

IMPACT OF CORPORATE TAXATION ON UNEMPLOYMENT

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Abstract. We study the effect of corporate taxation on unemployment utilizing a dynamic panel covering 41 countries over 11 years. The purpose of this article is to investigate how changes in the corporate income tax affect unemployment. We employ system general method of moments (GMM) due to peculiarities of the data set and the endogeneity issues present in the research problem. We find that a rise in the effective average corporate tax rate significantly increases unemployment levels, which directly contradicts past findings of some seminal authors. In addition, the present research supports findings of past studies on capital tax elasticity that obtained similar insights using differing methodologies. This research lays the groundwork for future studies, which may take the same methodology and apply it to even larger international panels. This research implies that international tax competition is affecting unemployment, presumably through its effects on international capital investment. These results provide support for policy makers who may be wary of raising corporate tax rates in countries where capital is especially mobile because of the negative effects which may accumulate to the voting public in the form of unemployment.

Keywords: corporate tax, business tax, unemployment, system GMM, FDI, corporate tax elasticity.

JEL Classification: H2, J6.

Introduction

The effect of corporate taxation on unemployment is much speculated but scarcely studied. The purpose of this article is to investigate how changes in the corporate income tax affect unemployment. We begin with a thorough literature review, starting with works which indirectly look at the problem at hand by investigating how corporate tax changes impact investment. These works then infer that changes in investment have an effect on unemployment. We also review the much smaller body of literature on studies which directly test the relationship between corporate or capital tax rates and unemployment. Following this, we discuss methodological concerns and justify our choice of method. Next we present our variables and data. Then we present the results of our regressions along with analysis. Finally, in the conclusions section we present some limitations along with possible implications for policy makers.

To the best of the authors' knowledge, there have only been several empirical studies (Fuest *et al.* 2015; Sieglöckh 2014; Feldmann 2011) whose main aim is to test for the relationship between corporate taxation and unemployment. The majority of other studies on the topic only indirectly study the effect on unemployment (or wages) as a by-product of foreign direct investment (FDI) changes, or capital tax elasticity. This study uses a data set of 41 countries over 11 years in a panel setting. A review of the methods available led us to choose system GMM due to the data set and the inherent endogeneity of the problem at hand. Namely, corporate taxation and unemployment being partially driven by political agendas and being determined at the same time. After conducting a slew of robustness checks, we confirm that our variable of interest, the effective average corporate tax rate, has a significant positive impact on unemployment.

1. Literature review

According to the economic literature, the effects of a change in the corporate tax rate on the unemployment level is murky at best. This is because any effect experienced will be indirect and may flow through several differing channels. The existing theory focuses on the effects of the corporate tax rate on the use of capital by firms. As a side note, many studies then attempt to infer how this change in capital would affect unemployment. First, there is the theory relating the effects of corporate tax changes on foreign direct investment (FDI). There is a vast literature in this field reviewed by De Mooij and Ederveen (2003), De Mooij and Ederveen (2008), Devereux and Griffith (2002), and Becker *et al.* (2012) who find, in general, that increases in corporate tax rates result in a drop in inward FDI and/or capital formation. This is argued to result in less employment as multinational corporations exit the market.

Individual studies which investigate how corporate tax changes affect employment through capital tax incidence have produced conflicting results due to differing underlying assumptions guiding model formation. An early study by Wang (1993) investigates the incidence of the corporate income tax on labour vs capital using a general equilibrium model. He finds that capital bears a majority of any tax incidence but that, as a side effect, labour will move out of the corporate sector. According to his model assumptions, wages are higher in the corporate sector, meaning that the corporate wage rate is above the market-clearing price and that unemployment will occur. Thus, the corporate sector is the driver of unemployment and when the corporate sector declines, due to an increase in the corporate tax rate, unemployment declines.

While investigating the effects of financing unemployment benefits by trade unions, Halko (2005) constructs a model where monopolistic trade unions have extensive power in setting wages. According to this model, when corporate income taxes rise, the trade union loses some of its bargaining power, lowering wages, and thus decreasing unemployment. We can, therefore, say that the theory is unclear as to the direction of effect of the corporate tax on unemployment.

In a tax study conducted in Latin America by Lora and Fajardo (2012), a rise in the corporate income tax may result in capital being shifted from the formal to the informal sector of the economy. As capital levels contribute to the productivity and wages of workers, this would imply that higher skilled workers who remain in the formal sector would be negatively affected while less skilled workers in the informal sector may benefit. In addition, if there are downward wage rigidities, due to a minimum wage for example, then unemployment would be expected to rise in the formal sector.

To further the discussion of corporate tax incidence, a general equilibrium study by Clausing (2011) finds that there is some evidence to support the idea that corporate taxation may lower wages. However, it is by no means conclusive. He argues that labour market outcomes are shaped by a myriad of effects, which make modelling the situation incredibly difficult. Ultimately, there is no clear answer as to the direction of the effect of a corporate tax on unemployment.

Bettendorf *et al.* (2009) analyse how corporate tax rates affect structural unemployment by utilizing a general equilibrium model based on European Union countries. In this study, the authors find that the effect differs considerably between countries and that the strength of the effect in question depends on the level of FDI in the host country. The authors note that there has been a downward trend in corporate tax rates in Europe. The downward movement may be attributed to the competition amongst countries with free capital movement for FDI. In their study, Bettendorf *et al.* (2009) use a CORTAX general equilibrium model, which incorporates distortions of marginal investment, international spill overs from FDI, and profit shifting by multinational firms. They begin with a standard neo-classical setup, including production and utility functions while incorporating corporate taxes, which affect the cost of capital for firms. A major feature of the model is a union bargaining framework, which is a driver of unemployment in the model. Ultimately, the results of the model suggest that by increasing the cost of capital, corporate income taxes raise the level of unemployment and that this effect is more pronounced in countries that are more open. There have been other general equilibrium studies on this topic but they usually do not focus on unemployment, as these models quite often assume no unemployment to begin with.

A study by Zellner and Ngoie (2015) looks into how corporate tax rate changes affect growth in the U.S. While this study does not directly relate corporate tax rates to unemployment, changes in GDP should be expected to be related to unemployment, thus, we can indirectly infer a link. They use a Marshallian macroeconomic model to predict that a permanent cut in the tax rates will increase GDP growth. The authors find that a 5 percentage decrease in the personal and corporate tax rates results in a 3 percentage point rise in GDP.

Finally, a study by Exbrayat and Geys (2015), which investigates the same question of tax incidence of the corporate tax rate, attempts to address the persistent endogeneity problem associated with the idea that the causal relationship between corporate tax rates and wages may be dual. They find that governments subsidise firms for high labour costs through lower corporate tax rates and that firms transfer their tax burden to their workers in the form of lowered wages. Further, they find that the standard tax

competition hypothesis of a race-to-the-bottom may not exist, as cuts in the tax rate may not affect capital movements. Ultimately, the authors conclude that workers might be harmed, or better off from tax competition.

The number of direct studies that explicitly investigate the relationship between corporate income tax and unemployment is low, most likely because of the complex structure between the two variables of interest (corporate tax rates and unemployment).

Feldmann (2011) approaches the problem of corporate tax effects on unemployment with a two stage least squares estimation. He uses a variety of corporate tax measures, mainly effective tax rates. He also focuses heavily on control variables, as the bias that may occur from their omission would be especially problematic to the study. He constructs a panel of 19 industrial countries over the years 1979–2005 and instruments their corporate tax variables with lagged differences of the corporate tax variables over the previous 4 years. The results of the study indicate that a 10% rise in the corporate tax rate is associated with a 2.1% reduction in the unemployment rate. As a justification of his result, the author suggests that higher taxes force a substitution of labour for capital, increasing the demand for labour. In addition, trade unions reduce their wage demands so that the multinational firms do not leave the country. Finally, the government may use the added revenue from the increased taxes for more labour-intensive work than the firms usually do, thus increasing employment. As these results are controversial, we propose doing a similar study with an improved methodology.

Siegloch (2014) addresses the same problem directly by using data on 11,441 municipalities in Germany to measure the effects of changes on business taxes on unemployment. He finds that a one-euro increase in the tax burden of the employer results in a decline of 20 euro cents in their wage bills over two years. According to Siegloch (2014), this effect can be accounted for by the fact that a rise in local business taxes induces firms to move to other municipalities, thus lowering employment. However, he posits that this effect might only be true within the country due to the relative mobility of the labour force domestically. In a similar study, Fuest *et al.* (2015) study the effect of corporate tax rates on wages in Germany, also using data from local municipalities. They use an event study design to show that workers bear approximately 40% of the corporate tax burden. In addition, they find that this effect goes down to zero in firms that operate in multiple jurisdictions. They posit that this may be due to profit shifting opportunities. We have attempted to find other more recent studies which directly test for the effect of corporate tax rates on unemployment but an exhaustive search has yielded no further more recent studies in existence.

2. Methodology

We begin the present section by reviewing the methods used in the Feldmann (2011) study on the topic of corporate tax and unemployment, as this is the only other study to use an international panel of countries, which we also plan to use. The first major issue for the study of corporate tax rates and unemployment is that of endogeneity. There is reason to believe that a two-way causal relationship exists between the two variables. It may be that governments lower their corporate tax rates when there is a recession

with unemployment as a way to attract foreign firms or to give relief to local firms. It may also be that a change in the tax rate changes firms' plans with regards to firing or hiring of employees. This dual causality may lead to correlations between the variables and the error terms of a regression, leading to biased estimates. To give an example, the studies listed in the literature review assume that tax rates affect unemployment, but there are also works in the field of tax competition which assume that unemployment rates affect tax setting behaviour (Swank 2016). This endogeneity issue has been dealt with by several methods. Two stage least squares (2SLS) uses instrumental variables to combat endogeneity, but is not feasible when there is a lack of suitable instruments. A popular and efficient way of dealing with the endogeneity issues faced by researchers is to use the Generalized Method of Moments (GMM). Several variations of this method are appropriate for the specific type of model to be applied by the authors. Difference GMM accounts for the endogeneity issue by incorporating lagged endogenous variables that are not influenced by unobservable factors and uses them as instruments-solving the problems of inadequate numbers and quality of instruments (Arellano, Bond 1991). This method also uses first differences of the included variables much as the fixed effects method would. However, this method runs into problems when the lagged endogenous regressors are weak instruments. This issue led to the creation of system GMM by Blundell and Bond (1998). System GMM is an improvement over difference GMM by the inclusion of additional instruments. Namely, by taking the lagged levels and using them as instruments along with the lagged first differences – thus utilizing a wider set of moment conditions.

Feldmann (2011) used the 2SLS estimator, instrumenting the corporate taxation variables with lagged differences of themselves, similar to what is done in difference GMM. Feldmann (2011) does not use difference or system GMM because his sample size parameters are not in line with the assumptions required to use those methods, namely, that there is a large amount of cross sections and a small amount of time periods. However, Soto (2009) conducted a Monte Carlo simulation to investigate the properties of smaller sized samples when using dynamic panel data. She showed that even in small samples ($N = 35$, $T = 12$ was used in the simulation), when compared to the properties of other estimators (like OLS, fixed effects, and difference GMM), system GMM systematically outperformed the others in terms of bias and variance. With these facts in mind, the authors will employ system GMM as suggested by Roodman (2009a).

For the present research, the authors propose using a dynamic model. Dynamic models are appropriate when dealing with unemployment because this variable is quite often persistent (Hujer *et al.* 2006). It will also allow us to analyse the time lag between the change in the tax rate and the unemployment level. The model can be specified as follows:

$$Unemp_{i,t} = Unemp_{i,t-1} + \beta_1 Tax_{i,t} + \beta_2 X_{i,t} + \gamma_i + \varepsilon_{i,t} \quad (1)$$

$Unemp_{i,t}$ represents the unemployment rate in country i at time t and is included as the dependent variable for the study. On the right hand side of the equation we include lagged unemployment to capture the dynamic element, the corporate tax rate (Tax), while incorporating control variables (X), fixed effects (γ), and the error term (ε). In order to establish the validity of the results, the authors will provide several standard tests.

The Hansen and Sargan tests are included to test whether the instrument set used in the regression is exogenous or not. The Hansen test is robust to heteroscedasticity and to autocorrelation but, unfortunately, this test is subject to reliability issues as the number of instruments is increased. In order to deal with this issue, one of the robustness tests will use varying numbers of instruments to check for its impact on the Hansen test. The other test used is the Sargan test, which is not affected by the number of instruments but is not robust to heteroscedasticity or autocorrelation. Additionally, we also include the Arellano-Bond test for autocorrelation. The AR(2) test is especially important because a major assumption of the model is that there is no autocorrelation between groups. The regressions are performed using the Xtabond2 program in Stata according to the suggestions of Roodman (2009a). The authors use a two-step specification, employing the Windmeijer correction to correct for the underestimated standard errors produced by the two-step method. Orthogonal deviations are also employed to deal with the slightly unbalanced nature of the dataset.

3. Variables and data

This study incorporates data from the OECD, World Bank, and the Oxford Centre for Business Taxation. The sample consists of 41 countries¹ covering the years of 2001–2012. The dataset was selected on the criteria of data availability in order to reduce the possibility of problems associated with unbalanced panels and the summary statistics are presented in Table 1.

Table 1. Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Unemployment	0.073	0.037	0.018	0.252	372
GDP/hour	0.016	0.022	-0.063	0.078	371
EATR	0.256	0.055	0.136	0.368	369
Gov/GDP	0.194	0.042	0.103	0.294	366
FDI Inflow/GDP	0.046	0.09	-0.551	0.747	369
Urban Pop	0.765	0.111	0.499	0.975	372
Working Age Pop	0.672	0.023	0.613	0.729	372
Crisis Step Dummy	0.583	0.494	0	1	372
EU Country	0.645	0.479	0	1	372
EMTR	0.168	0.067	-0.1	0.386	369
Statutory Tax Rate	0.292	0.065	0.15	0.409	372

¹ List of countries: Argentina, Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States, Brazil, China, India, Indonesia, Russian Federation, South Africa.

Data on corporate tax rates used in this research is in the form of effective average tax rates (EATR). As suggested by Devereux *et al.* (2008), the effective average tax rates are those which corporations would be most interested in when deciding to make an investment in a country or whether to pull out. Thus, there is reason to believe that these rates could affect the unemployment rate. However, a problem with EATR is that they differ by industry and we will use aggregated data which takes the average EATR for each country. Effective Marginal tax rates (EMTR) are also available, but these would only be useful in determining the behaviour of firms that are already located within a country. We will include EMTR for robustness checking purposes. Some studies also rely on statutory tax rates, but these can be problematic in that they do not include deductions and can differ widely from the effective rate paid by corporations. The effective average tax rates are calculated as the difference between pre-tax net present value and post-tax net present value of total investments, divided by the present value of income. One issue with using tax rates as a variable is that they are quite often serially correlated. To deal with this issue we will use standard errors which are robust to serial correlation. As robustness tests, we will also include regressions incorporating effective marginal tax rates and the statutory corporate tax rates.

We also control for some of the major factors which are thought to impact the unemployment rate. First, we include GDP (as measured per hour worked) as a percentage change from the previous year. This variable is included to account for Okun's law as the economic situation in a country is expected to have an impact on the unemployment rate. According to Lee (2000), Okun's law as a rule of thumb is observed to be present in the OECD countries, which also make up a majority of the present sample used by the authors. Secondly, we include government expenditure as a percentage of GDP in order to incorporate the effects of the fiscal multiplier on unemployment, suggested by such authors as Rendahl (2016). Next, we include Inward FDI flows as a percentage of GDP to capture the effect on unemployment that may be coming from inflows of capital from foreign firms. The literature is still unclear as to the overall effects of FDI on unemployment, but according to Driffield and Taylor (2000), FDI should at least lead to an increase in the use of skilled labour. We also include demographic statistics as Herbertsson *et al.* (2002) have established a relationship between the age structure of a society and the unemployment rate. We also include a variable for the percentage of the population which is urban to expand the demographic variables control set. A step dummy to represent the impact of the financial crisis is included, as looking at the data in Figure 1, it is clear to see that the unemployment rate² (the y-axis) in the countries from our sample is significantly affected by the financial crisis. Finally, a dummy variable is included to represent membership in the EU. This dummy should account for the theoretically dampening effect of free labour movement on unemployment rates.

² Data on the unemployment rate for selected countries are from <https://data.oecd.org>

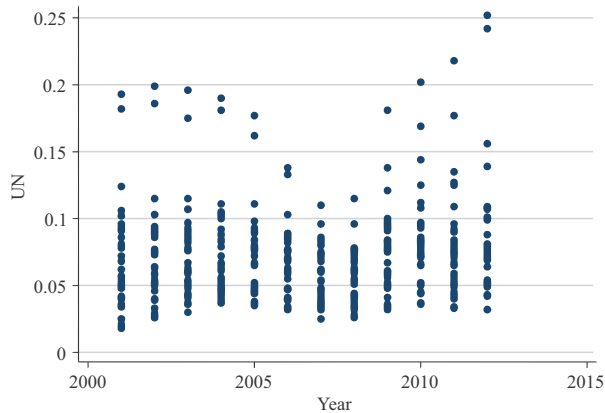


Fig. 1. Plot of unemployment rates for countries³ in the study

Note: The unemployment rate (UN) for all of the countries is measured as a percentage.

While there are a host of other control variables mentioned in the literature that could have also been included, which are used by Feldmann (2011), the use of system GMM imposes restrictions on the number of variables which may be included in the regression. The inclusion of each new variable requires that lags of the variable also be included into the instrument set. Incorporating too many instruments has a propensity to over fit system GMM models as mentioned by Roodman (2009b). A description of the variables used can be found in Table 1.

4. Results

Table 2 displays the baseline results of the system GMM model (1) and is accompanied by a fixed effects and OLS regression for the purposes of robustness comparison. The Fixed effects model is expected to have a downward bias for the autoregressive component and the OLS regression is expected to have an upward bias for the autoregressive component, so a first robustness check is to make sure that the system GMM dynamic coefficient is between those two results, which ours is. The coefficient for the lagged unemployment variable is relatively high (0.886), confirming the initial idea of the necessity to use a dynamic setting. The main variable of interest, EATR is highly significant and implies that for a 1% raise in the tax rate, unemployment is expected to rise by 0.4%, which is a large effect not fully captured by the fixed effects or the OLS model. This result directly contradicts the results of the other main study using a

³ List of countries: Argentina, Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States, Brazil, China, India, Indonesia, Russian Federation, South Africa.

similar methodology in this area performed by Feldmann (2011). Looking at the tests provided, the only problematic result is the Sargan test, but, as mentioned earlier, this test is unreliable under the conditions of heteroscedasticity that is expected to be severe due to structural governmental differences between countries.

Table 2. Estimation results for corporate tax on unemployment

	(1) System GMM	(2) Fixed Effects	(3) OLS
L. Unemployment	0.886***	0.853***	0.925***
EATR	0.435***	0.047	0.040*
GDP/hour	-0.155*	-0.032	-0.049**
Gov/GDP	-0.201	0.554***	0.039
FDI Inflow/GDP	-0.234	-0.013	-0.012
Urban Pop	0.032	-0.682***	-0.056**
Working Age Pop	0.086	-0.168**	-0.020
Crisis Step Dummy	-0.099*	-0.111***	-0.097***
EU Country	0.292	0.000	0.010
Sargan	0.0081		
Hansen	0.5073		
AR(1)	0.1493		
AR(2)	0.7714		
Instruments	20.0000		

Standardized beta coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In Table 3, results are presented with various alternative corporate tax rate measures. The effective average marginal tax rate (EMTR) was not statistically significant at the 10% level but the statutory tax rate was highly significant ($p < 0.01$) with a very similar coefficient to EATR (approx. 0.4). As the effective marginal tax rate only affects established firms in a country, we may infer that the changes in corporate tax rates affect unemployment through the international movement of firms or new investments. The similarity in the coefficients for EATR and the statutory rate may be due to the effect that movements in both of these variables may be highly correlated.

Table 4 shows the results of the baseline regression with alternative lags of the instrument sets. Regression (1) shows the baseline which uses lags of 2–3 years, while (2) shows the results with lags pushed further back to 3, and 4 years. This specification may be more relevant if there is first order autocorrelation, because allowing longer lags reduces the chances of the instruments being correlated with the error term (Roodman 2009b). Finally, in (3) we present a specification with many additional lags (2–6) to see if the increased use of instruments has any large effects on the specification or on the p-values of the Hansen test. When comparing the results from (2) and (3) it is clear that the coefficient value and significance level of our main variable of interest, EATR, have both decreased. We conclude that our specification is somewhat sensitive to the lag

structure of the model. The effect of including extra lags in (3) produces almost the same coefficients and significance levels as those in (1), so we conclude that it has almost no influence. In addition, the effect of including the extra lags in (3) on the Hansen test were minimal when compared to the Hansen test in (1).

Table 3. Estimation results with differing tax measures

	(1)	(2)	(3)
L. Unemployment	0.886***	0.868***	0.861***
EATR	0.435***		
GDP/hour	-0.155*	-0.170	-0.121
Gov/GDP	-0.201	0.115	-0.165
FDI Inflow/GDP	-0.234	-0.099	-0.199*
Urban Pop	0.032	-0.098	-0.005
Working Age Pop	0.086	0.086	0.073
Crisis Step Dummy	-0.099*	-0.054	-0.108*
EU Country	0.292	0.103	0.196
EMTR		0.482	
Statutory Tax Rate			0.424***
Sargan	0.0081	0.0003	0.0028
Hansen	0.5073	0.5102	0.3299
AR(1)	0.1493	0.1069	0.1289
AR(2)	0.7714	0.3563	0.5999
Instruments	20.0000	20.0000	20.0000

Standardized beta coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Estimation results with differing lagged instruments

	(1)	(2)	(3)
L. Unemployment	0.886***	0.752***	0.868***
EATR	0.435***	0.202*	0.334***
GDP/hour	-0.155*	-0.040	-0.159
Gov/GDP	-0.201	-0.042	0.047
FDI Inflow/GDP	-0.234	-0.082	-0.189
Urban Pop	0.032	-0.056	-0.078
Working Age Pop	0.086	0.018	0.070
Crisis Step Dummy	-0.099*	-0.113*	-0.107
EU Country	0.292	0.151	0.096
Sargan	0.0081	0.0000	0.0000
Hansen	0.5073	0.0830	0.6444
AR(1)	0.1493	0.2003	0.0771
AR(2)	0.7714	0.4114	0.6491
Instruments	20.0000	20.0000	35.0000

Standardized beta coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 presents a sensitivity test, examining how the removal of variables affects the main results. The coefficient and significance of the main variable of interest (EATR) appears to be fairly robust to changes in control variable choice.

Table 5. Estimation results with differing variables

	(1)	(2)	(3)	(4)	(5)
L. Unemployment	0.900***	0.957***	0.741***	0.889***	0.891***
EATR	0.440***	0.322**	0.344**	0.323**	0.342***
GDP/hour	-0.161*	-0.279**	0.066	-0.205*	-0.222**
Gov/GDP	-0.268		-0.122		
FDI Inflow/GDP	-0.233*	-0.076			
Working Age Pop	0.050	0.038	0.105	0.067	
Crisis Step Dummy	-0.101*	-0.029	-0.165*	-0.053	-0.057
EU Country	0.307	0.086	0.183	0.115	
Urban Pop		-0.070			
Sargan	0.0084	0.0477	0.0050	0.0055	0.0087
Hansen	0.5404	0.1926	0.2427	0.0652	0.1030
AR(1)	0.1133	0.0369	0.1046	0.0445	0.0238
AR(2)	0.6983	0.1101	0.1598	0.0909	0.0800
Instruments	19.0000	17.0000	16.0000	13.0000	11.0000

*Standardized beta coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Table 6 presents the results when all of the independent variables are lagged, implying a delayed effect on unemployment. Interestingly, FDI inflow becomes a significant factor on unemployment with the addition of the lag. In regression (2), inclusion of the second lag of the dependent variable confirms a strong relation between EATR and a previous lag of unemployment, as the EATR variable becomes insignificant and the significance of the second lag is scaled down. These results confirm our initial arguments for using the system GMM due to persistence dynamics in the relation of interest. Finally, in regression (3) we also lag the instrument set to 3–4 years as a further robustness check. The lagged FDI variable loses statistical significance but EATR remains significant at the 5% level.

The interesting aspect of this research is that it directly contradicts the results of Feldmann (2011), which is one of the first studies to investigate the effect of the corporate tax rate on unemployment. While we did not do a straight replication of Feldmann (2011), we did use a similar method and dataset. However, we would argue that our results are superior to those of Feldmann (2011), based on the fact that according to Monte Carlo simulations of Soto (2009), system GMM is the most appropriate method to use for the given sample. In addition, the Table 6 findings support the necessity of us-

Table 6. Estimation results with lagged variables

	(1)	(2)	(3)
L. Unemployment	0.783***	1.093***	0.702***
L2. Unemployment		-0.388**	
L. EATR	0.349**	0.019	0.268**
L. GDP/hour	-0.053*	-0.026	-0.029
L. Gov/GDP	-0.093	0.016	-0.087
L. FDI Inflow/GDP	-0.031**	-0.014	-0.099
L. Urban Pop	-0.062	-0.033	-0.047
L. Working Age Pop	0.058	0.001	0.038
Crisis Step Dummy	-0.141***	-0.072*	-0.133***
EU Country	0.207	0.094	0.235
Sargan	0.0001	0.0001	0.0001
Hansen	0.1614	0.0917	0.0997
AR(1)	0.0468	0.0177	0.2090
AR(2)	0.2126	0.2016	0.2109
Instruments	20.0000	20.0000	20.0000

Standardized beta coefficients: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

ing efficient dynamic panel methods, contrary to Feldmann, who did not use a dynamic panel model, despite the fact that several other authors recommend using dynamic panel models for unemployment studies (Hujer *et al.* 2006) due to the inherent persistence of the unemployment variable.

Conclusions

Overall, the main novel result of this research is that a rise in the expected average corporate tax rate is associated with increases in the unemployment rate. This relation is robust to variations in the model specification, exogenous variable set, selection of the proxy variable to measure taxation, and to endogeneity. Relating this back to the theory provided, our results suggest that corporate tax rates affect international firm investment choices, which ultimately results in employment changes.

This study is an important addition to the literature on the relationship between corporate taxation and unemployment. While it has been established that there are many studies testing for corporate tax elasticities, only a small number of studies have directly addressed the question of the effect of the corporate tax rate on unemployment. Our results are in line with the country specific studies but contradict a similar study using an international panel. Our findings add more weight to the evidence that increasing corporate tax rates may lead to increases in unemployment. This research implies that

international tax competition is affecting unemployment, presumably through its effects on international capital investment. These results may provide some support for policy makers who are against raising corporate tax rates in countries where capital is especially mobile, as negative effects may accrue to the voting public in the form of unemployment.

In the present political and intellectual climate where there are fears of increasing income inequality, our results are quite pertinent. While having a lower corporate income tax may be associated with higher incomes for the rich, it also appears to decrease unemployment. Thus, it would be interesting to further investigate the connection between corporate tax rates, income inequality, and unemployment.

As little empirical work has been done on directly testing the relationship between corporate taxation and unemployment, further studies are highly welcomed. More studies using different data sets and methods need to be instituted before any policy makers use these results. As there is currently evidence pointing to the idea that increases in the corporate tax rate can both raise and lower unemployment, it may also be feasible that some kind of non-linear relationship exists between the two variables. This could be one possible way to synthesize the results of the previous studies

Nevertheless, the present research does suffer from some limitations. While the use of aggregate data does allow for the possibility of larger data sets, specific country and industry level effects may differ greatly. Further studies, with the use of more specific data could provide results which would be more useful for country level policy makers. In addition, the effective tax rate measures could be broken up by industry to see which ones would have the largest changes in unemployment. Finally, looking at more specific variables, like the inclusion of labour unions, would also be recommended.

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