R&D Employment Spillovers in Trade and MNE Networks

Evidence from an R&D Tax Reform

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Motivation

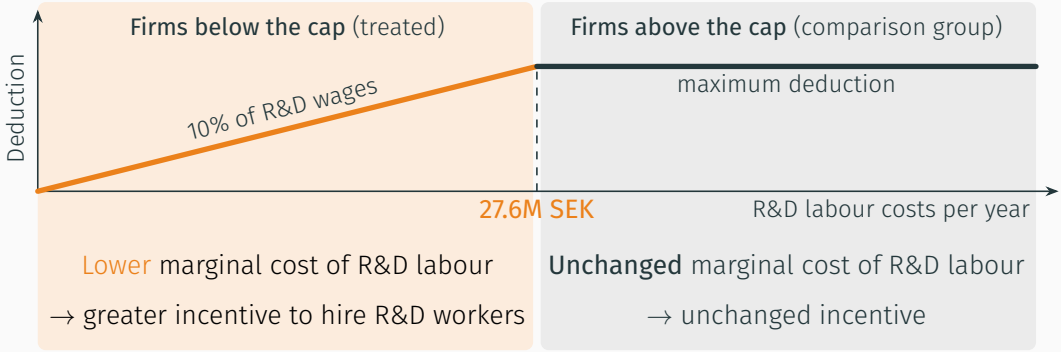
- Firms tend to underinvest in R&D because of positive externalities
  → Governments subsidise R&D: subsidy rates more than tripled since 2000 (OECD 2025)
- Global firms account for the majority of R&D investment
- Evidence on R&D spillovers *within* international trade and MNE networks is lacking
  - Firm-to-firm links across borders are rarely observed

This talk

Data	Firm-to-firm sales within the EU from VAT records (VIES), merged and linked with Danish and Swedish register data
Application	The 2014 Swedish R&D tax reform: impact on Swedish firms, and then on Danish firms linked to them by trade or ownership

The 2014 Swedish R&D Tax Reform

- From January 2014, firms can deduct 10% of the wages of R&D employees from their employer contributions
  - Firms of all sectors and sizes are eligible
  - Employees must spend at least 75% of their time on R&D and be aged 26–65
- Cap: maximum deduction of 230,000 SEK per month (2.76M SEK per year)



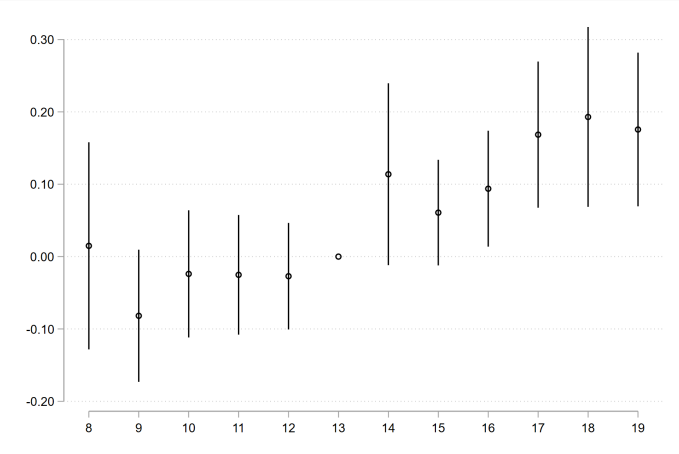
Empirical Approach: Effect of the Reform on Swedish Firms

- Difference-in-differences model as in Bøler et al. (2015), comparing Swedish firms below and above the cap:

$$\log y_{jt} = \gamma \, 1\{t \geq 2014\} \times H_j + \mu_j + \eta_t + \varepsilon_{jt}$$

- $H_j = 1$ if firm j's pre-reform R&D labour costs are below 27.6M SEK (R&D survey, 2011 and 2013)
- y_{jt}: salaries to college-educated workers, or R&D labour costs
- μ_j, η_t: firm and year fixed effects
- γ: intention-to-treat effect of the reform; we expect $\gamma > 0$
- Event-study version: γ^k for each year 2008–2019, relative to 2013

Effect of the Reform on Swedish Firms: College Salaries



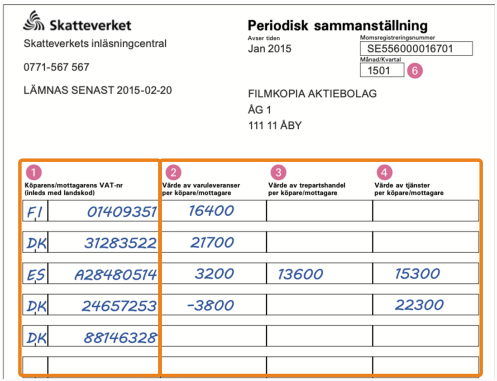
Post-reform average of γ

- College salaries: 0.16 (0.026)
- R&D labour costs, survey: 0.15 (0.059)

$\rightarrow$ Effects on linked Danish firms require firm-to-firm data across the border

Notes: Event-study estimates γ^k for log college salaries, base year 2013. Firm and year fixed effects, robust standard errors.

VIES Data: Firm-to-Firm Sales within the EU



Skatteverket

Skatteverkets inläsningcentral

0771-567 567

LÄMNAS SENAST 2015-02-20

Periodisk sammanställning

Avser tiden
Jan 2015

Momsregistreringsnummer
SE556000016701

Månad/Kvartal
1501

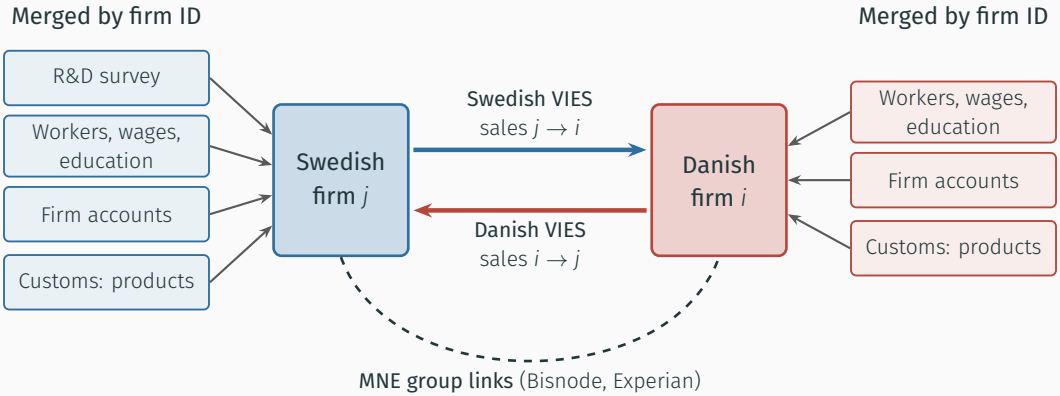
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FILMKOPIA AKTIEBOLAG
ÄG 1
111 11 ÄBY

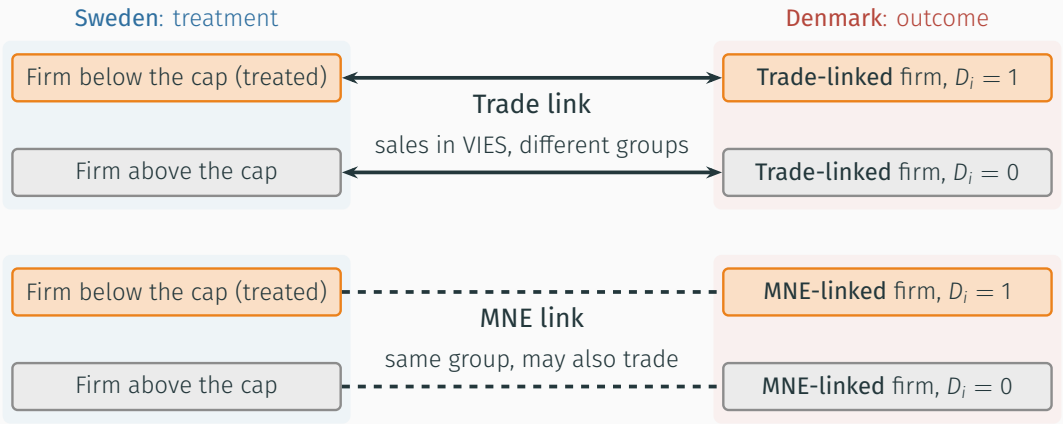
1 Köparens/mottagarens VAT-nr (inleds med landskod)		2 Värde av varuleveranser per köpare/mottagare	3 Värde av trepartshandel per köpare/mottagare	4 Värde av tjänster per köpare/mottagare
FI	01409351	16400		
DK	31283522	21700		
ES	A28480514	3200	13600	15300
DK	24657253	-3800		22300
DK	88146328			

- Sellers report their sales to VAT-registered buyers in other EU countries (VAT Information Exchange System, VIES)
- Seller $\times$ buyer's VAT number $\times$ month or quarter
- Goods, services and triangular trade
- The seller invoices without VAT and reports the buyer's VAT number

Merged and Linked Swedish and Danish Data



Empirical Approach: Spillover Effects on Danish Firms

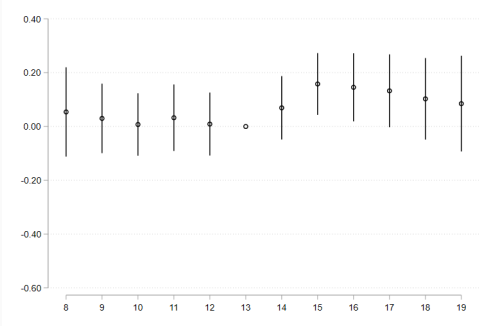


$$\log \text{College Salary}_{it} = \delta \, 1\{t \geq 2014\} \times D_i + \mu_i + \eta_t + \varepsilon_{it}$$

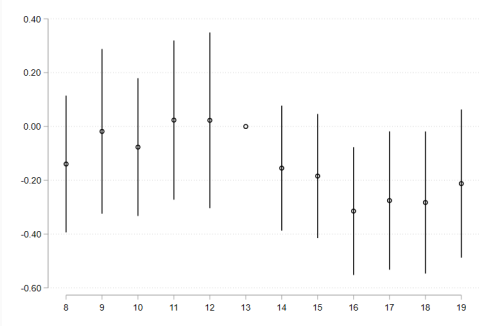
Estimated separately for trade-linked and MNE-linked Danish firms

Spillover Effects on Danish Firms: College Salaries

Trade-linked firms: 0.095 (0.035)



MNE-linked firms: −0.20 (0.056)



Notes: Event-study estimates δ^k, base year 2013. Above each panel: estimate of δ, robust standard error in parentheses.

- R&D activities are complements in trade networks: positive spillovers to partners
- R&D activities are substitutes in MNE networks: MNEs shift activity to Sweden

Spillover Effects on Danish Firms: Reduced-Form Estimates

Outcome (log):	College salaries			Wage bill		
	(1)	(2)	(3)	(4)	(5)	(6)
$1\{t \geq 2014\} \times D_i$	0.061*	0.095***	-0.20***	-0.0097	0.0017	-0.24***
	(0.034)	(0.035)	(0.056)	(0.028)	(0.028)	(0.053)
Firm sample	Any link	Trade-linked	MNE-linked	Any link	Trade-linked	MNE-linked
Observations	103,148	101,187	8,538	103,148	101,187	8,538

Notes: Danish firms, 2008–2019, links from 2012–2013. Firm and year fixed effects. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

- Pooling trade and MNE links (column 1) averages two opposite effects
- The overall wage bill is unchanged in trade-linked firms and falls in MNE-linked firms

Mechanisms: Firm-to-Firm Trade

Firm-pair sample:	Trade-linked			MNE-linked		
	(1)	(2)	(3)	(4)	(5)	(6)
Trade value flow (log):	SE↔DK	SE→DK	SE←DK	SE↔DK	SE→DK	SE←DK
$1\{t \geq 2014\} \times D_i$	0.069***	0.077*	0.096***	-0.18	0.013	-0.12
	(0.025)	(0.042)	(0.030)	(0.13)	(0.12)	(0.21)
Observations	172,750	124,306	87,942	4,800	5,184	2,504
Sample years	2012-18	2010-18	2012-18	2012-18	2010-18	2012-18

Notes: Swedish–Danish firm pairs. Firm-pair and year fixed effects. SE↔DK: total trade; SE→DK: Swedish exports; SE←DK: Swedish imports. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

- Trade within trade-linked pairs increases by about 7%, in both directions
- Treated Swedish firms are 2.2 pp more likely to hire from a linked Danish firm

Further Applications of VIES Data

1. Cross-border effects of national policies
   - VIES links from before a policy identify the exposed firms in other member states
2. Innovation and patents
   - Patents of linked firms measure R&D output and knowledge flows between trade partners
3. Trade in services between firms
   - VIES records the services sold to each buyer; customs data cover goods only
4. Propagation of shocks along supply chains
5. Small exporters and new trade relationships
6. Additional countries
   - All 27 member states collect VIES data under the same rules
   - Next countries: Finland? Netherlands? Estonia?

Thanks!