on investment intensity (i.e. invested amount)

Bivariate Probit

$$\begin{cases} \text{intan}D_{it}^{T} = \mathbb{1}[\alpha \cdot \text{dissatisfied}_{it} + X_{it}\beta + u_{it} > 0] \\ \text{dissatisfied}_{it} = \mathbb{1}[X_{it}\delta + WW_{it}\gamma + v_{it} > 0] \end{cases}$$

- *intanD* can be:
  - one when the firm invests in *any* intangible
  - one when the firm invests in *at least two* intangibles

Bivariate Probit

$$\begin{cases} \text{intan}D_{it}^{T} = \mathbb{1}[\alpha \cdot \text{dissatisfied}_{it} + X_{it}\beta + u_{it} > 0] \\ \text{dissatisfied}_{it} = \mathbb{1}[X_{it}\delta + WW_{it}\gamma + v_{it} > 0] \end{cases}$$

- *dissatisfied* can be:
  - one when the firm is dissatisfied with at least one loan term
  - one when the firm is satisfied with the loan amount but dissatisfied with other loan terms

Bivariate Probit

$$\begin{cases} \text{intan}D_{it}^{T} = \mathbb{1}[\alpha \cdot \text{dissatisfied}_{it} + X_{it}\beta + u_{it} > 0] \\ \text{dissatisfied}_{it} = \mathbb{1}[X_{it}\delta + WW_{it}\gamma + v_{it} > 0] \end{cases}$$

- X are controls (age, size, ownership, and country/sector/year dummies)
- WW is the Whited-Wu financial constraint index

IV Tobit

Firm's *latent* investment in intangibles is given by:

$$\begin{cases} \text{intanA}_{it}^{T*} = \alpha \cdot \text{dissatisfied}_{it} + X_{it}\beta + u_{it} \\ \text{dissatisfied}_{it} = \mathbb{1}[X_{it}\delta + WW_{it}\gamma + v_{it} \geq 0] \end{cases}$$

Firm's *observed* investment is:

$$\text{intanA}_{it}^{T} = \begin{cases} \text{intanA}_{it}^{T*} & \text{if intanA}_{it}^{T*} > 0 \\ 0 & \text{if intanA}_{it}^{T*} \leq 0 \end{cases}$$

Outline

Results

Table: **Probability to invest in any intangible**

	Probit	Bivariate Probit					
	(1) IntanD Coef.	(2) Dissatisfied Coef.	(3) IntanD Coef.	(4) IntanD Marg. Eff.	(5) Dissatisfied Coef.	(6) IntanD Coef.	(7) IntanD Marg. Eff.
Loan condition indices:							
Dissatisfied	0.17**		-0.73**	-0.12**			
	(0.069)		(0.29)	(0.056)			
Dissatisfied alt.						-0.55	-0.090
						(0.37)	(0.064)
Instrument:							
WW index		1.64***			1.43***		
		(0.31)			(0.34)		
ρ		0.49***			0.39**		
Log Lik	-1332.7	-3646.2			-3273.9		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4693	4711	4711	4711	4550	4550	4550

Results

Table: **Probability to invest in several intangibles**

	Baseline			Alternative dissatisfaction index		
	(1) Dissatisfied Coef.	(2) IntanD Coef.	(3) IntanD Marg. Eff.	(4) Dissatisfied Coef.	(5) IntanD Coef.	(6) IntanD Marg. Eff.
Loan condition indices:						
Dissatisfied		-1.01***	-0.30***			
		(0.17)	(0.049)			
Dissatisfied alt.					-0.86***	-0.26***
					(0.23)	(0.067)
Instrument:						
WW index	1.84***			1.60***		
	(0.30)			(0.34)		
ρ	0.60***			0.51***		
Log Lik	-4883.5			-4469.4		
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4711	4711	4711	4550	4550	4550

Results

Table: **Amount invested in intangibles**

	Baseline			Alternative dissatisfaction index		
	(1) Dissatisfied Coef.	(2) IntanA Coef.	(3) IntanA E(Y)	(4) Dissatisfied Alt. Coef.	(5) IntanA Coef.	(6) IntanA E(Y)
Loan condition indices:						
Dissatisfied		-5.82***	-5.46***			
		(0.16)	(0.13)			
Dissatisfied Alt.					-5.88***	-5.49***
					(0.16)	(0.13)
Instrument:						
WW index	2.91***			2.91***		
	(0.21)			(0.22)		
Log Lik	-14415.7			-13688.0		
Controles	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4711	4711	4711	4550	4550	4550

Conclusion

- Bank loan terms can have heterogeneous effects on intangible investment
- Loan amount is the key determinant of the likelihood to invest in intangibles, other loan terms have no significant effects
- Inadequate cost, maturity and collateral requirements have a significant negative impact on:
  - The probability to invest in several intangible assets simultaneously
  - The amount invested in intangibles

Policy Perspective

- Our results suggest that an adequate loan amount is not sufficient to fully unlock intangible investment in Europe
- This lends support to policies such as subsidized interest rates, credit guarantee schemes and intangible-backed lending

Possible Next Step

- Analysis of the costs of inadequate loan terms in terms of innovation/productivity (Arquié et al. 2019, Cincera et al. 2019)

Appendix

Table: **Probability to invest in each type of intangible**

	R&D			Software			Training			OrgaCapital		
	(1) Diss Coef.	(2) IntanD Coef.	(3) IntanD Marg. Eff.	(4) Diss Coef.	(5) IntanD Coef.	(6) IntanD Marg. Eff.	(7) Diss Coef.	(8) IntanD Coef.	(9) IntanD Marg. Eff.	(10) Diss Coef.	(11) IntanD Coef.	(12) IntanD Marg. Eff.
Loan condition index:												
Dissatisfied		-1.04***	-0.34***		-0.82***	-0.25***		-1.07***	-0.30***		-0.51	-0.18
		(0.12)	(0.039)		(0.21)	(0.062)		(0.23)	(0.060)		(0.41)	(0.15)
Instrument:												
WW index	1.98***			1.70***			1.66***			1.55***		
	(0.27)			(0.30)			(0.30)			(0.30)		
ρ	0.72***			0.51***			0.59***			0.38		
Log Lik	-4962.4			-4869.7			-4709.8			-5309.9		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4711	4711	4711	4711	4711	4711	4711	4711	4711	4711	4711	4711