Do wages rise when corporate tax rates fall?
Difference-in-differences analyses of the german business tax reform 2000

Nils aus dem Moore and Tanja Kasten, 2009

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Motivation

- ***What is the direct incidence of corporate income tax on wages? How far taxes on corporate income are directly shifted onto the workforce?***

- ✓ They exploit the German Business Tax Reform 2000 in a quasi experimental setting.

- ✓ In the year 2000: Germany enacted a major tax reform involving significant cuts in corporate and personal tax rates and a controversial change in the system of dividend taxation.

Introduction

- Empirical literature:

  Arulampalam, Devereux and Maffini (2008) present evidence on the incidence of the corporate income tax on wages. They conclude that labour bears a burden of the corporate tax.

- Central result: 1$ of additional corporate tax burden reduces wages by 92 cents in the long run.

Methodology

The authors use the ADM framework as a theoretical starting point and transformed their model to fit in a difference in differences approach.

Large database on firms for Germany, Great Britain and France. In their analyses, they compare a sample of German companies with comparison groups of british and french companies respectively. For each comparison group, they performed a general difference in difference analysis that measured the effect in the post reform period compared to the pre reform period.

1) **Theoretical framework of ADM**: Presentation of the wage bargaining model of corporate tax incidence.They use a difference in differences approach to evaluate GBTR 2000

2) **Empirical Analysis**: They present datas, econometric model and the results.

1) The wage bargaining model of corporate tax incidence

w = wage rate (w); N = labour force

w and N are determined through Nash bargaining between firm and a single union representing all workers in the company.

$\bar{w}$ → outside wage (alternative jobs, unemployment benefits)

The union aims to maximise $(u(w) - u(\bar{w}))N$

K = capital stock → firm chooses K by maximising π

Domestic post-tax profit is $\pi = F(K, N) - wN - rK - T.$

Corporation tax is defined by: $T = \tau\,[F(K, N) - wN - \alpha rK + \phi\,].$

Where:

τ = tax rate

Φ = other factors that can affect firm´s tax position → interest payments, stock relief, losses brought forward from an earlier period (carry-over), and so on.

It is the existence of the factors incorporated in Φ which allow the identification of the effects of the corporate income tax independently of the revenue function F(K,N).

The wage bargaining model of corporate tax incidence

- μ = bargaining power of the firm;
- $(1-\mu)$ = barganing power of the union;
- Central equation of the theoretical model:

$$w \cong \mu \bar{w} + (1-\mu)\left\{ \frac{F(K,N)-(1+m)K}{N} - \frac{\tau\phi}{(1-\tau)N} - \frac{\pi^*}{(1-\tau)N} \right\}.$$

"wage bargain effect"

- Conditional on other factors (such as the leves of capital, employment and pre-tax profit), a rise in φ induces a rise in tax and should lead to a reduction of the wage rate since:

$$\frac{\partial w}{\partial \phi} = -\frac{(1-\mu)}{N}\frac{\tau}{(1-\tau)} < 0.$$

2) A difference in differences approach to evaluate GBTR 2000

- **Highlights of the German Business Tax Reform 2000: (with effect from January 2001**
- Corporation Tax System: Individual shareholders would only be taxed on 50 percent of the dividends received from German corporations.
- Corporation Tax Rates: changes in the structure and level of the tax rate: from split-rate (40% retained and 25% distributed profits) to single uniform tax rate of 25%.
- Corporation Tax Base: broadening of the tax base by cutting back the depreciation rules both for tangible fixed assets (from 30%to 20%) and for buildings (from 4% to 3%).
- Income Tax Rates: reduction of the top marginal personal income tax rate from 53% before the reform, in three successive steps, ending up to 42% in 2005.

Difference-in Differences approach to evaluate GBTR 2000

- Aim of the Paper: Identify the effect of the German corporate tax rate cut on wages in the manufacturing sector via a comparison of German manufacturing companies with manufacturing companies in France and Great Britain.
- Criteria for valid control group: flat evolution of corporate tax measures in a sufficient time span of several years before and after the German tax reform.
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- Corporate Tax System (3 measures):
- i) Statutory Tax Rate (STR): headline rate from tax law;
- ii) Effective Marginal Tax Rate (EMTR): relevant tax burden for decisions about investments in existing production facilities;

  iii) Effective Average Tax Rate (EATR): relevant tax burden for decisions like the location choice for a new production facility;
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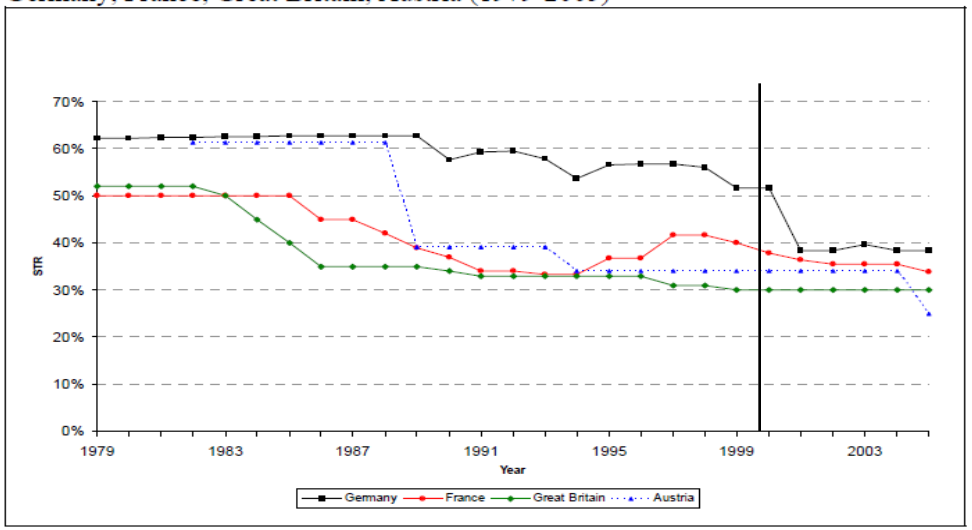
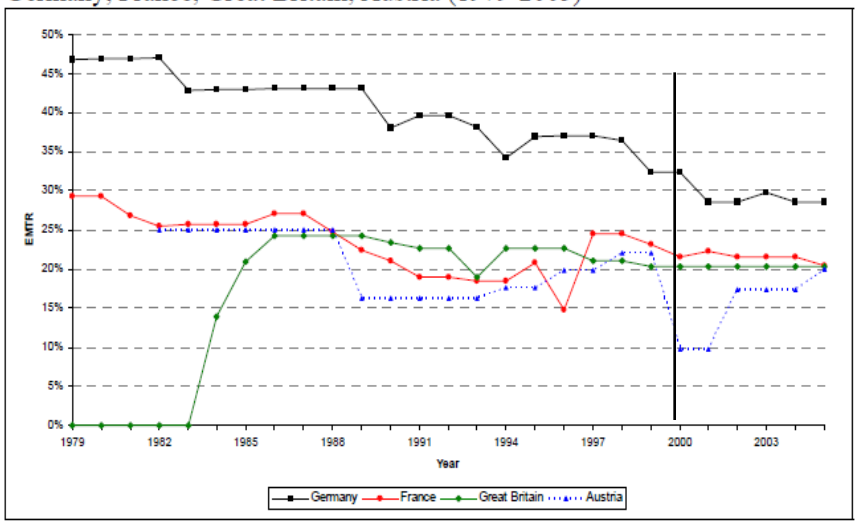
  - Great Britain – all three tax measures show a flat evolution. It looks a good choice as comparison country (control group) in diff-in-diffs approach.
  - France – downward trend in the 1st half of the relevant time span. It doesn´t seem a good choice for the control group, however, France and Germany are more similar to each other in a number of relevant aspects (i.e. Industry structure, intensity of labour market regulation and union coverage) than Great Britain and Germany.

Statutory Tax Rates (STR)
Germany, France, Great Britain, Austria (1979-2005)

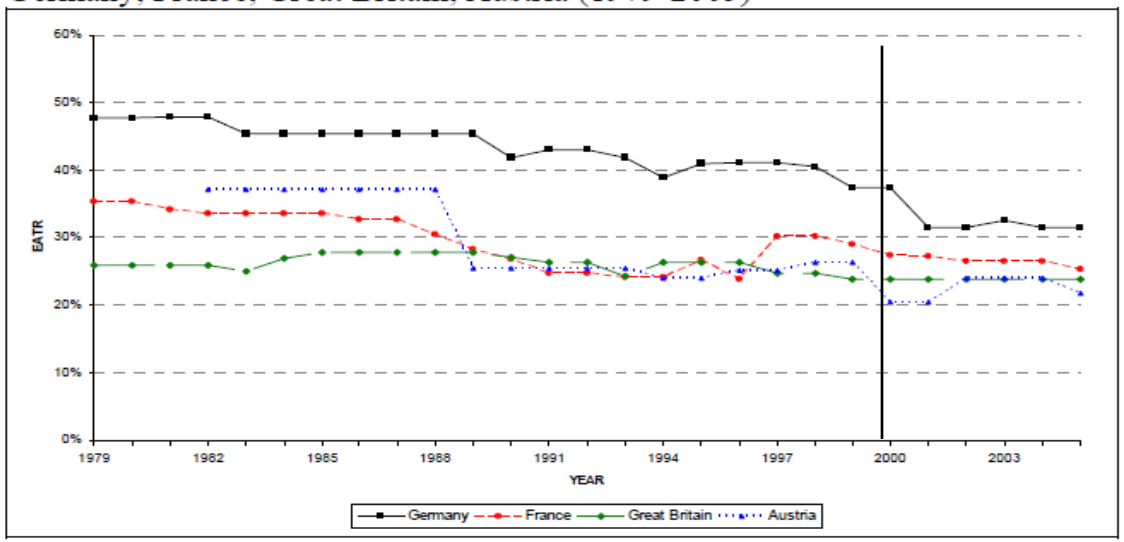


Source: Klemm (2005).

Effective Marginal Tax Rates (EMTR)
Germany, France, Great Britain, Austria (1979-2005)



Effective Average Tax Rates (EATR)
Germany, France, Great Britain, Austria (1979-2005)



3) Empirical Analysis

- Data

data from the pan-European database Amadeus;

- 48 738 firms located in Germany, Great Britain and France;
- companies of the corporate manufacturing sector;
- “micro” companies are excluded;
-observations in the 5th and 95th percentile of the distribution for the main variables are also excluded.

- Econometric model:

✓ General equation:

$$\ln w_{it} = \alpha + \beta_{01} \ln w_{i,t-1} + \beta_{02} \ln w_{i,t-2} + \beta_{20} \ln \pi_{it} + \beta_{21} \ln \pi_{i,t-1} + \beta_{22} \ln \pi_{i,t-2} + DiD_{it} + treat + year_t + \mu_i + \varepsilon_{it}$$

where *DiD* = 1 for German companies in the post reform period and 0 otherwise

✓ Time specific regression:

definition of a all set of *DID* indicators as the product of the treat dummy and a dummy variable for each year of the post reform period

Estimation results

1) comparison group: Great Britain

✓ General estimation

Table 1
General Difference-in-Differences-Analysis; Comparison Group: **Great Britain**;
Dependent Variable: Log. wage rate

	OLS (robust) (1)	Fixed Effects (robust) (2)	Difference-GMM (3)	System-GMM (4)
Log. wage rate (t-1)	0.6298***	0.0755***	0.2236***	0.5122***
	(0.0111)	(0.0152)	(0.0401)	(0.0195)
Log. wage rate (t-2)	0.2706***	0.0062	0.0754**	0.1731***
	(0.0109)	(0.0118)	(0.0177)	(0.0145)
Difference-in-Differences (*DiD*)	0.0514***	0.0876***	0.4525	1.2094***
	(0.0109)	(0.0153)	(0.2944)	(0.4441)
Treatment Group (*Treat*)	-0.0262***			-1.1010**
	(0.0100)			(0.4358)
Log. profit per employee	0.0117***	0.0112***	0.0152	0.0137*
	(0.0010)	(0.0013)	(0.0133)	(0.0077)
Log. profit per employee (t-1)	-0.0027**	0.0042***	-0.0029	-0.0028
	(0.0011)	(0.0013)	(0.0043)	(0.0034)
Log. profit per employee (t-2)	-0.0024**	0.0037***	0.0003	-0.0014**
	(0.0010)	(0.0012)	(0.0018)	(0.0018)
Observations	16,195	16,195	10,362	16,195
Firms	5,535	5,535	3,821	5,535
Instruments			78	110
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.78			
Within- R^2		0.10		
AR(1) – p-value	0.003	0.000	0.000	0.000
AR(2) – p-value			0.350	0.316
Hansen χ^2-test – p-value			0.000	0.000

Notes: (i) Year dummies and a constant term are included in all estimates. (ii) The standard errors are in parenthesis. (iii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level. (iv) First-Differences of EMTR, EATR and the statutory tax rate (Devereux/ Griffith 2003) are used as additional instruments in columns (3) and (4).

a) With OLS and fixed effect estimations find significant but small coefficients;

b) System-GMM estimation implies that due to the reform, the wage rate in German manufacturing companies rose 1.21 percent in the post-reform-period compared to the counterfactual scenario (without the tax rate cut).

- Time-specific estimation

Table 2
Time-specific Difference-in-Differences-Analysis; Comparison Group: **Great Britain**;
Dependent Variable: Log. wage rate

	OLS (robust) (1)	**Fixed Effects (robust) (2)**	**Difference-GMM (3)**	**System-GMM (1)**
Log. wage rate (t-1)	0.6290***	0.0754***	0.2094***	0.5142***
	(0.0111)	(0.0152)	(0.0419)	(0.0203)
Log. wage rate (t-2)	0.2717***	0.0074	0.0746***	0.1786***
	(0.0109)	(0.0118)	(0.0180)	(0.0149)
DiD_2001	-0.0894***	-0.0731***		
	(0.0146)	(0.0180)		
DiD_2002			0.4650	1.0178**
			(0.2999)	(0.4448)
DiD_2003	0.0223	0.0477**	0.4605	1.0789***
	(0.0140)	(0.0213)	(0.2995)	(0.4207)
DiD_2004	-0.0423***	0.0160	0.4040	1.0680**
	(0.0140)	(0.0230)	(0.3124)	(0.4281)
DiD_2005	-0.0612***	-0.0077	0.3339	0.9828**
	(0.0119)	(0.0230)	(0.3118)	(0.4273)
Treatment Group	0.0632***			-0.9260**
(*Treat*)	(0.0107)			(0.4145)
Log. profit per employee	0.0117***	0.0112***	0.0156	0.0140*
	(0.0010)	(0.0013)	(0.0139)	(0.0076)
Log. profit per employee	-0.0027**	0.0042***	-0.0024	-0.0028
(t-1)	(0.0011)	(0.0013)	(0.0044)	(0.0034)
Log. profit per employee	-0.0024**	0.0038***	0.0006	-0.0013
(t-2)	(0.0010)	(0.0012)	(0.0018)	(0.0017)
Observations	16,195	16,195	10,362	16,195
Firms	5,535	5,535	3,821	5,535
Instruments			78	110
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.78			
Within- R^2		0.10		
AR(1) – p-value	0.003	0.000	0.000	0.000
AR(2) – p-value			0.216	0.213
Hansen χ^2-test – p-value			0.000	0.000

Notes: (i) Year dummies and a constant term are included in all estimates. (ii) The standard errors are in parenthesis. (iii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level. (iv) First-Differences of EMTR, EATR and the statutory tax rate (Devereux/ Griffith 2003) are used as additional instruments in columns (3) and (4).

a) Confirms findings of the general estimations;

b) according to System-GMM estimations, the largest effect is displayed for 2003 (first year of the post reform period without overlaps with the pre-reform period due to lagged variables.

2) Comparison group : France

a) Coefficients obtained for *DiD* variable both in the general and time-specific estimations, aren't significant;

b) authors explain that this is due to changes in the french corporate tax system (a downward trend), during the first half of the period of interest

Conclusion

- Results:
- For the british case, they find a positive wage effect of the corporate tax rate cut from the reform. (cf. significant coefficient).
- For the french case, it is more ambigous. Their conclusions don't allow us to have a clear conclusion concerning the wage effect of the corporate tax cut.
- Nevertheless, they maintain the main result of the british case: POSITIVE WAGE EFFECT OF THE GBTR 2000 in the manufacturing sector.