

Corporate Income Taxation and Firm Efficiency

Evidence from a large panel of European firms

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Motivation

- Theory: taxes are (almost) neutral
 - if $Q = \operatorname{argmax}\Pi$ then $\forall\tau$ it holds that $Q = \operatorname{argmax}(1 - \tau)\Pi$
 - tax shield (financing cost and structure)
 - taxes on K and L could be affecting optimal K/L

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Question

Are CI taxes neutral for firm efficiency?

- Taxes may be a cost \rightarrow reduce capital accumulation & investment
- Taxes may drive away from efficient technologies

Motivating example

Technology 1: immediate gratification

- Investment easily divisible
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Technology 2: suffering through the dungeons of depreciation

- Indivisible and large investments
- Long cycle from investment to revenue
- Low liquidity

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Contribution

- Instead of reforms: “business as usual” identification
- Instead of inter-temporal decision: value added (efficiency)
- Generally accessible data

Identification strategy

$$Y_{i,t} = \mathcal{A}(tax_{i,t}, \cdot) K_{i,t}^{\beta_k^s} + L_{i,t}^{\beta_l^s} \quad (1)$$

OLS estimation of \mathcal{A} biased \rightarrow instrument

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1. Measure technology specific effective tax rate \rightarrow deviations
 - average across all countries LYO (=all but "mine")
 - deviation from the national effective tax rate
 - in a given sector (NACE 4 digit)
 - standardized (in SDs)
2. Firm FE, so only variation over time (country and sector specific)

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$$IV_{c,s,t} = \frac{(ETR_{s,t} - \frac{\sum_{i \notin (c)} ETR_{s,t}}{\sum_{i \notin (c)} i})}{\sqrt{\frac{1}{\sum_{i \notin (c)} i} \sum_{i \notin (c)} (ETR_{s,t} - \frac{\sum_{i \notin (c)} ETR_{s,t}}{\sum_{i \notin (c)} i})^2}}$$

3. Use this $IV_{c,s,t}$ in estimation

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$$\begin{aligned} \log VA_{i,t} &= \beta_k^s \log k_{i,t} + \beta_l^s \log l_{i,t} + \alpha tax_{i,t} + u_t + u_i + \epsilon_{i,t} \\ tax_{i,t} &= \delta \cdot IV_{c,s,t} + \eta_t + \epsilon_{i,t} \end{aligned}$$

Data

Uniquely vast data

8 waves of Amadeus data

- 12 mio firms, 69 mio firm-years over nearly 3 decades from 44 countries

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- Flexibility in measurement of taxation

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- Flexibility in measurement of taxation
- Firm history + country tax rules \rightarrow carry forward eligibility

Some stylized facts

Table 1: Sources of variation in taxation measures

Variable	All firms			Firms ineligible to CF		
	Firm	Country	Sector	Firm	Country	Sector
BTD	17.8%	0.1%	0.4%	15.5%	0.1%	0.5%
BTD / Assets	7.3%	0.0%	0.1%	6.9%	0.0%	0.0%
BTD / PTI	65.3%	14.0%	17.1%	69.3%	14.4%	18.4%
BTD/ taxes paid	33.2%	0.7%	0.5%	31.2%	0.8%	0.5%

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BTD/ taxes paid	33.2%	0.7%	0.5%	31.2%	0.8%	0.5%
Taxes paid	73.8%	9.6%	63.9%	76.8%	9.5%	71.9%
Taxes paid / Assets	85.0%	5.2%	11.2%	88.0%	5.4%	6.6%
Taxes paid / Lagged assets	66.8%	5.7%	9.8%	68.6%	6.5%	10.6%

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ETR (1Y)	62.9%	18.0%	20.2%	68.5%	19.7%	21.6%
ETR (2Y)	41.1%	0.3%	45.6%	43.7%	1.3%	3.4%

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CF incidence	69.6%	5.9%	11.1%			

Positive correlation is robust: $\text{corr}(\tau, \pi) > 0$

Table 2: Elasticity of output with respect to taxation (FE OLS)

	Full (1)	Q1 T (2)	Q2 T (3)	Q3 T (4)	Q4 T (5)	P25 T (6)	P50 T (7)	P75 T (8)
tax	0.133 (0.000)	0.107 (0.000)	0.115 (0.000)	0.135 (0.000)	0.167 (0.000)	0.119 (0.000)	0.125 (0.000)	0.147 (0.000)
k	0.255 (0.000)	0.231 (0.000)	0.254 (0.000)	0.273 (0.000)	0.274 (0.000)	0.245 (0.001)	0.263 (0.000)	0.276 (0.000)
l	0.539 (0.000)	0.602 (0.000)	0.570 (0.000)	0.524 (0.000)	0.474 (0.000)	0.577 (0.001)	0.549 (0.000)	0.504 (0.000)
R^2	0.851	0.879	0.872	0.852	0.812	0.873	0.865	0.841
# i	2,625,365	814,839	529,788	634,856	645,882	313,784	509,907	501,467

N (1) \approx 10.2 mln

N (2) – (5) \approx 2.2mln

N (6) – (9) \approx 2 mln

Positive correlation is robust: $\text{corr}(\tau, \pi) > 0$

Table 3: Elasticity of production with respect to taxation (FE OLS)

	Q1 VA (2a)	Q2 VA (3a)	Q3 VA (4a)	Q4 VA (5a)	P25 VA (6a)	P50 VA (7a)	P75 VA (8a)
tax	0.205*** (0.000)	0.146*** (0.000)	0.123*** (0.000)	0.108*** (0.000)	0.167*** (0.000)	0.132*** (0.000)	0.117*** (0.000)
k	0.286*** (0.000)	0.249*** (0.000)	0.232*** (0.000)	0.231*** (0.000)	0.261*** (0.000)	0.240*** (0.000)	0.228*** (0.000)
l	0.483*** (0.000)	0.544*** (0.000)	0.572*** (0.000)	0.564*** (0.000)	0.518*** (0.000)	0.562*** (0.000)	0.573*** (0.000)
R^2	0.861	0.865	0.862	0.828	0.863	0.865	0.853
# N	1,927,477	2,491,774	2,867,614	2,876,870	1,820,682	2,167,947	2,382,326
# i	660,251	652,751	656,461	655,902	526,093	524,682	523,986

Results

$$\begin{aligned}\log VA_{i,t} &= \beta_k^s \log k_{i,t} + \beta_l^s \log l_{i,t} + \alpha(\widehat{tax}_{i,t}) + u_t + u_i + \epsilon_{i,t} \\ tax_{i,t} &= \delta \cdot IV_{c,s,t} + \eta_t + \epsilon_{i,t}\end{aligned}$$

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Table 4: OLS vs IV estimation of α

	OLS		IV				
	Firms in 'trusted' sectors			Firms in 'trusted' sectors ineligible to CF			
	FE	FE	FD	FE	FD	MI FE	MI FD
Controlling for inputs	0.133 (0.000)	-0.043 (0.004)	-0.035 (0.008)	-0.056 (0.005)	-0.032 (0.008)	-0.053 (0.006)	-0.039 (0.011)

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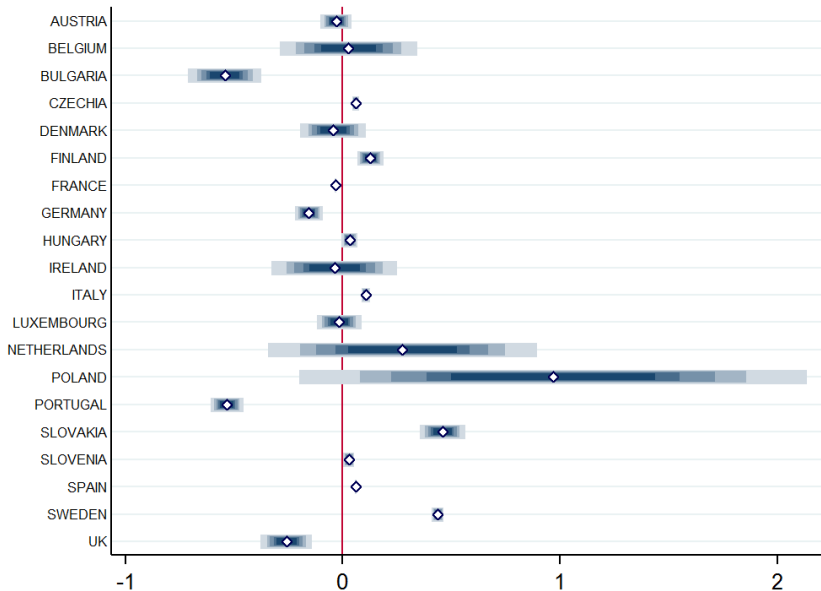
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No inputs	0.26 (0.000)	0.29 (0.005)	-0.092 (0.012)	0.35 (0.005)	-0.078 (0.013)	0.32 (0.006)	-0.094 (0.015)

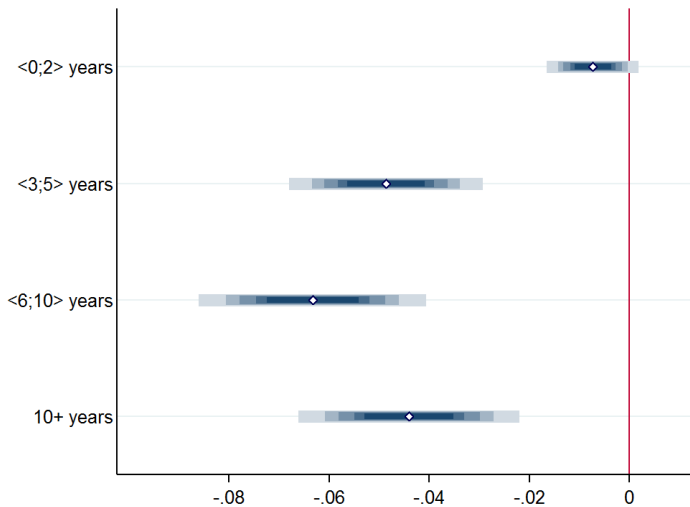
Table 5: Elasticity of TFP with respect to taxation (IV)

	Sector specific intercept				Sector specific intercept and slopes			
	All FE	No CF	All FD	No CF	All FE	No CF	All FE	No CF
	Second stage							
tax	-0.043 (0.004)	-0.056 (0.005)	-0.035 (0.008)	-0.032 (0.009)	-0.046 (0.004)	-0.060 (0.005)	-0.027 (0.002)	-0.038 (0.003)
k	0.35 (0.002)	0.37 (0.003)	0.31 (0.006)	0.32 (0.006)				
l	0.56 (0.001)	0.54 (0.001)	0.56 (0.001)	0.55 (0.001)				
R^2	0.75	0.71	0.40	0.42	0.92	0.91	0.93	0.92
	First stage							
IV	0.014 (0.000)	.015 (0.000)	.0056 (0.000)	.0063 (0.000)	0.014 (0.000)	0.015 (0.000)	0.045 (0.000)	0.040 (0.000)
R^2	0.12	0.13	0.05	0.06	0.55	0.57	0.55	0.58

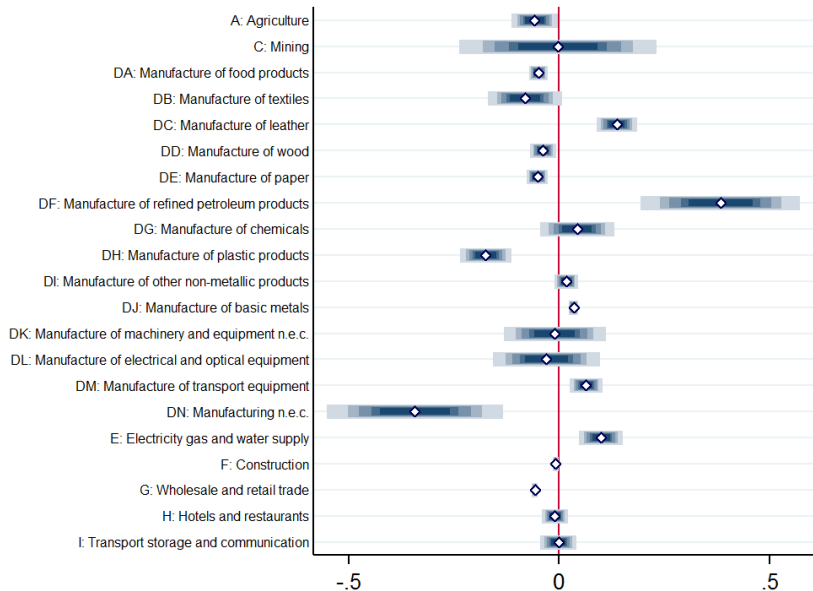
Results – a lot of heterogeneity



Results – but this heterogeneity is not on skill



Results – and is quite specific to industries



**Let's pretend that we take those
results seriously**

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Implications

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- Myopia in technology choice by firms
- Credit constraints vs “type” of technology
- Another friction in “directed” search
- Where from the cross-country heterogeneity? What does it imply?
- Can we build intuitions on this unobserved choice from the data?

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- We test neutrality of taxation with large new panel and a new instrument
- on average 10% more CIT to be paid \rightarrow 4% lower VA
- very heterogeneous: across industries and countries \rightarrow WHY?
- Where next (empirically):
 - try out this IV vs Bartik instruments vs “traditional” causal identification
 - selection into CF?

Thank you and
I am happy to take questions!

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