Corporate Income Taxation and Firm Efficiency

Evidence from a large panel of European firms

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AEA, San Diego, 2020

Motivation

- Theory: taxes are (almost) neutral
  - if $Q = argmax\Pi$ then $\forall\tau$ it holds that $Q = argmax(1-\tau)\Pi$
  - tax shield (financing cost and structure)
  - taxes on K and L could be affecting optimal K/L
- Reality: More efficient firms $\longrightarrow$ profits $\uparrow \longrightarrow corr(\pi, tax) > 0$

Question

Are CI taxes neutral for firm efficiency?

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

Motivating example

Technology 1: immediate gratification

- Investment easily divisible
- Short cycle from investment to revenue
- High liquidity

Technology 2: suffering through the dungeons of depreciation

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

Literature

- Distortions to inter-temporal decisions (investment $\longrightarrow$ capital)
  - Modigliani & Miller (1965), Auerbach (1979), Fazzari et al (1988) ... Giroud and Rauh (2019)
- Exploit tax reforms / discontinuities for exogeneity
  - Romer & Romer (2010), Arnold et al (2011), Spinnewyn et al (2017)
- (Accounting) Literature on book-tax conformity and tax audits

Contribution

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

Identification strategy

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

OLS estimation of $tax_{i,t}$ biased $\longrightarrow$ instrument

- Measure technology specific tax rate (NACE 4 digit)

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

- Use this as instrument in estimation

$$\log \text{VA}_{i,t} = \beta_k^s \log k_{i,t} + \beta_l^s \log l_{i,t} + \alpha_i(ta\hat{x}_{i,t}) + u_t + u_i + \epsilon_{i,t} \tag{3}$$

$$tax_{i,t} = \delta \cdot IV_{c,s,t} + \eta_t + \varepsilon_{i,t} \tag{4}$$

Some stylized facts

Table 1: Sources of variation in taxation measures

	All firms			Firms ineligible to CF		
Variable	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%
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%
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%
CF incidence	69.6%	5.9%	11.1%			

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

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

	Full	Q1 T	Q2 T	Q3 T	Q4 T	P25 T	P50 T	P75 T
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
tax	0.133	0.107	0.115	0.135	0.167	0.119	0.125	0.147
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
k	0.255	0.231	0.254	0.273	0.274	0.245	0.263	0.276
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
l	0.539	0.602	0.570	0.524	0.474	0.577	0.549	0.504
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(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: $corr(\tau, \pi) > 0$

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***	0.146***	0.123***	0.108***	0.167***	0.132***	0.117***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
k	0.286***	0.249***	0.232***	0.231***	0.261***	0.240***	0.228***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
l	0.483***	0.544***	0.572***	0.564***	0.518***	0.562***	0.573***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(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

Results

$$\begin{aligned} \log \text{VA}_{i,t} &= \beta_k^s \log k_{i,t} + \beta_l^s \log l_{i,t} + \alpha_i(ta\hat{x}_{i,t}) + u_t + u_i + \epsilon_{i,t} \\ tax_{i,t} &= \delta \cdot IV_{c,s,t} + \eta_t + \varepsilon_{i,t} \end{aligned}$$

Table 4: OLS vs IV estimation

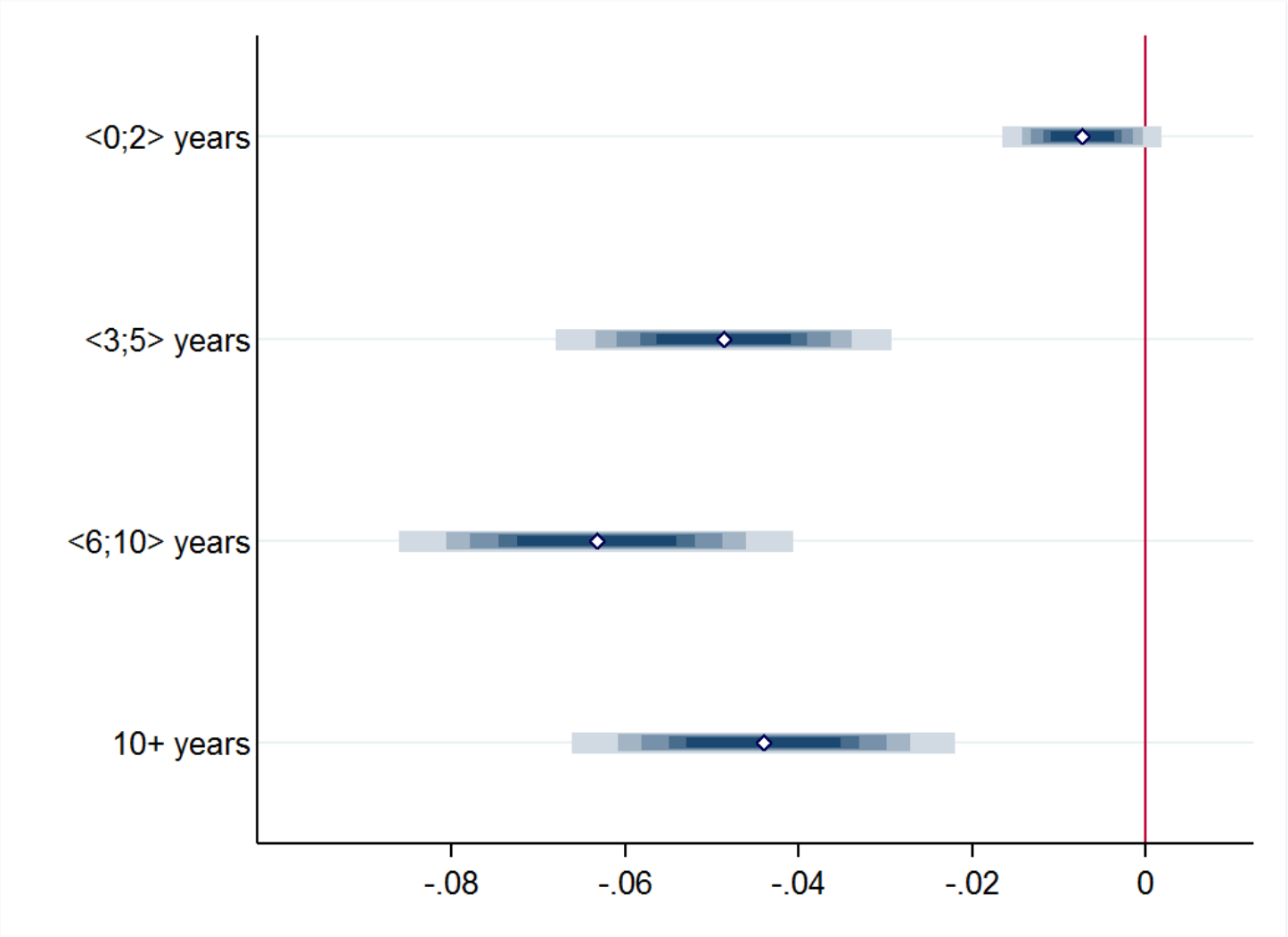
	OLS	IV					
	Firms in 'trusted' sectors			Firms in 'trusted' sectors ineligible to CF			
	FE	FE	FD	FE	FD	MI FE	MI FD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
No inputs	0.26	0.29	-0.092	0.35	-0.078	0.32	-0.094
	(0.000)	(0.005)	(0.012)	(0.005)	(0.013)	(0.006)	(0.015)
Controlling for inputs	0.133	-0.043	-0.035	-0.056	-0.032	-0.053	-0.039
	(0.000)	(0.004)	(0.008)	(0.005)	(0.008)	(0.006)	(0.011)

Results – robustness

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

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

Effects not too heterogeneous on experience/skill



Conclusions

- Still work in progress!
- We test neutrality of taxation
- We use a large, new panel dataset
- We propose a new instrument
- 10% more tax to paid $\longrightarrow$ 4% lower VA
- quite robust: for 2digit NACE all negative, or insignificant
- substantial heterogeneity across countries

Thank you and

I am happy to take questions!

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