Do wages rise when corporate tax rates fall? Difference-in-Differences Analyses of the German Business Tax Reform 2000

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Abstract

We examine the direct incidence of the corporate income tax on wages, i.e. how far taxes on corporate income are directly shifted onto the workforce. We use data on 48,738 companies located in Germany, France and Great Britain over the period 1996-2005. We exploit the German Business Tax Reform 2000 (GBTR) in a quasi-experimental setting. In two separate difference-in-differences analyses, we use manufacturing companies in France and in Great Britain respectively as control groups for German manufacturing companies. We find significant and positive wage effects of the corporate income tax rate cut that was a main element of the GBTR.

JEL Classifications: H22, H25, H32, H87

Keywords: effective tax incidence, wage determination, corporate income tax, corporate tax reform, difference-in-differences, firm-level data

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The true incidence of the corporate tax remains one of the primary mysteries of public finance.

Jonathan M. Gruber (2007)

1. Introduction

Tax competition and the downward trend in the rates of corporation tax are hotly debated issues in the realm of public finance. In this paper, we link this debate to another issue of central interest in the discipline, namely the effective incidence of the corporation tax. There is good reason for doing so: If tax competition leads to ever declining corporation tax rates, the question how the presumptive benefits from this trend are shared among the share- and stakeholders of corporations is of high importance for policy makers. This holds especially for the question of the effective incidence of the corporate income tax on the factor labour, since many theoretical models and empirical studies suggest that the immobile workforce may be the victim of tax competition (Sinn, 2003: 21).

The theoretical literature on the effective incidence of the corporate income tax is characterised by two starkly contradicting views that depend on whether one assumes a closed economy or an open economy setting. The fist view dates back to Arnold C. Harberger (1962). His seminal contribution presented a model of a closed economy with a corporate and a non-corporate sector that allowed the analysis of introducing a tax in the corporate sector only. Harberger (1962) showed that the incidence of the tax depended on a number of factors, including the elasticities of substitution between labour and capital used in each sector, and between the goods produced in each sector. His main conclusion was that under reasonable assumptions, the tax is borne by all owners of capital, across both sectors, as it drives down the post-tax return to capital. Similar results have been generated by a number of more complex Computable General Equilibrium models with a larger number of sectors (see John B. Shoven 1976 and a short review for this branch of the literature in Gentry 2007).

The second strand of the literature gives up the assumption of a closed economy, which ties down the supply of capital to the economy. It assumes instead that capital is perfectly mobile between countries, but labour is not. David F. Bradford (1978) and Laurence J. Kotlikoff and Lawrence H. Summers (1987) were the first to show that the introduction of a tax on corporate income in a home country tends to reduce the world rate of return to capital, and tends to shift capital from the home country to the rest of the world. This shift in capital reduces the return to labour in the home country, and increases the return to labour abroad. As the home country becomes small relative to the rest of the world, the effect on the world rate

of return diminishes towards zero: however, there remains an exodus of capital, and the home country labour force effectively bears the entire burden of the tax. Indeed, given a deadweight loss induced by the outward shift of capital, the cost to the home country labour force can exceed the tax revenue generated.

A number of recent contributions have developed more sophisticated general equilibrium models of the long-run incidence of taxes on corporate income in an open economy, see William G. Randolph (2006), Jane G. Gravelle and Kent A. Smetters (2006) and Harberger (1995, 2006). Incorporating more detailed assumptions about the economy, such as the extent of factor mobility, supply elasticities, the relative capital intensities of the different sectors and differentiating between perfect versus imperfect competition scenarios, these models arrive at intermediate predictions concerning the distribution of the corporate tax burden among the factors of production.

Against this backdrop of conflicting theoretical results that depend heavily on the assumptions made, a nascent empirical literature has developed that uses international data on corporate taxes and wages to estimate the burden of the corporate income tax. In particular, a trio of recent papers – Arulampalam, Devereux, and Maffini (2008, henceforth ADM); Hassett and Mathur (2006); and Felix (2007) – present new evidence on the incidence of the corporate income tax based on the relationship between cross-country variation in corporate taxation and wages. Instead of trying to measure how corporate taxes affect rates of return, these papers concentrate on whether corporate taxes reduce wages. By focusing on wages instead of rates of return to capital, these studies avoid some of the measurement issues associated with measuring rates of return as well as some of the short-run capitalization effects that can be conflated in estimating the effect of the corporate income tax on the rate of return to capital. Despite many methodological differences across the studies, the papers all come to the conclusion that labour bears a substantial burden of the corporate tax.

ADM (2008) present as their central result that $1 of additional corporate tax burden reduces wages by 92 cents in the long run (ADM 2008, abstract). Felix estimates that a ten percentage point increase in the corporate tax rate decreases annual gross wages by seven percent. Her estimates predict that labour's burden of the corporate income tax is more than four times the magnitude of the corporate tax revenue collected in the US (Felix 2007: 3). Hassett and Mathur (2006) also conclude that higher corporate taxes lead to lower wages. They estimate that a 1 percent increase in corporate tax rates is associated with nearly a 1 percent drop in wage rates (Hassett and Mathur 2006: 25).

A forth paper by Mihir A. Desai, C. Fritz Foley and James R. Hines (2007, henceforth DFH) employs a completely different identification strategy to address the same question: They use aggregate data on the activities of US companies in around 50 countries in four

years to estimate jointly the impact of the corporate income tax on the wage rate and the rate of profit. Fixing the sum of these effects to be unity, they find that between 45 and 75 percent of the corporate tax is borne by labour with the remainder falling on capital. By fixing the sum of the effects to be unity their approach abstracts from the indirect effects of the deadweight cost.

In this paper we extend the literature by using the approach of ADM (2008) in two distinct difference-in-differences analyses of the German Business Tax Reform 2000. The remainder of this paper proceeds as follows: Section II presents the theoretical framework of ADM (2008) in more detail and the modifications we apply to use it in two separate difference-in-differences analysis of the GBTR 2000. Section III presents our empirical analysis. Section IV concludes.

2. The wage bargaining model of corporate tax incidence (Theoretical Framework)

This paper builds on the approach developed by Arulampalan, Devereux and Maffini (2008, henceforth ADM) to identify the effective incidence of corporate income tax on wages. They draw on studies to wage determination to investigate how taxes on corporate income can play a role in the wage bargain. To do so, they introduce a tax on corporate income into the basic efficient bargaining framework of Ian M. McDonald and Robert M. Solow (1981). In this framework, the simple assumption that the aggregate stock of labour is fixed and that labour is paid its marginal product is skipped. Instead, the firm and the labour force bargain over both wages and employment. This bargain is motivated by the existence of firm-specific rents stemming from a world of non-perfect competition.

2.1 The wage bargaining model of corporate tax incidence

The starting point of the model derived by ADM (2008) that informs our empirical work below is a single firm in which the wage rate *w* and the labour force N are set through efficient bargaining between the firm and a single union representing all workers in the company.[1] Simultaneously, the firm chooses its capital, K. Employees have an outside wage available $\bar{w}$, unaffected by the bargain, that may reflect wages in alternative jobs or the unemployment benefit. The union aims to maximise $(u(w) - u(\bar{w}))N$ with $u(.)$ representing the utility of a single worker and N being the number of workers employed by the firm. The firm may have the option of shifting its activities to another location, or another activity, where, net of the costs of shifting, it can earn an outside post-tax profit of π^*. The firm is

[1] The following paragraphs draw heavily on the more detailed description in Arulampalam, Devereux and Maffini (2008). Since we do not modify their model substantially but use it in a different setting, we only present an abridged derivation of their model.

prepared to bargain over location–specific profit (before wages) – that is, the additional profit available by producing locally.

Domestic post-tax profit is $\pi = F(K, N) - wN - rK - T$. (1)

$F(K, N)$ is a standard revenue function, depending on capital and labour, and the output price. ADM (2008) interpret F as value added. The cost of capital is rK. Corporation tax, levied at rate τ, is denoted T and defined as

$T = \tau [F(K, N) - wN - \alpha rK + \phi]$. (2)

Thus, the tax is levied on revenue net of wage payments and an allowance for the cost of capital, where α is a measure of the generosity of depreciation allowances.

Of course, there are many other factors which can affect the firm's tax position: interest payments, the extent to which taxable profit can be shifted abroad to a lower-tax country through manipulating transfer prices, stock relief, losses brought forward from an earlier period, or the contribution to an investment reserve or pension fund. These factors are not explicitly modelled, ADM (2008) include them all in the term ϕ . The existence of this term implies that tax liabilities may vary across firms which have the same revenue, wage payments and investment. In the empirical work, it is the existence of the factors incorporated in ϕ which allow the identification of the effects of the corporate income tax independently of F.

To close the model, ADM (2008) introduce the bargaining power of the firm, μ, which depends on the cost of the firm of a temporary dispute with the workforce, and the bargaining power of the union $(1-\mu)$, which may depend on the availability of alternative income to the workers in the event of a dispute. Assuming (a) that wages and employment are determined by a Nash bargain and (b) that the firm chooses its capital stock by maximising the net of tax profit, π, ADM (2008) arrive at three equations that jointly determine the values of the wage rate, w, the capital stock, K, and the number of workers employed, N. On this basis, they derive the following central equation of their theoretical model:

$$w \cong \mu \bar{w} + (1-\mu) \left\{ \frac{F(K,N) - (1+m)K}{N} - \frac{\tau\phi}{(1-\tau)N} - \frac{\pi^*}{(1-\tau)N} \right\}. \quad (3)$$

In equation (3) the wage is approximately equal to a weighted average of the outside wage and a share of the per-employee location-specific profit gross of wages. The deductibility of labour costs form taxable income implies that there are only three elements of the home country tax in the expression, as detailed below.

The capital expenditure effect captured in the term $\frac{F(K,N)-(1+m)K}{N}$ is the effect of less than full deductibility of capital expenditure. For a cash flow tax, the effective marginal tax rate (EMTR) m = 0 because in this case of full depreciation $\alpha = 1$.[2] In the more realistic case of $\alpha < 1$, the additional tax liability reduces the profit over which the firm and the union will bargain, which leads to a reduction of the wage rate. α varies across firms depending on the mix of assets invested in by the firm.

The wage bargain effect $\frac{\tau\phi}{(1-\tau)N}$ captures in ϕ all other factors that determine the tax liability and thereby also influence the size of the past-tax profit over which the firm is prepared to bargain. Conditional on other factors, a rise in ϕ induces a rise in tax and should lead to a reduction of the wage rate, since $\frac{\partial w}{\partial \phi} = -\frac{(1-\mu)}{N}\frac{\tau}{(1-\tau)} < 0$.

ADM (2008) describe this effect as the *direct* impact of taxation through the wage bargain: a rise in ϕ reduces the wage conditional on the levels of capital, employment and pre-tax profit. This is the effect identified in their empirical estimation when the wage rate is regressed on the tax liability per employee conditional on F/N, proxied by the value added per employee.[3]

[2] The effective marginal tax rate (EMTR) is defined as $m = \tau(1-\alpha)/(1-\tau)$, see ADM 2008, 10.

[3] ADM (2008) also discuss indirect effects, firstly of a change in ϕ, via a change in value added, *F* and secondly through the impact of the effective marginal tax rate *m* on the cost of capital in equation (2), see ADM 2008, 11-13.

2.2 A difference-in-differences approach to evaluate GBTR 2000

The event that gives rise to the quasi-experimental setting we exploit with the difference-in-differences approach is the German Business Tax Reform (GBTR) 2000. Box 1 describes the most important elements of the tax reform.

Box 1 The German Business Tax Reform 2000

With effect from January 1, 2001, the German tax reform has changed the corporation tax system, reduced corporation and personal income tax rates and broadened the tax base.

***Corporation tax system*:** The full imputation system that has been in force since 1977 has been abolished and instead a shareholder relief system has been introduced. Under the new system, only one half of the dividends received by a private shareholder are subject to personal income tax. At the same time, all deductions connected with dividend income from the income tax base are halved. However, other elements of private capital income such as interest receipts are still taxed at the full rate.

Corporation tax rates: The changes in the corporation tax rate cover both the structure and the level of the tax rate. The split-rate that distinguished between retained (40%) and distributed profits (30%) has been abolished and a single uniform tax rate of 25% has been introduced.

Corporation tax base: There has been a broadening of the tax base by cutting back the depreciation rules both for tangible fixed assets and for buildings. The maximum declining balance rate for tangible fixed assets has been reduced from 30% to 20%. For buildings, the straight-line depreciation has been reduced from 4% to 3%.

Income tax rates: The top marginal personal income tax rate has being lowered from 53% (55.92% including the solidarity levy of 5.5%) in three successive steps leading to a rate of 42% (44.31% including the solidarity levy) in 2005. The top marginal tax rate begins at a taxable income of Euro 52,152. For the year 2001 the top marginal rate has been set at 48.5%, and at 47% for 2003 an after.

Source: EU-Commission 2001, 102. Updated and abridged.

GBTR 2000 affected more or less the entire business tax system. The simultaneous modifications of corporate tax rates and income tax rates imply that both, the corporate sector and the non-corporate sector were simultaneously affected by the reform. This fact led us to a research design that tries to 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 respectively.

The most important selection criteria for a valid control group in this context is a flat evolution of the relevant corporate tax rate measures in a sufficient time span of several years before and after the German tax reform. We made the selection for France and Great Britain on the basis of the statutory tax rate (STR), the effective marginal tax rate (EMTR) and the effective average tax rate (EATR) of these countries. These measures capture different aspects of the respective corporate tax system: The statutory tax rate (STR) is the headline rate from tax law that dominates political debates although its economic relevance is limited because it abstracts from tax base effects. In lieu thereof, the effective marginal tax rate (EMTR)

integrates depreciation allowances and therefore it is the relevant measure with regard to investment decisions at the intensive margin, i.e. decisions about investments in already existing production facilities. The effective average tax rate in contrast displays the relevant tax burden for decisions at the extensive margin, i.e. the location choice for a new production facility.

Figure A1 shows the evolution of these corporate tax rate measures in Germany, France, Great Britain and Austria. The inclusion of Austria shows why it is not sufficient to consider only the statutory tax rates when choosing a comparison country: Whilst Austria looks like a near-to-perfect comparison country in the relevant time span from 1996 until 2005, except for the drop in the last year, this picture changes significantly if one considers instead the effective marginal tax rates (Figure A2) or the effective average tax rates (Figure A3).

Based on all three tax measures, Great Britain looks like a good choice as comparison country in a difference-in-differences approach: Except for minor variations in the first years (1996-1998) of the pre reform period, all three tax measures show a flat evolution. We therefore chose to run a first set of diff-in-diffs estimations with British manufacturing companies as a comparison group for the treatment group of German manufacturing companies.

France is a more difficult candidate since it experiences a downward trend in the first half of the relevant time span albeit there is no significant tax rate cutback like the one in Germany from 2000 to 2001. Since France and Germany are more similar to each other in a number of possibly relevant aspects (i.e. industry structure, intensity of labour market regulations, union coverage) than Great Britain and Germany, we decided to include France in a second set of difference-in-differences estimations.

The world never gives us
a clean incidence scenario
Arnold C. Harberger (2006)

3. Empirical Analysis

The following subchapters describe the data used (3.1), derive the econometric model (3.2) and discuss the results that we obtained in our estimations with British and French manufacturing companies as alternative comparison groups (3.3).

3.1 Data

Our empirical analysis is based on the pan-European database Amadeus compiled by the Bureau van Dijk (BvD) (2009). It contains detailed accounting information of more than 10 million companies from 41 countries, including the EU countries and Eastern Europe. A standard company report include 24 balance sheet items, 25 profit and loss items 26 ratios, descriptive information including trade description and activity codes.[4] Additional ownership information are collected by the BvD.

In this paper we focus on the direct impact of corporate income taxation on the workforce, therefore our analysis is restricted to companies of the corporate sector. Furthermore, we only use information from Germany, Great Britain and France over the period 1996-2005. Since we are interested in identifying the firm-level effects of tax liability on the labour force, we only keep companies for which unconsolidated data are available. Furthermore, we limit our sample to the manufacturing sector, in order to eliminate sector-specific effects. In addition self-employed are dropped, as well as all those working in the farming sector. This sample selection guarantees that the estimation results are not biased due to special rules in taxation law.

Following Arulampalam et al. (2008) we select only companies that were not defined as "micro" by the European Commission (2003), that is companies with at least two subsequent years of recorded total assets bigger than € 2,000 and at least one employee. Finally, all observations in the 5th and 95th percentile of the distribution for the main variables have been removed.[5] The remaining subsample contains data on 48,738 firms located in Germany (10,334), Great Britain (19,518) and France (18,886) over the period 1996-2005.[6]

[4] Source: http://www.bvdep.com/en/printAMADEUS.html.
[5] The main variables are costs per employees, number of employees, profit before tax per employee and tax bill per employee.
[6] A detailed overview is given in Table A1 in the Appendix.

3.2 Econometric Model

We employ the identification strategy for the direct effect of corporate income tax on wages as developed by ADM (2008) in two distinct difference-in-differences analysis. In a closely related and somewhat preparatory study to the one at hand, we successfully tested whether the original approach of ADM (2008) can be used with a dataset that only comprises the three countries Germany, France and Great Britain (aus dem Moore and Kasten 2009, forthcoming). Equation (4) shows the basic log-linear version derived from expression (3) that is at the centre of this empirical work, where the per-employee location-specific profit gross of wages is captured by two terms: profit before taxes per employee and tax bill per employee. Then, identification of the *direct* effect of taxation is straightforward: conditional on the other factors, the tax bill per employee term identifies the effect of ϕ on the wage rate.

$$\begin{aligned}\ln w_{it} = {} & \alpha + \beta_{01} \ln w_{i,t-1} + \beta_{02} \ln w_{i,t-2} + \beta_{10} \ln \tau_{it} + \beta_{11} \ln \tau_{i,t-1} + \beta_{12} \ln \tau_{i,t-2} \\ & + \beta_{20} \ln \pi_{it} + \beta_{21} \ln \pi_{i,t-1} + \beta_{22} \ln \pi_{i,t-2} + year_t + \mu_i + \varepsilon_{it}\end{aligned} . \qquad (4)$$

In equation (4), *i* and *t* index companies and years respectively. w_{it} is the wage rate[7] and τ_{it} the tax bill per employee. π_{it} indicates the profit before tax per employee and $year_t$ represents year dummies. The vector μ_i denotes all company-specific time-invariant effects and ε_{it} is the error term.

We use this specification as the basis for our analysis of the corporate income tax rate cut in the GBTR 2000 with the difference-in-diffences-approach. In this context, the (lagged) tax bill variables τ drop out of the equation because the tax effect should be captured by the difference-in-differences-indicator DiD_{it}. Equation (5) shows our baseline specification:

$$\begin{aligned}\ln w_{it} = {} & \alpha + \beta_{01} \ln w_{i,t-1} + \beta_{02} \ln w_{i,t-2} + \beta_{20} \ln \pi_{it} + \beta_{21} \ln \pi_{i,t-1} + \beta_{22} \ln \pi_{i,t-2} \\ & + DiD_{it} + treat + year_t + \mu_i + \varepsilon_{it}\end{aligned} . \qquad (5)$$

In equation (5), the treatment dummy *treat* is "1" for German companies and "0" otherwise. For each comparison country, we carried out two different regressions: In a *general* regression, we followed the standard difference-in-differences approach by defining *DID* as the product of *treat* and an auxiliary variable *period* that is „1" if the respective year falls in the post reform period and „0" for the years of the ante reform period: *DID = treat x period.* Thereby, *DID* is „1" for German companies in the post reform period and „0" otherwise. Since we capture time effects with the *year* dummy, the *period* dummy itself plays no role in the estimation.

[7] Since the individual wage rate is not available in the dataset, we calculate the labour costs per capita by dividing the total costs for employees by the number of employees.

In a *time-specific* regression, we try to identify the time dimension more precisely by defining a whole set of *DID* indicators as the products of the *treat* dummy and a dummy variable for each year of the post reform period: $DID_{2001} = treat \times year_{2001}$, $DID_{2002} = treat \times year_{2002}$, ... , $DID_{2005} = treat \times year_{2005}$.[8]

3.3 Estimation Results

As explained in Section 2.2 we chose Great Britain and France as two comparison countries for two separate difference-in-differences analyses of the German Business Tax Reform 2000. The following two subchapters present our estimations for Great Britain (3.3.1) and France (3.3.2), giving first the results of the *general* DiD-regression and subsequently the results of the time-specific DiD-regression.[9]

3.3.1 Germany versus Great Britain

Table 1 shows that the four different estimation methods consistently find a positive effect of GBTR 2000 on wages, the respective coefficients are significant at the one percent level except for the Difference-Generalized Method of Moments GMM estimation.[10] This result supports the theoretical hypothesis that a corporate tax rate cut enlarges the size of the firm-specific rent and should lead to a wage increase, if one assumes an unchanged power relation in the bargain between the firm and the union.

A closer look at Table 1 reveals that the magnitude of the coefficients varies considerably between the different estimation methods: The OLS and Fixed Effects estimations find only small coefficients of 0.0514 and 0.0876 respectively, whereas the System-GMM estimation leads to a significant coefficient of 1.2094. This value would imply that due to GBTR 2000 the wage rate in German manufacturing companies rose 1.21 percent in the post-reform-period compared to the counterfactual comparison scenario without the corporate tax rate cut.

Note that the post-reform period of this estimation runs from 2002 to 2005: Due to the dynamic specification of our econometric model with two lagged values of the dependent variable and the main independent variables, the year 2001 is affected by a mixture of influences with variables stemming from both, the legal pre-reform period (1996-2000) and the legal post-reform period (2001-2005). The year 2002 is the first year in which the

[8] In a preparatory step, we defined year-specific *DID* dummies for the whole time span from 1996 to 2005. Consistent with the theory of the difference-in-differences approach, all *DID* indicators for the pre-reform period 1996-2000 where either close to zero or insignificant (in OLS and FE estimations) or dropped out of the estimation due to multicollinearity (Difference-GMM and System-GMM estimations).

[9] To control for consistency we use four different techniques to estimate our models: the pooled OLS, the Fixed Effects (FE) estimation, as well as the more appropriate Generalized Method of Moments (GMM) techniques Difference-GMM and System-GMM.

[10] We use the Stata command *xtabond2* to estimate our models using the Generalized Method of Moments (GMM) technique (Roodman 2006).

economically important first lag of the wage rate stems from the legal post-reform period. We therefore defined our *period* variable accordingly: *period* = „1“ for the years 2002 to 2005, *period* = „0“ for the years before.[11]

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-	0.0514***	0.0876***	0.4525	1.2094***
Differences (*DiD*)	(0.0109)	(0.0153)	(0.2944)	(0.4441)
Treatment Group	-0.0262***			-1.1010**
(*Treat*)	(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	-0.0027**	0.0042***	-0.0029	-0.0028
(t-1)	(0.0011)	(0.0013)	(0.0043)	(0.0034)
Log. profit per employee	-0.0024**	0.0037***	0.0003	-0.0014**
(t-2)	(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).

The coefficients for the other explaining variables appear to be in line with the theoretical framework: In all columns, the lagged log wage rate (t-1) has the largest explanatory power for the current wage, with coefficient values ranging from 0.2236 (Difference-GMM) to 0.6298 (FE). The twice lagged wage rate (t-2) also exhibits a positive, but smaller effect as expected. The profit per employee also shows the expected positive coefficient across the four estimation methods at least in the current period. Though, coefficients for the lagged values of profit per employee show no clear picture. This is no reason to worry since the coefficients are very small and economically irrelevant.

The results of the time-specific estimation displayed in Table 2 shed more light on the temporal dimension but the overall impression from Table 1 remains unchanged. OLS and

[11] This discrepancy between legal and economic period definitions applies likewise for the general DiD-analysis in the case Germany versus France presented in subchapter 3.3.2.

FE show negative effects only in the overlapping years 2001 and 2002 where lagged variables stem from the pre-reform period as explained above. But in 2003, the respective coefficients turn positive, pointing at the wage increasing effect of GBTR 2000.

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).

The results of the time-specific GMM-estimations also confirm the findings of the general estimations. Both methods lead to positive coefficients for the respective *DID* variable from 2002 onwards whereas only the coefficients estimated by System-GMM are statistically significant. In column (4), the largest effect with a significant coefficient of 1.0789 is displayed for the year 2003. That comes as no surprise since 2003 is the first year of the post-reform period without any overlaps from the pre-reform period due to lagged variables. The result of a two year time spread between the tax cut in 2001 and a significant wage effect in 2003 could also be interpreted as pointing toward delays due to time requirements of wage

negotiations or the simple fact that wage agreements in Germany usually have a duration of one to two years.

Summing up the difference-in-differences analyses with British companies as comparison country, we find strong evidence for a positive wage effect of the corporate tax rate cut that was a central element of the German Business Tax Reform 2000.

3.3.2 Germany versus France

Table 3 displays the results of the *general DiD-analysis* for the scenario with French manufacturing companies as comparison group. Overall, this estimation leads to a more ambiguous picture than the above scenario with British companies. The GMM estimations in columns (3) and (4) exhibit positive but insignificant coefficients. Only the FE estimation reports in column (2) a positive wage effect of GBTR 2000 that is significant at the 10 percent level.

Table 3
General Difference-in-Differences-Analysis; Comparison Group: **France**;
Dependent Variable: Log. wage rate

	OLS (robust) (1)	**Fixed Effects (robust) (2)**	**Difference-GMM (3)**	**System-GMM (1)**
Log. wage rate (t-1)	0.6383***	0.0238*	0.3517***	0.4603***
	(0.0094)	(0.0127)	(0.0127)	(0.0202)
Log. wage rate (t-2)	0.2823***	-0.0421***	-0.0421***	0.1294***
	(0.0091)	(0.0096)	(0.0159)	(0.0140)
Difference-in-	-0.0031	0.0250*	0.0168	0.0552
Differences (*DiD*)	(0.0105)	(0.0149)	(0.0213)	(0.0632)
Treatment Group	0.0210**			0.0392
(*Treat*)	(0.0097)			(0.0634)
Log. profit per employee	0.0125***	0.0119***	-0.0115	-0.0020
	(0.0007)	(0.0009)	(0.0133)	(0.0064)
Log. profit per employee	-0.0058***	0.0001	0.0034	0.0031
(t-1)	(0.0008)	(0.0009)	(0.0040)	(0.0029)
Log. profit per employee	-0.0026***	0.0017*	0.0009	0.0018
(t-2)	(0.0007)	(0.0009)	(0.0013)	(0.0013)
Observations	25,107	25,107	16,080	25,107
Firms	8,562	8,562	6,045	8,562
Instruments			48	71
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.82			
Within- R^2		0.04		
AR(1) – p-value	0.000	0.000	0.000	0.000
AR(2) – p-value			0.135	0.269
Hansen χ^2-test – p-value			0.243	0.201

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).

The coefficients for the other explaining variables underline the lack of stability in this estimation: The variable with the largest explanatory power, i.e. the lagged log wage rate (t-1), shows the expected sign and magnitude in all columns, with significance at the one percent level in OLS, Difference- and System-GMM and significance at the ten percent level in the remaining FE estimation. The results for log profit per employee are less convincing since the GMM estimations in columns (3) and (4) lead to insignificant coefficients.[12]

Table 4
Time-specific Difference-in-Differences-Analysis; Comparison Group: **France**;
Dependent Variable: Log. wage rate

	OLS (robust) (1)	**Fixed Effects (robust) (2)**	**Difference-GMM (3)**	**System-GMM (1)**
Log. wage rate (t-1)	0.6382***	0.0239**	0.3509***	0.4600***
	(0.0094)	(0.0127)	(0.0405)	(0.0201)
Log. wage rate (t-2)	0.2823***	-0.0421***	0.0995***	0.1298***
	(0.0091)	0.0096	(0.0167)	(0.0139)
DiD_2001	-0.0058	-0.0212	-0.0622	0.2091
	(0.0142)	(0.0178)	(0.1808)	(0.3697)
DiD_2002			-0.0520	
			(0.1808)	
DiD_2003	0.0002	0.0126	0.0067	0.1036
	(0.0136)	(0.0207)	(0.0558)	(0.2169)
DiD_2004	-0.0044	0.0085	0.0176**	0.0560
	(0.0136)	(0.0223)	(0.0083)	(0.2160)
DiD_2005	-0.0160	-0.0049		0.0471
	(0.0114)	(0.0224)		(0.2000)
Treatment Group	0.0268***			0.0317
(*Treat*)	(0.0103)			(0.1972)
Log. profit per employee	0.0125***	0.0119***	-0.0111	-0.0016
	(0.0007)	(0.0009)	(0.0133)	(0.0064)
Log. profit per employee	-0.0058***	0.0001	0.0033	0.0030
(t-1)	(0.0008)	(0.0009)	(0.0041)	(0.0029)
Log. profit per employee	-0.0026***	0.0017*	0.0010	0.0018
(t-2)	(0.0007)	(0.0009)	(0.0013)	(0.0013)
Observations	25,107	25,107	16,080	25,107
Firms	8,562	8,562	6,045	8,562
Instruments			48	71
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.82			
Within- R^2		0.04		
AR(1) – p-value	0.000	0.000	0.000	0.000
AR(2) – p-value			0.137	0.243
Hansen χ^2-test – p-value			0.384	0.244

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).

[12] For the estimation results reported in Table 3, the overlap problem caused by our dynamic model required the same adjustment of the economic pre- and post-reform periods (pre: 1996-2001; post: 2002-2005) apply with respect of the legal pre- and post-reform period (pre: 1996-2000; post: 2001-2005). The *DID* dummy in Table 3 therefore measures the wage effect due to GBTR 2000 for German manufacturing companies in the years 2002 to 2005.

In comparison to the British case summarized in Table 1, the overall picture of this general DiD-analysis seems to confirm the presumption enunciated at the end of subchapter 2.2 that due to changes in its own corporate tax system France might be less well suited as comparison country than Great Britain. The higher degree of ambiguity in the comparison with French companies continues in Table 4 that reports the results of our time-specific DiD-analysis for the French case. But the most important result of the estimations above tends to be confirmed by positive albeit not significant coefficient values for the DiD dummy of 2003. The only significant value for a DID dummy shows up in column (3) for the DiD dummy of 2004. The coefficients for the main explanatory variables are again broadly in line with the theoretical model: The lagged log wage rate (t-1) is positive and highly significant and the significant values for the profit per employee also go into the right direction.

In fact, a corporate rate cut would help a lot of voters,
though they might not know it. A corporation is not really
a taxpayer at all. It is more like a tax collector.
The ultimate payers of the corporate tax are those individuals who
have some stake in the company on which the tax is levied.
N. Gergory Mankiw (2008)

4. Conclusions

In this study, we tried to identify wage effects of the German Business Tax Reform 2000 (GBTR 2000) in the German manufacturing sector. A central element of this comprehensive reform package was the replacement of a split-rate system that distinguished between retained (40%) and distributed profits (30%) by a single uniform tax rate of 25 percent with effect from January 2001.

We used the framework proposed by Arulampalam, Devereux and Maffini (2008) for the *direct* incidence of the corporate income tax on wages as our theoretical starting point and transformed their model to fit in a difference-in-differences approach. We used a large database with data on 48,738 firms located in Germany (10,334), Great Britain (19,518) and France (18,886) over the period 1996-2005.

In two separate analyses, we compared a sample of German companies with comparison groups of British and French companies respectively. For each comparison group, we first performed a *general* difference-in-difference analysis that measured the effect in the post-reform period compared to the pre-reform period. In a second step, we tried to capture the temporal dimension of the wage effect more precisely through a *time-specific* difference-in-differences analysis.

Our results for the British case strongly support the hypothesis of a positive wage effect of the corporate tax rate cut from GBTR 2000. In the *general* analysis, we find a highly significant coefficient which would imply that wages in the manufacturing sector rose 1.21 percent due to the cutback in German corporate taxes. The *time-specific* analysis confirms this result. We find positive and highly significant coefficients for each year between 2002 and 2005. For the year 2003 alone, when the full reform effect can show up in the data for the first time, we find a positive wage effect of 1.08 percent.

In the French case, we find more ambiguous results that, on its own, would not allow a clear conclusion concerning the wage effects of the corporate tax rate cut. However, against the backdrop of the fairly convincing results form the British case, we tend to judge these results as corroborating hints for positive wage effects of the German Business Tax Reform 2000 in the manufacturing sector.

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Appendix

Table A1
Number of observations per country and year

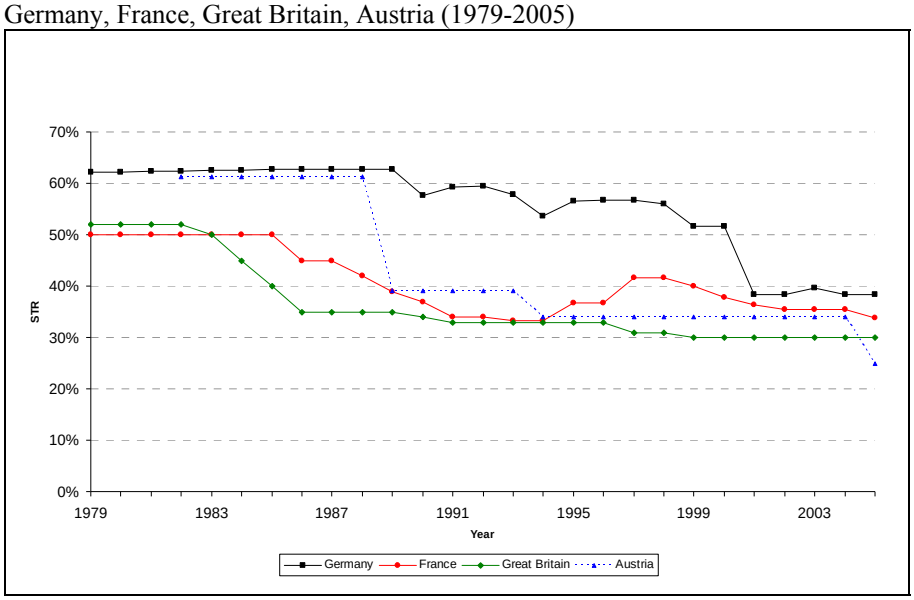
Year	Number of observations			
	Germany	Great Britain	France	**Total**
1996	10,334	19,208	18,886	48,428
1997	10,331	17,704	18,886	46,921
1998	10,322	16,105	16,016	42,443
1999	10,249	16,047	15,561	41,857
2000	10,198	15,839	15,309	41,346
2001	10,008	15,564	15,159	40,731
2002	9,770	15,400	15,091	40,261
2003	9,658	15,469	14,998	40,125
2004	9,479	15,821	14,720	40,020
2005	9,015	15,681	14,603	39,299
Total	99,364	162,838	159,229	421,431

Table A2
Descriptive statistics of the main variables

Variables	**Germany**		**Great Britain**		**France**	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Employees	191.57	144.05	112.69	104.95	86.66	97.95
Log. employees	4.94	0.84	4.39	0.81	4.03	0.88
Costs per employee	45.33	10.08	37.18	9.35	37.36	8.69
Tax liability	522.40	5,642.80	252.52	2,955.80	186.52	1,748.32
Tax liability per capita	2.14	2.85	2.06	2.48	2.26	2.69
Profit before tax	1,927.59	21,020.88	989.56	35,184.53	592.76	7,839.84
Profit per capita	7.00	9.16	6.39	8.88	6.47	8.80

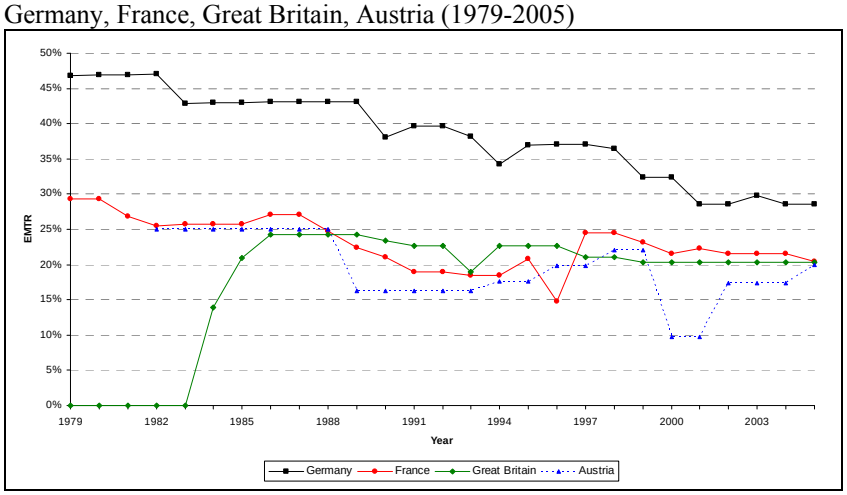
Note: All monetary values are in 2000 prices.

Figure A1
Statutory Tax Rates (STR)
Germany, France, Great Britain, Austria (1979-2005)



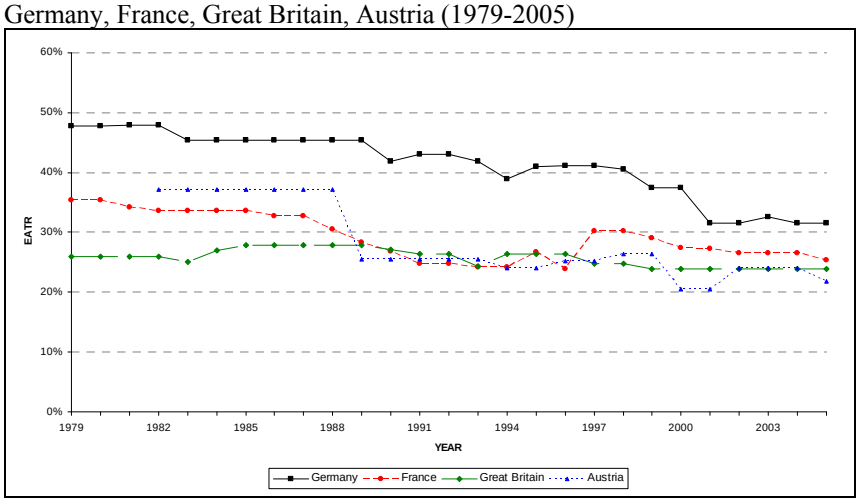
Source: Klemm (2005).

Figure A2
Effective Marginal Tax Rates (EMTR)
Germany, France, Great Britain, Austria (1979-2005)



Source: Klemm (2005).

Figure A3
Effective Average Tax Rates (EATR)
Germany, France, Great Britain, Austria (1979-2005)



Source: Klemm (2005).