Do wages rise when corporate tax rates fall?

Evidence from the German Business Tax Reform 2000

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Abstract

We evaluate the wage effect of the German Business Tax Reform 2000 (GBTR 2000) through a combination of the bargaining model for the direct incidence of the corporate income tax and the difference-in-differences approach. Since all firms in Germany are more or less affected by the reform our analysis is based on a counterfactual comparison of German and French manufacturing companies over the period 1996-2005. We find a significant and positive wage effect of GBTR 2000 which suggests that wages in the post-reform period were on average 6.4% higher due to the direct incidence of the wage bargaining channel. However, basic robustness checks cast some doubt on the significance of the effect. Therefore, further research is clearly warranted.

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1. Introduction

The last three decades saw considerable reforms to corporate income taxes in industrialized countries. A downward trend was most pronounced between the early 1980s and the end of the 1990s. In this period, corporate income taxes in OECD countries fell from an average of 48% to 35% (Devereux, Griffith and Klemm 2002). Germany was one of the last countries to jump on the corporate tax cut bandwagon when it abandoned its split-rate system of 40% for retained and 30% for distributed profits in favor of a single uniform corporate tax rate of 25% in 2001. We use this comprehensive German Business Tax Reform 2000 (in the following: GBTR 2000) as a quasi-experiment to shed some light on the empirical question of the effective incidence of the corporate income tax on wages. We employ a modification of the wage bargaining model of the direct incidence proposed by Arulampalam, Devereux and Maffini 2010 (in the following: ADM 2010) in a regression formulation of the difference-in-differences (DiD) approach. This research design enables us to gain some insight on our research question: Do wages rise when corporate taxes fall?

Our paper links the vast literature of (corporate) tax competition to the small but growing literature on effective incidence of corporate taxation. 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 labor, 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 characterized 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) who came to the conclusion that the tax is borne entirely by owners of capital. The second strand of the literature gives up the crucial assumption of a closed economy. It assumes instead that capital is perfectly mobile between countries, but labor is not. In this setting, a (higher) tax on corporate income tends to shift capital to the rest of the world. This outflow of capital reduces the return to labor and the home country labor force effectively bears the entire burden of the tax (Bradford 1978, Kotlikoff and Summers 1987, Gordon 1986).

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 Randolph (2006), Gravelle and Smetters (2006), Gravelle (2010), 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: ADM (2010); Desai, Foley and Hines (2007); Felix (2007); Felix and Hines (2009); Hassett and Mathur (2006); Liu (2009). These papers present new evidence on the incidence of the corporate income tax. Instead of trying to measure how corporate taxes affect rates of return on investment, these papers concentrate on whether corporate taxes reduce wages. Despite many methodological differences across the studies, these papers all come to the conclusion that labor bears a substantial burden of the corporate tax. ADM (2010) find a long-run elasticity of the wage bill due to taxation of -0.093. Evaluated at the mean, this implies that a tax increase of $1 is associated with a wage cut of 49 cents. Desai, Foley and Hines (2007) show that 45-75 percent of the burden of the corporate tax is borne by labor. The central result of Felix (2007) is that a rise of ten percentage points in tax drops mean annual gross wages by seven percent. Felix and Hines (2009) estimate that a 1 percent cut of state corporate tax rates yields a 0.36 percent higher wage premium. Hassett and Mathur (2006) detect that a 1 percent increase in corporate tax rates reduces wage rates by nearly 1 percent. The analysis of Liu (2009) leads to a 0.042 percent decrease of weekly wages due to a ten percent rise in the marginal effective tax rate. A first review of this literature was provided by Gentry (2007). Substantial methodological questions to some of the studies are raised by Gravelle and Hungerford (2010).

In this paper we extend the literature by using the approach of ADM (2010) in a regression formulation of the difference-in-differences (DiD) model. We identify the direct incidence of the GBTR 2000 on wages in the German manufacturing industry through a counterfactual research design that uses manufacturing companies in France as a comparison group. We find suggestive evidence that GBTR 2000 led to an accumulated average effect due to the direct incidence on wages of 6,4% in the years 2001 to 2005 compared to the counterfactual situation without the tax reform. The remainder of this paper proceeds as follows: Section II sketches the GBTR 2000, section III discusses the research design, section IV presents our empirical analysis and section V concludes.

2. The German Business Tax Reform (GBTR) 2000

The German Business Tax Reform (GBTR) 2000 was motivated by concerns about the international competitiveness of corporate income taxation in Germany. One of its goals was to make Germany a more attractive location for international investment. 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 been 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.

One of the most important elements of the GBTR 2000 is the harmonization and considerable reduction of the split corporation tax rate to 25%. This motivates the question whether this tax rate cut led to a significant wage effect. As shown in Box 1, GBTR 2000 affected more or less the entire business tax system in Germany. The simultaneous modifications of corporate tax rates and income tax rates imply that both, the corporate sector and the non-corporate sector were concurrently affected by the reform. This fact prevents us from implementing a difference-in-differences (DiD) approach based on a comparison within Germany of incorporated companies which are liable to corporate income taxation and non-incorporated firms which are not affected by changes of corporate tax rates. Hence, to identify the effect of the German corporate tax rate cut on wages, we need to find a comparison country similar to the German economy in which the relevant taxation remain fairly constant in an adequate time span around the GBTR 2000. A detailed description of our research design is given below.

3. Research Design

Our analysis is based on a modification of the bargaining model for the direct incidence of the corporate income tax proposed by ADM (2010). We try to identify the direct wage effect of the corporate tax rate cut due to the GBTR 2000 by using a modified bargaining model in a regression formulation of the difference-in-differences approach (henceforth: regression DiD). In subsection 3.1 we give an overview of the underlying bargaining framework. Subsection 3.2 describes the choice of an adequate comparison country.

3.1 Bargaining Framework

In the theoretical literature there are two well-established channels of *indirect* incidence of the corporate income tax on wages: one is caused by responses of investment (capital stock channel, substitution effect), the other is induced by the reaction of output prices. These two channels both affect the level of pre-tax profit. The capital stock channel is also responsible for the deadweight loss of the corporate income due to tax-induced changes in the behavior of the company. The direct incidence model of the corporate income tax derived by ADM (2010) establishes a new mechanism by which corporate taxes may be passed on in lower wages. This new wage bargain channel arises from the empirical literature on rent-sharing between workers and firms: For a given pre-tax profit of a firm, a higher (lower) tax bill will directly reduce (enlarge) the quasi-rent over which workers and firms can bargain. This conceptual framework leads ADM (2010) to an empirical specification for wages of the form

$$w = w(f, \mu, \overline{w}, \overline{\phi}) \qquad (1)$$

where f is the value added per employee, μ represents the union relative bargaining power, $\overline{w}$ the outside option for workers and $\overline{\phi}$ contains variables to capture the tax liabilities of the firms. In the econometric implementation, they specify a general dynamic model of the form

$$w_{it} = \sum_{j=1}^{2} \gamma_j w_{i,t-j} + \sum_{j=1}^{2} \beta_j x_{i,t-j} + \alpha_i + \alpha_t + \varepsilon_{it} \qquad (2)$$

where i and t index companies and years respectively and w is the log wage rate. The log of value added per employee, the tax liability per employee, various firm-level control variables and variables associated with wage bargaining such as outside wage and union density are all included in x. By controlling for the pre-tax profit, proxied by added value, ADM (2010) isolate the *direct* incidence of corporate income taxation due to the wage bargaining channel from the *indirect* effects. The possibility to empirically detect the direct wage effect by estimating it on the basis of firm-level accounting data motivates us to build our regression DiD approach on this bargaining model.

3.2 Choice of Comparison Country

To evaluate the direct incidence of GBTR 2000 by implementing the regression DiD approach we have to find a suitable control group outside Germany since all corporations in Germany are affected by the tax reform. The choice of a comparison country is based on three dimensions: the general comparability of a country with Germany with regard to the economic structure and the macroeconomic conditions, the stability of the corporate tax system in a relevant time span before and after GBTR 2000 and the question of data availability. The ideal comparison country should be similar to Germany in economic structure and macroeconomic situation, would possess a corporate tax system without any changes during our observation period, and comprehensive data. We start with France, the United Kingdom and Austria as three possible candidate countries since we have access to comprehensive information about the evolution of their corporate tax system based on Klemm (2005). Table A.1.1 gives a compressed overview of relevant variables with respect to size (population, nominal GDP), economic structure (nominal GDP per capita, output share of manufacturing, GDP share of trade), features of the labor market (wage bargaining system, union density, collective bargaining coverage, labor compensation per hour, hours worked) and the macroeconomic situation (unemployment rate, growth in nominal GDP) in Germany and these three possible source countries for our comparison group. A closer look at the eleven variables we select for this comparison reveals that there is no clear winner who comes close to the ideal of being an economic twin of Germany. Every candidate looks quite good in some dimensions and rather bad in others. However, not all dimensions have the same critical importance: In our regression DiD approach, we should be able to control for deviations in the macroeconomic evolution over time through country-specific and time-varying control variables like GDP or unemployment rates. If we focus on the more structural attributes and their change over time (displayed in the respective Δ columns either as a percentage change for base values in levels or as a change in percentage points if base values are percentages) France and Austria seem to be better suited as a comparison country than the United Kingdom.

Of critical importance as a selection criterion for a valid comparison group, beyond the variables in Table A.1.1, is in our context a roughly flat evolution of the relevant corporate tax rate measures in a sufficient time span of several years before and after the German tax reform. Figures A.3.1 to A.3.3 show the evolution of the statutory tax rate (STR), the effective marginal tax rate (EMTR) and the effective average tax rate (EATR) in Germany, France, UK and Austria. 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. The case 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 A.3.2) or the effective average tax rates (Figure A.3.3).

We finally choose France as comparison country because the relevant corporate tax rates remain fairly constant during the period of study, because it is similar to Germany in a number of possibly relevant aspects and because the data quality for France in our accounting data base is quite good.

4. Empirical Analysis

The following subchapters describe the database (4.1), derive the econometric model (4.2), present the estimation results (4.3) and discuss issues of robustness and possible threats to identification (4.4).

4.1 Data

Our empirical analysis is based on the pan-European database AMADEUS compiled by the Bureau van Dijk (BvD) (2009). The dataset contains detailed accounting information on more than 10 million companies from 41 countries, including the EU countries and Eastern Europe. A standard company report includes 24 balance sheet items, 26 ratios, 25 profit and loss items and descriptive information including trade descriptions and activity codes. The empirical approach used in this contribution requires a great number of observations for at least four subsequent years in both the period before and after the implementation of GBTR 2000. Therefore, we merged two updates of the dataset from the years 2006 and 2008 to cover a time span from 1996 to 2005 with detailed accounting information from Germany and France. We limit our sample to the manufacturing industry to improve comparability between firms from Germany and France. Furthermore, we only explore quoted companies, because in the dataset there is more comprehensive and complete information available for quoted than for non-quoted firms, especially for Germany. Following ADM (2010) we then only select companies that are 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 first and 99th percentile of the

distribution for the main variables[1] have been removed. Our final dataset contains information on 208 firms in Germany and 201 firms in France. Tables A.1.2 and A.1.3 show the summary statistics of the selected database.

4.2 Econometric Model

Since we want to evaluate the direct incidence effect of GBTR 2000 as a policy intervention, the tax liability per employee as the explanatory variable of interest in the ADM framework (see equation (2)) drops out of x in our regression DiD approach. Equation (3) shows our preferred specification:

$$\begin{aligned}\ln w_{it} = {} & \alpha + \beta_{10}\ln w_{i,t-1} + \beta_{11}\ln w_{i,t-2} + \beta_{20}\ln av_{i,t-1} + \beta_{21}\ln av_{i,t-2} \\ & + \beta_{30} treat_j + \beta_{31} period_t + \beta_{32} DiD_{jt} + \beta_{40} unempl_{jt} + year_t + \mu_i + \varepsilon_{it},\end{aligned} \tag{3}$$

where i, j and t index companies, countries and years respectively and w_{it} is the wage rate. Since we are only interested in detecting the direct incidence effect of the GBTR 2000 on the labor force, i.e. the wage effect of the tax rate cut arising from the bargaining channel, we control for the indirect incidence effects of corporate income taxation by including av_{it} in equation (3). av_{it} represents the added value reported in the firms' balance sheets. $treat_j$ is a dummy variable that indicates the treatment group in our quasi-experimental setting. Thus, $treat_j$ equals "1" if the firm is located in Germany and "0" for French companies. The time dummy $period_t$ is an auxiliary variable that is "1" if the respective year falls in the post reform period (2001-2005) and "0" if it is located in the time span before the GBTR 2000 (1996-2000). We follow the standard difference-in-differences approach by defining DiD_{jt} as the product of treat and period: $DiD_{jt} = treat_j$ x $period_t$. Therefore, DiD_{jt} is "1" for German companies in the post reform period and "0" otherwise.

Under the assumption that firms earn economic rents over which employers and employees may bargain, the extent of the wage rate essentially depends on the bargaining power of both negotiating partners. By adding a country-specific and time-varying unemployment rate ($unempl_{jt}$) in our estimation model we try to capture the bargaining power of the employees at least to some extent. In the context of the bargaining model we assume that the assertiveness of the union declines with higher unemployment rates.

By using year dummies $year_t$ we account for general time effects. Additionally, we include the vector μ_i in equation (3) to capture the company-specific time-invariant effects. ε_{it} represents the overall error term. In order to adjust for inflation, all monetary variables in model (3) are deflated to year 2000 prices by using the country- and year-specific Consumer Price Indices (CPI) provided by the OECD.

[1] The main variables are costs per employees, number of employees, added value per employee and tax bill per employee.

4.3 Estimation Results

We estimate our preferred dynamic specification (3) using four different estimation techniques[2]: We run pooled Ordinary Least Squares (OLS) and Fixed Effects (FE) as well as two variants of the Generalized Methods of Moments (GMM) – "Difference GMM" and "System GMM".[3] As commonly known OLS and FE estimates are inconsistent in a dynamic context, but they enable us to control for plausibility of our results. Where OLS overestimates the coefficients of the lagged dependent variables $w_{i,t-1}$ and $w_{i,t-2,}$ FE leads to underestimation. This implies that credible GMM results should fall between these bounds (Blundell, Bond and Windmeijer 2000). Table 1 summarizes the estimation results of our baseline specification.[4]

Table 1 – Difference-in-Differences-Analysis; Basic Specification;
Dependent Variable: Log. wage rate

	OLS (cluster) (1)	**Fixed Effects (cluster) (2)**	**Difference-GMM (3)**	**System-GMM (4)**
Log. wage rate (t-1)	0.5248***	0.1052**	0.0942	0.3863***
	(0.0432)	(0.0512)	(0.0686)	(0.0546)
Log. wage rate (t-2)	0.2114***	-0.1695***	-0.1021*	0.0452
	(0.0344)	(0.0529)	(0.0554)	(0.0430)
Difference-in-Differences (*DiD*)	0.0353	0.0531	0.0502	0.0644**
	(0.0411)	(0.0375)	(0.0322)	(0.0310)
Treatment Group (*Treat*)	-0.0098			-0.0070
	(0.0352)			(0.0303)
Log. *av* per employee	0.4290***	0.4123***	0.2727***	0.4364***
	(0.0606)	(0.0555)	(0.0877)	(0.0865)
Log. *av* per employee (t-1)	-0.1994***	-0.0568	-0.0871*	-0.1557***
	(0.0503)	(0.0476)	(0.0484)	(0.0560)
Log. *av* per employee (t-2)	-0.0774***	0.0640*	0.0396	0.0050
	(0.0249)	(0.0345)	(0.0314)	(0.0253)
Unemployment rate (*unempl)*	-0.0194	-0.0237*	-0.0401**	-0.0283**
	(0.0146)	(0.0142)	(0.0164)	(0.0123)
Observations	1,468	1,468	1,147	1,468
Firms	285	285	262	285
Instruments			79	111
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.76	0.50		
Within – R^2		0.40		
AR(1) – p-value	0.000	0.000	0.000	0.000
AR(2) – p-value			0.378	0.197
Hansen χ^2-test – p-value			0.578	0.399

Notes: (i) Year dummies and a constant term are included in all estimates. (ii) The standard errors are reported in parentheses. (iii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level. (vi) Columns (3) and (4) show results of two-step estimators with finite sample correction.

[2] The choice of two lags for the wage is necessary to capture adequately the high degree of wage persistence.
[3] We use the Stata command *xtabond2* to estimate our model using the GMM technique, see Roodman (2006).
[4] In an extended version we additionally control for the country- and time-specific gross domestic product. The corresponding results are reported in Table A.2.1 in the Appendix.

The results in Table 1 show that only System GMM leads to an estimate of the coefficient of the lagged dependent variable *Log wage rate (t-1)* of 0.39 that lies between the upward-biased OLS estimate (0.52) and the downward-biased FE estimate (0.11). The diagnostic tests for this estimation are also satisfactorily: The test for first order serial correlation is rejected, but the test for second order serial correlation is not. This means that the crucial condition of no serial correlation in the errors of the levels equation is fulfilled. The Hansen test for over-identification is not rejected. We can therefore concentrate our interpretation on the System GMM results in column (4).

As expected, the coefficients for the lagged wage rate and for the added value per worker are highly significant at the one percent level and of considerable but not implausible size (0.39 and 0.44 respectively). Although it is only measured at the country-level, the unemployment rate has a significant and, as expected, negative effect on the wage rate (-0.03). Our very parsimonious model therefore seems to capture quite well the most important drivers of wages at the firm-level.

Turning to the three variables that define our DiD framework, we first note that, as expected, $period_t$ dropped out of the equation due to collinearity with the included $year_t$ dummies. The insignificance of $treat_j$ shows that after inclusion of the control variables at firm- and country-level, there were no statistically significant differences left between German and French companies that showed up over the whole time-span from 1996 to 2005. Against this backdrop, the coefficient value 0.064 of the interaction term DiD_{jt} which is significant at the 5% level suggests that GBTR 2000 led to an accumulated average effect due to the direct incidence of 6.4% in the years 2001 to 2005 compared to the counterfactual situation without the corporate tax reform. In an extended specification that includes the growth rate of real GDP as a further macroeconomic control variable, the System GMM estimation leads to an even higher DID_{jt} coefficient of 0.072 which is also significant at the 5% level (see Table A.2.1 in the appendix). But since the coefficient on GDP is insignificant, we keep the specification above as our main result.

4.4 Robustness

The robustness of our result depends on the validity of our identification strategy and the sensitivity of our results to changes in the estimated specification. There are several threats to our identification strategy which are linked on the one hand to the firm-level data we use and on the other hand to the comparison between companies from Germany and France. Firstly, we had to use consolidated accounts of quoted companies to ensure the necessary density of observations for the German companies that is needed for the estimation of a dynamic model,

especially if one has to employ the data consuming GMM methods. As a result, the information in these accounts does not only result from the business activity in Germany but, for the multinational groups in our dataset, also from their international facilities. The resulting composition effect does not necessarily invalidate the use of the bargaining model from ADM (2010) as our conceptual framework, since the empirical study of Budd, Konings and Slaughter (2005) suggests that the domestic labor forces of multinational enterprises bargain over the aggregate profits at group level, not only over the domestic share of these profits. However, it would be a reasonable refinement of our analysis to distinguish purely national from multinational companies in future versions of the present study. Secondly, our wage rate is a very rough measure since it is constructed by dividing the total cost of employees by the number of employees. Due to this construction a layoff of workers might, given unchanged overhead costs, lead to an artificial rise of our wage rate. To control for this employment effect, we included the number of employees in an extension of our preferred specification but its coefficient was very small and not significant.[5] Thirdly, we report only the results of a very parsimonious model that does not include further variables with a likely impact on the tax situation of a firm like its debt ratio or its capital intensity. We included these variables in extensions of the baseline specification but none of them was found to be significant.

With respect to the validity of the comparison between manufacturing companies from Germany and France, the ideal *ceteris paribus* condition of no changes over time except for GBTR 2000 was of course not fulfilled in the real world. There were a number of reforms and policy changes that possibly had an impact on wages in both countries. The most obvious disturbance might result from changes in social security contributions. At the present stage of this study we have to assume that they are roughly constant over time. In further work it will be necessary to incorporate time series of social security contributions to adequately control for their share in the costs of employees that is the basis for our wage rate variable.

To check the sensitivity of our baseline result we followed a simple aggregation procedure proposed by Betrand, Duflo and Mullainathan (BDM 2004) and experimented with different instrument sets in the implementation of the System GMM technique. If we ignore the time-series information by averaging the data before and after the law and run a static OLS regression on the resulting panel of length 2 as advocated by BDM (2004: 267), all coefficients except the one for added value turn insignificant. This result does not support the claim of a significant wage effect of GBTR 2000 but it does not entirely preclude it either since the time-series information is obviously an important part of the model in a dynamic

[5] The results of all reported robustness checks are available from the authors upon request.

context and the application of GMM techniques. That simple means of our variables before and after GBTR 2000 do not reveal by themselves a significant DiD effect was the reason why we set up a regression DiD framework in the first place.

A second source of doubt, in our study as in almost every implementation of the System GMM technique, is the influence of the variable sets used for instrumentation. Our results are not immune to changes in the size or composition of the instrument set used. The significance of the DiD variable vanishes if we restrict the instrument set by collapsing the instruments (through the Stata command *collapse*) or if we restrict the instrument set to include only levels of the exogenous variables (through the Stata option *eq(level)* applied to the definition of the *ivstyle* set of exogenous standard instruments). However, the imperative to reduce the size or the composition of the instrument set is not present in our preferred estimation: Given a benign ratio of 111 instruments used in an estimation with 285 groups (firms), our results should not be driven by instrument inflation.

5. Conclusion

We use the bargaining model for the direct incidence of the corporate income tax proposed by ADM (2010) as the basis of a regression formulation of the difference-in-differences model to identify the wage effect of GBTR 2000 for workers in the German manufacturing sector. We use manufacturing companies in France as the comparison group. We estimate a dynamic model to account for adjustment lags with OLS, Fixed Effects and GMM techniques. Our preferred System GMM specification suggests that GBTR 2000 led to a significant accumulated average effect due to the direct incidence of a 6.4% rise in wages in the years 2001 to 2005 compared to the counterfactual situation without the corporate tax reform. This result, however, is not entirely robust in alternative specifications and weakened by threats to our identification strategy that have to be addressed in future refinements of the present study.

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Appendix

A.1 Descriptive Statistics

Table A.1.1 – OECD country profiles for Germany and France (selected Variables)

	Germany			France			United Kingdom			Austria		
Variable	1996	2005	Δ	1996	2005	Δ	1996	2005	Δ	1996	2005	Δ
Population (m. USD)	81.915	82.469	0,7%	58.026	60.996	5,1%	58.164	60.238	3,6%	18.311	20.395	11,4%
nom. GDP (bn. USD)	1.892	2.588	36,8%	1.243	1.869	50,4%	1.220	1.969	61,4%	412,27	696,83	69,0%
nom. GDP per capita (USD)	23.098	31.380	35,9%	20.845	29.759	42,8%	20.977	32.695	55,9%	21.600	32.586	50,9%
Output share of manufacturing*	32,5%	35,2%	2,7pp	23,4%	25,6%	-2,8pp	27,9%	19,10%	-8,8pp	28,00%	28,90%	0,9pp
GDP share of trade	24,4%	38,40%	14pp	22,4%	26,5%	4,1pp	29,3%	28,1%	-1,2pp	19,3%	21,0%	1,7pp
Unemployment rate total	8,7%	10,6%	1,9pp	11,5%	9,3%	-2,2pp	7,9%	4,8%	-3,1pp	8,2%	5,1%	-3,1pp
Labor comp. per hour worked, manufacturing* (EUR)	24,60	30,00	22,0%	20,50	27,29	33,1%	16,96	26,81	36,7%	17,52	23,76	35,6%
Avg. Hours worked, all industries	1518	1435	-5,5%	1655	1558,794665	-5,8%	1742	1676	-3,8%	1799	1732	-3,7%
Wage bargaining system**	Dominance of sectoral bargaining; with some company bargaining in certain sectors or companies			Parallel existence of sectoral and company bargaining with no dominant bargaining level. Intersectoral agreements on some specific issues			Dominance of company bargaining; with sectoral bargaining in a very few sectors (eg construction and public services)			Dominance of sectoral bargaining; company bargaining is limited to very few companies		
Union density***	27,8%	22,6% (2003)	-5,2pp	8,3%	8,3% (2003)	/	31,7%	29,30%	-2,4pp	40,1%	35,4% (2002)	-4,7pp
Collective bargaining coverage***	70,0% (Wes:) and 54% (East)			90,0%			<40%			98-99%		

Source, if not indicated otherwise by asterisks: OECD country statistical profiles for 2009

*Source: EU KLEMS Growth and Productivity Accounts, November 2009 (Values for UK converted with avg. annual foreign exchange rate from 2005)

**Source: EIRO, Changes in national collective bargaining systems since 1990, Dublin, May 2005

***Source: Visser, J. (2006): Union membership statistics in 24 countries, Monthly Labor Review, January 2006

Table A.1.2 – Number of observations (firms) per country and year

Year	Number of observations		
	Germany	France	**Total**
1996	208	199	407
1997	207	200	407
1998	206	199	405
1999	205	199	404
2000	206	200	406
2001	205	200	405
2002	206	201	407
2003	203	201	404
2004	203	199	402
2005	204	200	404
Total	2,053	1,998	4,041

Table A.1.2 – Descriptive statistics of main variables

Variables	Germany		France	
	Mean	S.D.	Mean	S.D.
Employees	13,703.93	52,984.19	3,277.55	13,587.81
Log. Employees	7.16	2.08	5.83	2.01
Costs of employees	750,861.30	3,136,300.00	106,449.40	475,374.10
Costs of employees per capita	48.82	15.70	42.54	16.31
Tax liability	63,206.86	280,353.20	14,249.75	68,434.01
Tax liability per capita	5.17	10.92	5.17	11.21
Profit before tax	285,369.70	2,867,166.00	48,568.56	279,335.10
Profit before tax per capita	9.46	46.34	12.56	40.16
Operating profit	290,920.60	2,844,876.00	53,478.98	305,806.50
Operating profit per capita	12.44	51.65	14.95	34.95
Added value	1,176,477.00	4,715,486.00	192,743.10	940,965.60
Added value per capita	73.82	61.19	67.43	62.81
Operating revenue	3,427,890.00	15,300,000.00	625,747.90	3,403,749.00
Operating revenue per capita	237.73	279.61	208.39	176.27

Note: All monetary values are in thousands and in 2000 prices.

A.2 Estimation Results

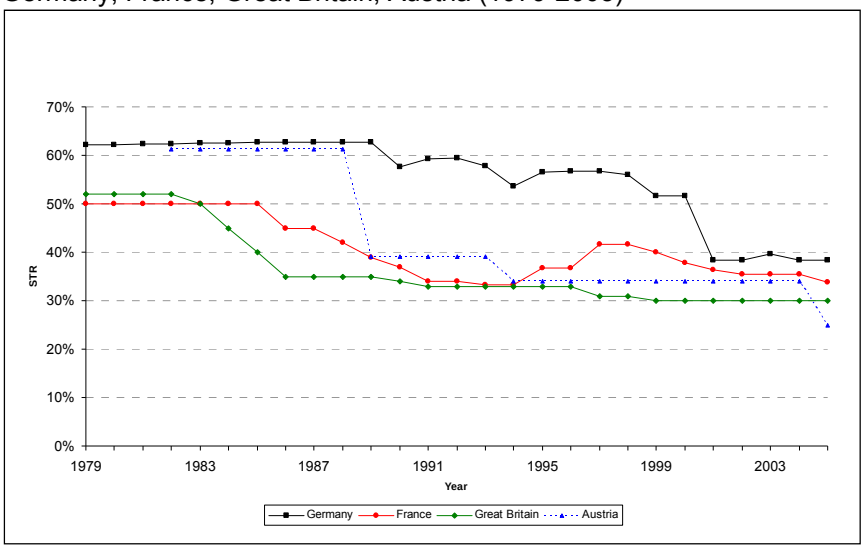
Table A.2.1 – Difference-in-Differences-Analysis; Extended Specification;
Dependent Variable: Log. wage rate

	OLS (cluster) (1)	**Fixed Effects (cluster) (2)**	**Difference-GMM (3)**	**System-GMM (4)**
Log. wage rate (t-1)	0.5242***	0.1060**	0.1007	0.3847***
	(0.0430)	(0.0510)	(0.0705)	(0.0541)
Log. wage rate (t-2)	0.2121***	-0.1680*	-0.1024*	0.0470
	(0.0345)	(0.0536)	(0.0589)	(0.0430)
Difference-in-Differences (*DiD*)	0.0555	0.0666*	0.0553*	0.0720**
	(0.0427)	(0.0389)	(0.0326)	(0.0298)
Treatment Group (*treat*)	-0.0719			-0.0414
	(0.0498)			(0.0342)
Log. *av* per employee	0.4280***	0.4113***	0.2682***	0.4316***
	(0.0606)	(0.0551)	(0.0876)	(0.0868)
Log. *av* per employee (t-1)	-0.1988***	-0.0567	-0.0791	-0.1536***
	(0.0503)	(0.0476)	(0.0519)	(0.0566)
Log. *av* per employee (t-2)	-0.0767***	0.0643*	0.0439	0.0050
	(0.0248)	(0.0344)	(0.0326)	(0.0254)
Unemployment rate (*unempl)*	-0.0276*	-0.0291**	-0.0378**	-0.0306**
	(0.0151)	(0.0145)	(0.0163)	(0.0121)
GDP growth rate (*gdp*)	-0.0397*	-0.0289	-0.0091	-0.0250
	(0.0216)	(0.0211)	(0.0210)	(0.0163)
Observations	1,468	1,468	1,147	1,468
Firms	285	285	262	285
Instruments			80	112
F-test – p-value	0.000	0.000	0.000	0.000
R^2	0.77	0.51		
Within – R^2		0.40		
AR(1) – p-value	0.000	0.000	0.000	0.000
AR(2) – p-value			0.407	0.192
Hansen χ^2-test – p-value			0.557	0.396

Notes: (i) Year dummies and a constant term are included in all estimates. (ii) The standard errors are reported in parentheses. (iii) *** significant at 1% level; ** significant at 5% level; * significant at 10% level. (vi) Columns (3) and (4) show results of two-step estimators with finite sample correction.

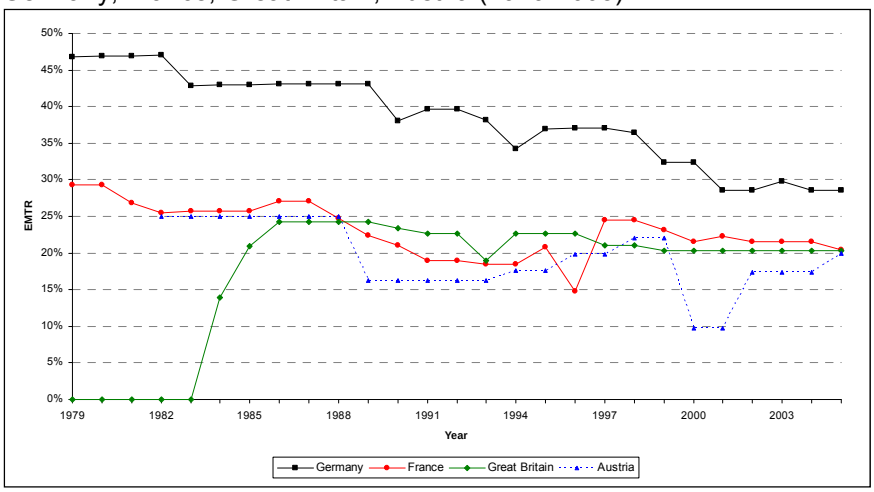
A.3 Figures

Figure A.3.1
Statutory Tax Rates (STR)
Germany, France, Great Britain, Austria (1979-2005)



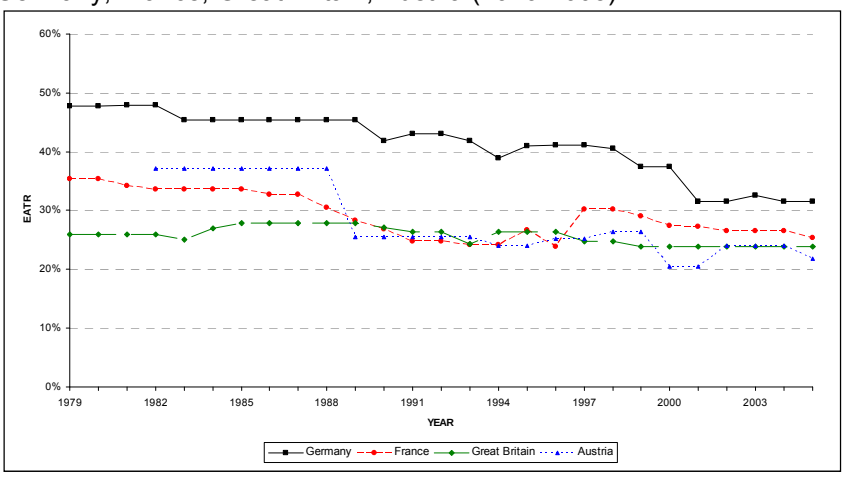
Source: Klemm (2005).

Figure A.3.2
Effective Marginal Tax Rates (EMTR)
Germany, France, Great Britain, Austria (1979-2005)



Source: Klemm (2005).

Figure A.3.3
Effective Average Tax Rates (EATR)
Germany, France, Great Britain, Austria (1979-2005)



Source: Klemm (2005).