The Effect of Corporate Taxation on Foreign Direct Investment in eight EU Countries

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ABSTRACT

Theoretical framework showing the negative impact of the user cost of capital on the initial decision for investing in a foreign country is presented. The user cost is used as channel of transmission of the effect of the statutory tax rate on the initial investment decisions. The paper attempts to test whether higher statutory corporate tax rate through the user cost of capital will result in less FDI inflow. The empirical tests are made on a panel data on country FDI stock that includes industry break downs of the FDI and thus accounts for some firms specifics that may influence the outcome. Three empirical methods are used to test the impact of the user cost on the initial investment decision. The first-differencing estimation gives significant and negative results and confirms that higher user cost leads to negative change in the rate of FDI flow into a country.

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1. Introduction

Foreign Direct Investment is a type of investment decision firms make. Similar to the other investment decisions, the possibility governments to influence it is a much debated topic. For foreign investment there are two governments influencing this decision – the home and the host. The focus of this paper is on the host-country methods of influencing FDI. From government perceptive an often cited argument about promoting FDI in the country is that it facilitates general economic development. Other more specific reasons why governments try to attract more FDI are aiming at lowering unemployment in some parts of the country or the country as a whole, or increasing the exports. The usual fiscal tool for influencing the FDI flows into the country employed is corporate taxation. Besides the statutory corporate tax rate there other tax incentives such as tax holidays or some industry-specific tax alleviation. However, the effect of the taxation on FDI by itself is under question. Empirically, taxes tend to have little impact on the investment decisions. One of the reasons is that there are many other factors influencing the FDI flows into a country. These factors are related to countries' resources, political stability, and economics indicators. This leaves one situation where the taxes should matter more -when there is sufficient economic and political stability in a group of geographically close to each other countries.

The sample used in this paper contains eight countries that are members both of the EU and OECD. The membership in this union/organization guarantees transparent tax legislation and some avoidance of double taxation among these countries and between these countries and sufficiently large number of other countries members of only one these organizations or none of them. This leaves very little room of using FDI as a tax evading technique. Furthermore, they are on the same continent with not substantial geographical distance between each other. Thus, it matches as close as possible the situation where taxes should produce a significant impact on investment decision. For guaranteeing better measure

of the tax effect on investment I break down the FDI in industries. That is something not very typical for testing taxation effects on FDI using aggregate data.

Though compare to the others the corporate tax rate has the greatest impact on the price of capital, the statutory tax rate cannot by itself cause change in investment decisions or induce such. It is incorporated in the investment decision through its influence on the price of the investment considered. Despite the same statutory corporate tax rate across industries its effect on the user coast varies from industry to industry. To capture this variation across industries industry-specific depreciation rate is employed. The depreciation rate enters the user cost of capital together with the tax rate and creates industry specific user costs. The user cost of capital is the main factor affecting FDI derived in the theoretical part in this paper and it is used in the empirical tests. FDI data is only on real business investments and thus the user cost to the price of capital to be invested should be a sufficient measure of the corporate tax effect on FDI flows.

The data set used in the empirical part is a three-dimensional unbalanced panel data. Three techniques for panel data estimation are used – regression with dummies, first-difference, and fixed effects estimation. Half of the regressions and two estimation methods give significant and negative results for the coefficient on the user cost. The first-differencing with included time dummies proved to be the most robust estimation. The coefficient on the user cost in this regression is negative and significant which is line with the expectations.

The next two sections summarize some of the relevant points in the earlier literature about FDI and tax investment incentives. Section III and IV contain the derivation of the user cost and the description of the empirical methods respectively. They are followed by data description and discussion of the regression results. The last section concludes.

2. Brief Discussion of Some of the Relevant Literature

Foreign Direct Investment besides being an investment decision is also a form of location decision a firm makes. There are different reasons why a firm may choose to locate in a given country. It could be that the firm is evaluating export possibilities to locating in a certain region or searching for a way to cut production costs. Locating in a country usually also gives the firm access to the whole region, which lowers transportation and other trade related costs. Sometimes certain types of country endowments or preferential tax treatment attract the firms to this location. However, whether and to what extent a country can influence location decision depends not only on the country's fiscal policies and endowments, but also to the company's characteristics. That makes the industry break down very a way of accounting for some firm's specifics. Even under the representative firm assumption, it allows for 'several' representative firms – one per industry. Thus, when the location decision of FDI can be approach from country perspective, that is how much FDI a country receives given its corporate tax, some firms' specifics will still be accounted.

Among the country-specific factors affecting FDI there are political and economic stability, infrastructures, endowments, market size, and tax system, other related policies. Morisset and Prinia (1999) claim that fiscal incentives do not make up for other major flaws in the country. Thus to evaluate the impact of tax rates on FDI, the countries should be relatively politically and economically stable. Furthermore, they argue that different fiscal instruments would bring different investment depending on whether the firm is export-oriented, its mobility and size, the weight put on initial investment and on the later-on profit. Therefore, if countries are similar in endowments, economic and political terms, tax incentives would not only help some of them to attract more FDI, but the type of tax incentives would also influence the type of firms investing in these countries. Making the empirical test on eight EU countries minimizes the effects if the other factors on FDI and

stresses the effect of a single fiscal incentive – corporate taxation. As already mentioned some firms' specifics are captured by the industry break down of the FDI data.

Locating in one of the EU countries gives the firms access to the single European market as well as the countries in Europe that are not EU member states. This is consistent with Haufler and Wooton's (1998) claim that a firm rarely goes to a new market when targeting only that market. Firms usually aim at the surrounding countries as well. In that perspective it should not really matter which of the eight countries included a firm chooses for locating in. Hence, the taxation should matter even more when considering the different possibilities.

Furthermore, the fiscal incentives should appeal differently to companies from different industries. Hence some industries could be more affected by corporate taxes. Bond(1981) argues that labor-intensive industries are more mobile and shows that the tax holidays in Puerto Rico results in plant turn-over because the industries have low entry costs, the firms are small, and thus have no incentive to reinvest after the tax holiday is over. In this case such industries will have higher sensitivity to changes in the tax codes. It guarantees that indeed the industry FDI captures some of the firms' characteristics.

When making the initial decision all tax related issues besides the corporate tax such as tax holiday or other type of short-term tax alleviation should be considered. Nevertheless, according to Clark (2000) the statutory tax rate is the most influential tax policy on foreign direct investment. Thus, in this paper the effect of the tax rate is incorporated in the use cost of capital and the rest of the tax incentives are ignored. Regardless of this determining of the present value of the user cost of capital is requires for project evalutaion.

Not testing a direct effect of corporate tax on investment is generally considered better approach for estimating the taxation impact on investment (see De Mooj and Vee, 2003). The usual way doing so is to define an effective tax measures. One of the approaches

of deriving an effective tax rate measure is exactly by user cost derivation. Due to data issues most probably such an effective tax rate measure would not differ much from the statutory tax rate for the sample used in this paper. Thus, the focus will be on the effect of the user cost on the investment.

In constructing the user cost measure I rely on five articles. In their article "Taxation and Investment" (1996) and its revision for the Handbook of Public Economics in 2003, "Taxation and Business Investment", Hasset and Hubbard discuss the two most widely used theories for testing the effect of taxes on investment decisions through firms' capital accumulation decisions: user cost of capital and the Q-theory. The former theory leads to determining the optimum capital stock, whereas the later links the market value of the new capital to its replacement cost. Neither of these theories is suitable by itself for the type of discrete investment decision the firm makes initially when it comes to FDI, though the user cost is more appropriate.

Devereux and Griffith (1999) use similar to the user cost set-up and project evaluation technique to derive the effective average tax rate, which they claim is a better measure of the effect of taxation on discrete investment choices. Later on in 2003 they in their article "Evaluating Tax Policy for Location Decision" again emphasized that unsuitability of the traditional taxation/investment approaches when it comes to discrete investment and not investment on the margin. I combine the project evaluation method with the user cost for a better capturing of the decision for initial investment in a foreign country. The user cost in this paper is derived by discrete-time profit maximization. As in the Katay and Wolf (2004) article the user cost of capital to is the way of the transmission of economic (monetary) policies into firms' investment decisions, thus I follow similar to theirs steps in deriving the user cost. Their approach is relies on Jorgenson's (1963) article in which he builds an investment behavior theory on the capital accumulation theory.

3. Theoretical Model

As discussed there are two main theories describing the investment decisions taken by firms – user cost of capital and the q-theory. The first one leads to a static solution of the optimum level of capital at a given time. The later one puts dynamics into the optimization problem by accounting for adjustment cost of the investment. These theories are described in both Hasset and Hubbard (2003) article, where they discuss in detail the q-theory. The user cost of capital as a channel of transmission of policies is used in Katay and Wolf's (2004) article. They examine the influence on interest rate on firms' investment decision through the user cost, which resembles the goal of this paper to show the transmission of a fiscal policy in the firms' investment decisions through the user cost of capital.

Furthermore, the investment decision into consideration is a decision a multinational company faces when choosing to make an investment in a foreign country is not like the investment decision companies make in general. It is type of discrete investment decision as argued by Devereux and Griffith (1999). The model is based on a single multinational firm that should make a location decision of its foreign investment between eight EU countries. As argued in the introduction the similar geographical location, political and economics stability, as well the low barriers to export to other EU countries should increase the effect of corporate tax on this decision. The corporate tax effect is incorporated in the user cost of capital and thus the effect of the user cost should also increase. At the moment of decision making the company chooses the optimal stock of capital for this investment decision.

Since the nature of the project is the same and just the possible locations differ, I assume that regardless of the country of choice the new investment would require the same fixed costs. That will also prevent the firm to invest in two of these countries simultaneously for that will mean for the firm to incur the fixed costs twice. Moreover, due to the fixed costs,

it is expected to have increasing returns to scale in least initially at any of the possible foreign location. Otherwise, there will be no point of undertaking the investment.

Following Devereux and Griffith (2003) the firm will choose the location based on the highest after-tax revenue. Besides the assumptions that it is a single firm incurring the same fixed across possible investment locations, I also assume that the technology it will use does not change and does not depend on the eventual location choice. Taking in to account that the increasing returns to scale, it will be enough to compare the expected post-tax capital stock in a country to determine the location of the investment. That should be sufficient because the difference in the expected revenue from the different locations is given by the amount of capital invested there and the price of the product. Since the firm target the market of the whole region this price level should account for the markets in al countries in the region. Assuming that the firm puts the same weight of the market in each of the countries regardless of its locations decision with addition of close to zero transportation cost (geographical proximity of the countries), the price component in the revenue function should account for all the aforementioned consideration. Thus it should be the same across the possible locations. Therefore, the production complement of the revenue is the driving force for its changes and the revenue is an increasing function of the capital due to the increasing returns to scale. One more assumption needed for the user cost of capital in the eight different locations to sufficient to determine in which location the firm will be able to invest the greatest amount of capital (and hence incur the greatest revenue) is perfect foresight.

The model is this paper is in a discrete time profit-maximization set-up. It resembles the model set up used by Katya and Wolf (2003) in their article, though their model is in continuous time profit maximization problem frame. Another major difference is that I cannot use CES production function for deriving the user cost. The CES production function is not appropriate since that will imply constant returns to scale and that is not suitable for

this model. Furthermore, the model will not be tested on firm level data. It aims to show whether the countries influence the investment decision of firms through taxes that enter the user cost of capital. That is why the dividend taxes and the financing decision of the firms are not incorporated in it. The focus is on the countries' impact through its fiscal policy on the investment decision.

I start developing the model by assuming that the firm's revenue function can be split it two separate revenue functions – one for the home and one for the foreign entity:

$$R^h = p^h F^h\left(K^h, L^h\right)$$
$$R^f = p^f F^f\left(K^f, L^f\right)$$

The *h*,f indices stand for 'home' and 'foreign' and I use them to distinguish between the two entities. 'Home' refers more to the head quarters of the firm than to a specific location of the first established entity of a multinational corporation. Furthermore, I assume that in period *t* when the investment decision is made, the firm is fully aware of its performance (profit by the home entity) for this period and has a perfect foresight about the profits in period *t+1* from the foreign entity. It is very probable that part of the revenue of the foreign entity goes to the home entity and it will enter as a cost in the foreign entity profit maximization and as a revenue in the home one. Assuming that the countries avoid double taxation of corporate profits then whatever the home entity gets from the foreign it will not be taxed again in the home country. That is in fact a full tax exemption of revenue from foreign locations.

These lead to the following expression for overall firm profit:

$$\Pi_t = \Pi_t^h + \Pi_t^f + \frac{1}{1+r}\left(\Pi_{t+1}^h + \Pi_{t+1}^f\right)$$

In the period *t* when the investment decision is made the entity in the foreign country has no profit, while the home one incurs additional cost for the new investment. The subsequent investment decisions are assumed to be made on individual entity level. The result is the following profit function:

$$\Pi_t = \left[R_t^h - w_t^h\left(1+\tau_{l,t}^h\right)L_t^h\right]\left(1-\tau_{c,t}^h\right)+\tau_{c,t}^h dK_t^h - I_t + 0$$
$$+\frac{1}{1+r}\left\{\left[R_{t+1}^h - w_{t+1}^h\left(1+\tau_{l,t+1}^h\right)L_{t+1}^h\right]\left(1-\tau_{c,t+1}^h\right)+\tau_{c,t+1}^h dK_{t+1}^h + (1-\gamma)\Pi_{t+1}^f - I_{t+1}^h\right\}$$
$$+\frac{1}{1+r}\gamma\left\{\left[R_{t+1}^f - w_{t+1}^f\left(1+\tau_{l,t+1}^f\right)L_{t+1}^f\right]\left(1-\tau_{c,t+1}^f\right)+\tau_{c,t+1}^f dK_{t+1}^f - I_{t+1}^f\right\}$$

where γ gives the fraction of the foreign entity profit that stays with the foreign entity and it does not matter for the final results of the derivation. The rest of the variables are the following: *w* – real wage rate; *L* – labor; *K* – capital; *I* – investment; τ_c - corporate tax rate; τ_l - personal income tax; *d* – depreciation allowance. As in the revenue function the *h*, *f* indices stay for designating the entity in the home and in the foreign country respectively; *t* is a time index.

From the usual equation of motion of capital $K_{t+1} = (1-\delta)K_t + I_t$ and the assumptions made so far, the following expressions for the investment variables is obtained:

$I_t = K_{t+1}^h - (1-\delta)K_t^h + K_{t+1}^f$, where $K_{t+1} = K_{t+1}^h + K_{t+1}^f$ is the new capital for the entire company;

$I_{t+1}^h = K_{t+2}^h - (1-\delta)K_{t+1}^h$ and $I_{t+1}^f = K_{t+2}^f - (1-\delta)K_{t+1}^f$, based on the assumption that after the initial investment the two plants of the company make investment decisions separately.

Plugging these into the profit function leads to the following FOCs determining the capital and labor in the new foreign entity:

$$\frac{\partial \Pi_t}{\partial K^f_{t+1}} = -1 + \frac{1}{1+r}\left[\frac{\partial R^f_{t+1}}{\partial K^f_{t+1}}\left(1-\tau^f_{c,t+1}\right)+\tau^f_{c,t+1}d+\left(1-\delta\right)\right]=0$$

$$\frac{\partial \Pi_t}{\partial L^f_{t+1}} = \frac{\partial R^f_{t+1}}{\partial L^f_{t+1}} - w^f_{t+1}\left(1+\tau^f_{l,t+1}\right)=0$$

A Cobb-Douglas production function with $\alpha,\beta>0$ and $\alpha+\beta>1$ is chosen to incorporate the increasing returns to scale for the foreign entity. Since the home entity production function does not influence the solution of the above system of equations, its form is not really important. Nevertheless, it can be argued that there are increasing returns to scale even for the home entity. If the firm is considering locating in one of the countries in the region at least party to target the market in this region then it is reasonable to assume that either this firm has already exported to the region or plans to do so. Both of these situations if not imply than at least allow for increasing return to scale in the home entity.

Based on the production function form there is the following revenue: $F(K,L)=AK^{\alpha}L^{\beta} \Rightarrow R^f_{t+1}=p^f_{t+1}A_{t+1}\left(K^f_{t+1}\right)^{\alpha}\left(L^f_{t+1}\right)^{\beta}$, where *A* is a technology measure. *A* does not take country index because the company should use the same technology in any of the possible the foreign locations when calculating the future revenue from all the locations in question. Allowing the technology to change over time will not influence the solution for the optimal capital stock regarding the initial investment.

The FOCs become:

$$\frac{\partial \Pi_t}{\partial K^f_{t+1}} = -1 + \frac{1}{1+r}\left[\left(1-\tau^f_{c,t+1}\right)p^f_{t+1}A_{t+1}\alpha\left(K^f_{t+1}\right)^{\alpha-1}\left(L^f_{t+1}\right)^{\beta}+\tau^f_{c,t+1}d+\left(1-\delta\right)\right]=0 \quad (1)$$

$$\frac{\partial \Pi_t}{\partial L^f_{t+1}} = p^f_{t+1}A_{t+1}\beta\left(K^f_{t+1}\right)^{\alpha}\left(L^f_{t+1}\right)^{\beta-1} - w^f_{t+1}\left(1+\tau^f_{l,t+1}\right)=0 \quad (2)$$

Solving this system for K_{t+1}^{f} will five an expression linking the capital to its user cost.

Simplifying (2) results in the following expression for labor:

$$\left(L_{t+1}^{f}\right)^{\beta} = \frac{w_{t+1}^{f}\left(1+\tau_{l,t+1}^{f}\right)L_{t+1}^{f}}{p_{t+1}^{f}A_{t+1}\beta\left(K_{t+1}^{f}\right)^{\alpha}}. \tag{3}$$

Rearranging (1) and plugging (3) into it leads to:

$\frac{\alpha}{\beta}\left(\frac{K_{t+1}^{f}}{L_{t+1}^{f}}\right)^{-1} w_{t+1}^{f}\left(1+\tau_{l,t+1}^{f}\right)L_{t+1}^{f} = \frac{r+\delta-\tau_{c,t+1}^{f}d}{1-\tau_{c,t+1}^{f}}$ as the expression on the right-hand side is the user cost of capital. This gives the optimum capital in the foreign plant:

$$K_{t+1}^{f} = \frac{\alpha}{\beta} w_{t+1}^{f}\left(1+\tau_{l,t+1}^{f}\right)L_{t+1}^{f}\left(\frac{r+\delta-\tau_{c,t+1}^{f}d}{1-\tau_{c,t+1}^{f}}\right)^{-1}. \tag{4}$$

This solution can be expresses also in capital per revenue terms. Instead of substituting the (3) into (1), (1) can be rearranged in the following way:

$\left(1-\tau_{c,t+1}^{f}\right)p_{t+1}^{f}A_{t+1}\alpha\frac{\left(K_{t+1}^{f}\right)^{\alpha}}{K_{t+1}^{f}}\left(L_{t+1}^{f}\right)^{\beta} + \tau_{c,t+1}^{f}d = r+\delta$ and from here it can be seen that the nominator contains the original expression of the revenue function. Thus new capital per revenue is given by:

$$\frac{K_{t+1}^{f}}{R_{t+1}^{f}} = \alpha\left(\frac{r+\delta-\tau_{c,t+1}^{f}d}{1-\tau_{c,t+1}^{f}}\right)^{-1}. \tag{5}$$

Both (4) and (5) clearly link the rate of invested capital negatively to the user cost; the former through level of investment, the later through rate of investment. It should be bared in mind that the foreign capital is equivalent to the investment in the foreign location in this set-up. Therefore, there is a direct negative impact of the user cost on the investment in the foreign location.

Though, this is a static solution and captures perfectly the initial investment decision of the firm. It gives the optimum capital to be invested in a given location. By comparing these optimums the firm will invest in the location with the highest capital. Given the negative correlation between the capital and the user cost this should be the location with the lowest user cost. That is why each year new foreign direct investment in a country can be seen as a consequence of comparing user cost in different possible locations. However, the FDI inflow in a country for a given year does not include only such initial investments. All subsequent transactions from the home to the already established foreign entity are considered FDI and thus included in the total investment flow per year within a country. There is no empirical way to distinguish between them. Going back to assumption that the subsequent investment decisions are taken separately, this situation is possible only in case the foreign entity decides on the investment and asks the home one for financing.

If there subsequent transitions are viewed as capital adjustments, they can be related to the second investment theory - the q-theory. Moreover, this adjustment of capital requires dynamic solution, which in line with the q-theory of investment. Nevertheless, q can be seen as a present value of all user costs at the moment of decision making and it incorporates the initial investment. That is why the changes in the user cost over time will be correlated with the changes in the q. Furthermore, for any given year in the FDI inflow for a country there will be firms making their initial investments together with the firm making their subsequent transactions. That gives a substantial role of the user cost over the total FDI inflow. In that

case the user cost should be a good approximation of the investment cost the firm faces for the empirical tests. The methods for testing the effects of the user cost on FDI used for the empirical estimation are discussed in the following section.

4. Empirical Methods

The empirical estimation is of a dynamic equation. As a dependent variable I use the change of log of the capital stock, it gives the change of the inflow of FDI and resembles the rate of foreign direct investment in a country. In general that presupposes having the 'q' on the right-hand side. However, for as argued in the former section, 'q' is approximate with the user cost. That is possible due to its correlation with the user cost. This approximation, however, simplifies the impact of the user cost on FDI for it ignores the differences of the new and subsequent transactions between the home and the foreign entity. It is like taking all FDI as a new investment.

An advantage of using the rate of investment is that it relates to equation (5) from the theoretical section. Thus, it allows for non-inclusion of the variables related to the labor market – wage, personal income tax, and labor supply, in the estimation. There is not data available on industry specific labor supply and wage rates, therefore, the possibility not to account for them is welcomed. Instead, I include other country-specific variables which besides influencing the FDI in a country mostly by singling about the stability and the size of its market also implicitly controlling for labor market. These variables account for market size and political and economic situation in the host countries. Market size, political stability and stable macro-economic indicators are suggested by Morisset and Pirnia (1999) as important FDI affecting factor, which is also empirically shown by Billigton (1999).

The data set used is three dimensional panel. In order to isolate the effect of the user cost on FDI inflow I need to account for country-, industry- , and time-specific effects. There are three ways to do this with panel data set – regression with dummies, first-differencing, and fixed effects. All of these methods are used so that the robustness of the results can be confirmed. In all of the regressions the following variables are included: unemployment rate, population, per capita GDP, and a quality of governance measure. These variables should

capture some of the country specifics. Nevertheless, in the regression with dummies country dummies are still included to account for any missed-out country effects. There are also dummies to capture the time and the industry effects. Thus, the regression with dummies model takes the following form:

$$\Delta \ln K_{ijt} = \beta_0 + \beta_1 \ln \frac{r_{jt} + \delta_i}{1 - \tau^c_{jt}} + \beta_2 \ln unemp + \beta_3 \ln pop + \beta_4 \ln capgdp + \beta_5 \ln gov$$
$$+ \beta_6 IND_i + \beta_7 YEAR_t \left(+ \beta_8 C_j\right) + \varepsilon_{ijt}$$

where *IND* is a vector of industry dummies, *YEAR* – of time dummies, and *C* – of country dummies. The coefficient on $\frac{r_{jt} + \delta_i}{1 - \tau^c_{jt}}$ variable is the one of interest. This variable defines the user cost of capital without accounting for depreciation allowance. It excludes the interaction term between the corporate tax and the depreciation allowance rate due to data unavailability on the later. Based on the theoretical derivations and the investment theory the expected sign of β_1 is negative for this as all of the other regression specifications.

The regression with dummies model not only shows whether an increase in the user cost cause a decrease in the change of capital stock once controlled for country-, industry-, and time- effects but also provides measure for the influence of the fixed effects on the capital flow. However, the estimation of the constant-over-time terms may not be precise enough to allow for interpretation. This is not a problems since the coefficients on the dummies are of no particular interest and thus their magnitude and significance will not be reported. It is expected this regression and the regression using fixed effects to produce the same results. Nevertheless, I do not expect this to happen with the data set used for these regressions because the regression with dummies specification does not account for crossed

fixed effects. It is not feasible to include them for the sample size would not allow for estimating a regression with so many dummies.

The second method used for testing the effect of the user cost on FDI flows is first-differencing (FD). To obtain the equation needed, I first-differentiate the equation used for regression with dummies estimation. Since the left-hand side variable has already been differenced once differencing again results in having the second difference for this variable and this will lead to further loss of observations. This method subtracts the time-invariant fixed effect and hence no country and industry effects are left in the regression equation. It also eliminates any *country*×*industry*, *country*×*time*, and *industry*×*time* effects. However, there still could be some time effects (constant across countries and industries). These effects will be still present even after I difference equation I used for the regression with dummies. Thus, the first-difference model is:

$$\Delta^2 \ln K_{ijt} = \beta_0 + \beta_1 \Delta \ln \frac{r_{jt} + \delta_i}{1 - \tau^c_{jt}} + \beta_2 \Delta \ln unemp + \beta_3 \Delta \ln pop + \beta_4 \Delta \ln capgdp + \beta_5 \Delta YEAR_t + \varepsilon_{ijt}.$$

If sufficient part of the variation in given country-specific variable (unemployment, population and per capita GDP) is time-invariant, it may result in insignificant coefficients for these variables. This is because this variation will be practically zero after the first-differencing. Nevertheless, these variables should be included for a good estimation of the user cost coefficient. FD estimation needs fewer than fixed effect estimation assumptions to achieve efficiency. Though it requires strict exogeneity and no collinearity among the time-varying variable, it allows for random walk feature of the error terms of the non-differenced model. The FD estimation also leaves no room for constant-over-time explanatory variables. However, as mentioned there is no interest in the effects of these dummies on the FDI flow so the method is suitable for estimation the effect I am after.

The last method of estimation used is fixed effects (FE). The panel dimension is defined on *country*×*time*. That means that the fixed effects estimation accounts for *country*×*time*-, country-, and time- specific effects. There are still some fixed effects left out from this regression specification – the industry ones. Therefore, the model is tested with and without industry dummies for a reason of comparison. That is testing the following equation:

$$\Delta \ln K_{ijt} = \beta_0 + \beta_1 \ln \frac{r_{jt} + \delta_i}{1 - \tau^c_{jt}} + \beta_2 \ln unemp + \beta_3 \ln pop + \beta_4 \ln capgdp + \varepsilon_{ijt}.$$

The results of the FE estimation should be the same as the estimation with the dummy variables. This is within transformation – uses the time variation within each group defined. The means are obtained by averaging the equation and that gives the cross-section equations. After that the averages are subtracted from each variable in the original equation. The efficiency of the fixed effect estimator depends on stronger assumptions than the FD one. Besides the usual strict exogenenity requirement and that the elements that do not vary over time when transformed is identically zero for all time periods and any the cross section, the errors terms of model before transformation should be homoskedastic and serially uncorrelated.

Though in case of two-time period models the FE and FD estimators are identical that is no longer true when there are more time periods. The sample covers 10-year time spam. Thus the FE and FD estimations may give different results. Which of these results is more efficient depends on the assumption made about the error term. The more sticker assumption required for efficient FE estimator imply that is more likely that FD produces the best estimation for user cost effect on FDI flows. Any factor that causes the strict erogeneity assumption to fail such as measurement errors and omitted variables, which may cause contemporaneous correlation between the error term and any of the other variables on the

left-hand side, will make estimators of any of the three methods inconsistent. In case of differences in the results from the different methods, the reasons will be discussed in details in section 6.

5. Data Description

5.1 General Description

The data set includes yearly observations of FDI stock by industry, corporate tax rates, nominal interest rate, inflation, unemployment rate, GDP in national currencies, population, depreciation rate, and quality of governance measure for the time period 1997 - 2006 for eight European countries – Czech Republic, Greece, Hungary, Italy, Poland, Portugal, Slovak republic, and Spain. The data is break into seven industries – Agriculture and Fishing; Mining and Quarrying; Manufacturing; Electricity, Gas, and Water; Construction; Hotels and Restaurants; and Transportation, Storage, and Communication. Not all of the countries reported values for all of the industries and/or all of the years. Moreover, some of the other variables not related to the country reports like the quality of governance measure do not cover the all years. That results in highly unbalanced data set.

Most of the variables are taken from the OECD database, the rest are from IFS but two exceptions. The Governance Measure is taken from the World Bank Governance Indicators Database and the industry specific depreciation rates are constructed using the EUKLEMS database and their paper on methodology in determining assets depreciation rates. Due to assumption that depreciation is neither country- nor time-specific it is sufficient to calculate the industries' depreciation rates for only one of the eight countries. The weights of the different assets within a industry are taken for Czech Republic.

Among the rest of the variables used in the regression some are taken straight from the data bases some are constructed. The capital stock used in constructing the FDI is reported per industry in '000 USD. Data on nominal interest rate and inflation rate are used first in determining the real interest rate and then together with the corporate tax and the industry-specific depreciation rate in constructing the user cost of capital measure. The per capita GDP is calculated by first calculating the countries GDP in '000 USD and than

dividing it on the population. The unemployment is a percentage per annum and the population is reported in '000 of people. The last country-related variable included in the governance measure. World Bank provides six different governance measures as I choose only one of them, which I found the most suitable. The "Regulatory Quality" measure focuses exactly on the ability of the government policy making and facilitation of the private sector development. This measure is calculated annually and varies from -2.5 to 2.5 as the higher the number the greater the regulatory quality in the country. Graphs and variables summary statistics are in the appendix.

On average across countries the FDI increased over years while the corporate tax rate decreased (see the first graph in the Appendix). This, of course, does not imply a causal relationship, however, shows a general trend worth investigating. Since this paper is focused on industry level FDI, I include eight tables in the appendix – one for each country. There it can be seen the development of the FDI stock within a country as well as its break-down in industries for the 10-year time spam. All of the graphs include the entire 10-year period so that there it can be also seen for which years the country did not report FDI at all. I do not include any tax measure in these graphs, but it is included in the each of country-based discussion to follow.

5.2 Country By Country Details

Czech Republic – reported all seven industries in all ten years. There is an increase in the overall FDI over time. The greatest FDI is in Manufacturing, which applies for all of the countries. The next two largest sectors are Transport, Storage, and Communication and Electricity, Gas, and Water. Agriculture received the least investment. Construction and Mining varies a lot across years but both increased substantially after 2001. The corporate tax rate has been gradually decreasing over the time-spam, so there is not drastic change in the

corporate tax rate in 2001 which can be related to change in the Construction and Mining sector.

Greece – reported all seven industries in all years but 1997. There are periods of increase and decrease in the total FDI as a smooth upward trend can be observed after 2001. As in Czech Republic there is rather small amount of FDI in the Agriculture sector and the most FDI goes for Manufacturing. After Manufacturing the industry with quite huge FDI stock is Transportation, Storage and Communication. Another extreme is the rather small compared to the rest of the year investment in Mining in 2002 (practically unobservable on the graph). The tax rate in Greece also gradually decreased so there are no abrupt changes in this variable.

Hungary – reported all seven industries in five of the years. There is one non reported year between the reported ones – 2001, nevertheless, it can be seen that there is an increasing trend of the total FDI in the country. It has slightly more investment in Agriculture than any of the aforementioned counties but as in all of them the industry with highest FDI is Manufacturing. Similar to Czech Republic the next two largest sectors are Transport, Storage, and Communication and Energy related. The investment in Mining is rather small and as the Mining in Greece in 2002, it is practically unobservable on the graph. As in the countries discussed before in Hungary there are no abrupt changes in the corporate tax rate.

Italy – reported all ten years, but there are no reports regarding Hotels and Restaurants industry, as well as there are no reports on Electricity, Gas and Water industry for the years from 1997 to 2003 including. Moreover, there are no reports or zero value reoports on investment in Construction but in 2003. As in the other countries the greatest share of FDI goes to Manufacturing. Italy made a huge change in the corporate tax rate from almost 54 % in 1997 to 37% in 1998 as after that it gradually decreased.

Poland – reported all seven industries in all ten years. There is an upward trend in total FDI as well as in the two industries with highest proportions of FDI – Manufacturing and Transportation, Storage and Communication. The Construction and Electricity, Gas, and Water industries have good but volatile investment over the yeas. Hotels and Restaurants and Agriculture started having noticeably greater FDI stock after 2003. Poland had gradually decreased its corporate tax rate till 2003 when there was a bigger change of 8 percentage point from 27% to 19% in 2004.

Portugal – reported all industries but Agriculture and Mining in all ten years. This is the only country in the sample with no trend at all in either total FDI or industry-specific FDI. In all of the years Manufacturing receives the greatest share of FDI and the second greatest goes for as in the other countries Transportation, Storage, and Communication. Portugal decreased its corporate tax rate gradually with no drastic changes.

Slovak Republic – reported all seven industries from 1998 to 2002 inclusive. Total FDI increased over the period. No industry trends. As for the rest of the countries Manufacturing got the greatest shared of FDI in every year reported. An interesting fact is that there was rather small investment in the Electricity, Gas, and Water industry till 2001 and that there was a abrupt jump in that sector putting it on the second place by share of total FDI in 2002. Another sector with substantial investment is Transportation, Storage, and Communication. Slovak Republic did not change its corporate tax gradually. There are two major changes in 2000 from 40% to 27% and in 2004 from 25% to 19%. Unfortunately, there is no FDI data for covering the second change.

Spain – reported all seven industries in only two years – 2005 and 2006. That is not enough to see and trends in the Spanish FDI. However, it is interesting enough to observe the large change in FDI from 2005 to 2006.

To summarize: There are no particular trends in industry-specific FDI but in Poland. The industry with greatest share of FDI in every country and for every year is Manufacturing. Transportation, Storage and Communication and Electricity, Gas, and Water are the industries with second and third (not necessarily correspondingly) share of investment. All the countries but Spain have decreased their corporate tax rate. In Spain it stayed constant over the ten year.

6. Results and Discussion

6.1 Discussion of the Empirical Results

The sample contains observations of FDI stock for industries with first-digit classification. Though the industry break down is quite aggregate and there are lots of missing observations there is enough variation in the sample to produce meaningful results. Each of the three methods discussed in section 4 are tested in two different specifications. There is negative coefficient on the user cost in all regression specifications. However, only two methods and three regressions have significant coefficient on the user cost. These are two regression using first-differencing and one of the regressions with dummies.

From the other variables, unemployment is the one which is insignificant in all six regressions but in one of the FD specifications. Moreover, this FD specification is the only one that results in negative coefficient for unemployment. Even if the coefficient on unemployment is positive, this is not necessarily the wrong sign. If unemployment signals potential available work force to the firms, this may results in positive coefficient on employment. The rest of the variables change either the significance or the sign or both with different regression specifications. There is, however, a trend in the significance change. The more dummies are included the more variables become insignificant, implying possible multicollinearity between the dummies and the rest of the left-hand side variables. The significance in all six regressions is taken at 10% lever and the results are reported in Table 2 below. These issues will be assessed in detail below where the results of the regression are discussed in groups by econometric method.

The first two regression test the regression with dummies method. The coefficient on the user cost tells by how much the FDI flow changes if the user cost is increased by one unit. When country dummies are included all the variables become insignificant, while with no country dummies only unemployment is insignificant at 10%. That may suggest

multicollinearity between the country dummies and the other non dummy variables. If there is mulitcollinearity then that will increase the standard deviation and may result in lowering the significance of the variables. The R-square of the regression with all dummies is higher. However, that does not speak about the explanatory power of the model and it is a result of the inclusion of higher number of dummies.

Both FD regression produce negative and significant at 10% level coefficient on the user cost. Similar to the first two regressions when time dummies are included that makes the rest of the variables insignificant. However, contrary to the regression with dummies method, both FD specifications have significant and negative coefficient on the user cost. Though it is a bit small in magnitude, it confirms the negative effect of the user cost on the rate of change of FDI flows. The FD regression without time dummies is the only one that produces significant coefficients on all of the explanatory variables. However, in the time-dummy specification the significance of the user cost is a bit lower, suggesting that the inclusion of time dummies is important for correct estimation of the coefficient on the user cost. Without them we have important omitted variables and thus biased estimation. The two FD regressions have relatively low R-square, which is not surprising since the estimation results in not including many factors that for sure influence the FDI but are fixed over time and the sample sized is further reduced by the differencing.

The two FE regressions give insignificant coefficient on the user cost and statistical software used dropped the other non-dummy variables from the regression. The way the panel is specified for the FE estimation is on *country*×*time* dimension. This specification accounts for country-time effects as well ass for individual country and time effects. The drop-outs of the other non-dummy variables could be because they do not have enough variation in *country*×*time* dimension. The R-sqr measure does not say anything about the overall effect of the model that is why its lower values are not worrisome. The insignificance

in the two regressions with FE specification can be result of unsuitability on FE estimation for this data sample. The error terms may have different variances in every cross-section group or can be even serially correlated that will make the FE estimator inefficient. That is why tests for heteroskedasticity and serial correlation are performed. While there was no evidence of serial correlation, homoskedasticity was strongly rejected. The presence of heteroskedasticity is not surprising. It will be too much to expect from a sample with eight different country groups to have errors with constant variance. These facts are sufficient to proof that the FD method is the better estimation method. The FE results are also different from the ones in the regressions with dummies. In sum, the FD estimation is superior to both FE and regression with dummies estimations.

One potential thing can, however, make all of these estimation methods give inconsistent results. If the strict exodeneity fails then all of the regression results are useless. Two factors can cause endogeneity – measurement errors in the left-hand site variables and omission of firm-specifics not captured by the industry dummies. Later issue cannot be address with this sample since it requires firm-level data. The former issue with the measurement error is mostly like to occur in the user cost through two different channels. There is lack depreciation allowance or any other form of tax exemption in the calculation of the user cost. Such a variable would have given greater variation across industries, especially since the depreciation allowances are asset specific and the same asset enters each industry with different weights. Moreover, the depreciation allowance would be included in the error term and it will make the coefficient on the user cost in consistent. If however, depreciation allowance is time invariant at least in these ten years this problem will be solved by the FD method.

The other possible measurement error is connected with the interest rate. Real interest rate requires inflation rate in order to be calculated. However, the way inflation is accounted

in the different countries may have some mismeasurements or be incomparable and thus the problem will be translated to the real interest. Moreover, there could be issues with the interest rate if the firm finances the investment by borrowing and is allowed to borrow both in the home and in the foreign country. This results in two different interest rates affecting the investment decision. Either of these interest rate measurement issues would mean that there is a correlation between the user cost variable, which contains the interest rate measure, and the error term. This type of measurement error is unlikely to be fully addressed by the first – differencing.

Regarding the magnitude of the impact of the user cost on FDI flows, here follows few more comments. Based on the prior discussion the most robust result is given by FD method with time dummies. Though the result is promising and in line with the theory, the coefficient is rather small in magnitude. That could be because from the sample with 640 entries the sample size used in the regression is reduced to one third of the original size due to missing observations. Moreover, it is should be acknowledge that some endogeniety still may be present and causes bias in the estimation of effect of the user cost on the change of the FDI flows.

Table 2 – Regression Results

Dependent Variable: $\Delta \ln K_{ijt}$						
	OLS with Dummies		FD		FE	
ln*uc*	-.2580739 (.1318252)	-.1184563 (.1037966)	-.2144973 (.0842959)	-.2753486 (.089246)	-.0713868 (.168705)	-.0524602 (.2301742)
ln*unemp*	.0838072 (.2853442)	.046604 (.3659009)	-1.709225 (.9090249)	.2093315 (1.207437)	dropped	dropped
ln*pop*	.4280806 (.1577998)	10.90588 (9.761829)	49.57476 (22.58403)	13.9643 (28.46831)	dropped	dropped
ln*capgdp*	-.4016087 (.2980874)	.5753426 (1.135119)	2.061682 (.5822428)	.2157597 (1.794071)	dropped	dropped
ln*gov*	.8044367 (.3248761)	.3550897 (.2517958)	-1.334459 (.7396563)	-.3032608 (1.021162)	dropped	dropped
Country Dummies	no	yes	no	no	no	no
Industry Dummies	yes	yes	no	no	no	yes
Year Dummies	yes	yes	no	yes	no	no
Cons	-.0981707 (1.00068)	-18.97273 (18.29555)	-.3804454 (.1159629)	.4563698 (.089246)	.1295418 (.6234882)	.1662305 (.909774)
R-sqr	0.2144	0.6669	0.2464	0.2949	0.0905	0.0010
No of obs	212	212	96	96	212	212

Notes: The FD is based on the first-differencing of the second OLS with Dummies specification, the one including all dummies. The panel variable for the FE estimations is defined on *country*×*time*. The non-dummy explanatory variables in the FE specifications are dropped by STATA when running the regression

6.2 Further Discussion

The best estimation (FD with time dummies) gives negative and significant results on the coefficient user cost. This suggests that the user cost is a way to transmit the corporate tax effect on FDI flow. Most authors of the articles this paper refers to make claims that the earlier estimation of taxation effects on FDI produce small, quite divergent, and some times

insignificant results were due to lack on disintegrated data. It is true that the estimations based on firm-level data produce significant results. Nevertheless, the results in this paper show that even on aggregate level data there still is possible to obtain result consistent with the theoretical predictions. Moreover, it is possible to account for some of the firm specific effects. That is in line with Clark (2000) discussion of empirical evidence on effects of taxation on FDI. He claims that the tax sensitivity of foreign investment has increased over time. That could be as Clark (2000) suggest because the non-tax barriers of FDI have decreased or because the countries usually tested empirically are more and more economically and politically stable and similar. These arguments give plausible explanation of the significant and negative outcome of the user cost coefficient in this paper there is some.

Two articles use aggregate data for estimating the corporate tax effects on FDI – Billington (1999) and Hines (1996). They approach the problem as estimating the FDI in only one host location. While Billigton focuses on determinants of FDI in UK, Hines (1996) analyses the US as a host country. Moreover, they both also make estimation on county/state level. They find negative impact of taxation on FDI. However, they do not use any of the empirical methods used in this paper nor their estimation is based on including statutory tax rate in to the regression equation. According to De Moojo and Veen (2003) this is not very appropriate why of measuring tax effect on investment. Two interesting facts in these articles are worth few more lines. Billington (1999) also estimate positive coefficient on the unemployment rate and argues that unemployment is more of a signal of available labor force than an indication of general economic state. Hines (1996), argues that magnitude of the effect of host country corporate tax depends on whether this taxes are exempt in the home location. In deriving the model I assumed that there is full tax exemption in the home country. This backs the claim made earlier in the this section that lack of observations of

deprecation allowance and tax exemption rules have effect if not on the significance of the coefficient on the user cost then at least on its magnitude.

The negative effects of corporate tax are reconfirmed in different specification and models including the one in this paper. Though significant result, the FD estimation does not show great magnitude of the impact of user cost on FDI. This implies that the increasingly stable political and economic conditions in Europe and not only here, the corporate tax rates can be expected to become more influential but are still not that important in affecting the FDI flow. There may be tendency countries to rely more heavily on statutory corporate tax rate than short-term investment temptations as tax holidays to achieve more stable over time results FDI inflow. However, this does not seem have any crucial effect on the FDI. There is, moreover, no proof that the optimum corporate tax rate for greater FDI flows is zero given the other government's objectives. It is not really plausible to expect the countries to engage in tax wars that will lead to zero tax rates. After all governments need to resources to finance public project and the taxation is the source of government revenue. Thus, this leaves little room for further lowering of tax rates. Furthermore, once the countries reach a similar low level tax rates, it is very likely the taxation will become rather unimportant and may be insignificant determining for FDI location.

7. Conclusion

The theoretical model derived in this paper confirms the negative relation of the new capital invested in a foreign country to the user cost of this capital. The user cost is the channel through which the government fiscal policy, the corporate tax rate in particular, is transmitted to the investment decision of the firm. Panel date of eight countries and seven industries is used for testing whether the user cost has significant and negative impact on FDI flow. The countries are stable politically and economically as well as in close geographical proximity with one another. That helps in isolating the effect on the tax on FDI.

Three different estimation techniques for panel data are used – regression with dummies, first-differencing, and fixed effects. Each of the methods is used in two different regression specifications. The most robust result is achieved under FD with time dummies. The results confirm the negative and significant impact of the user cost on the FDI flows. Nevertheless, the effect of the user cost is still quite small and there is still a potential endogeneity problem related to the interest rate. Thus, this result can be accepted only with some reservations.

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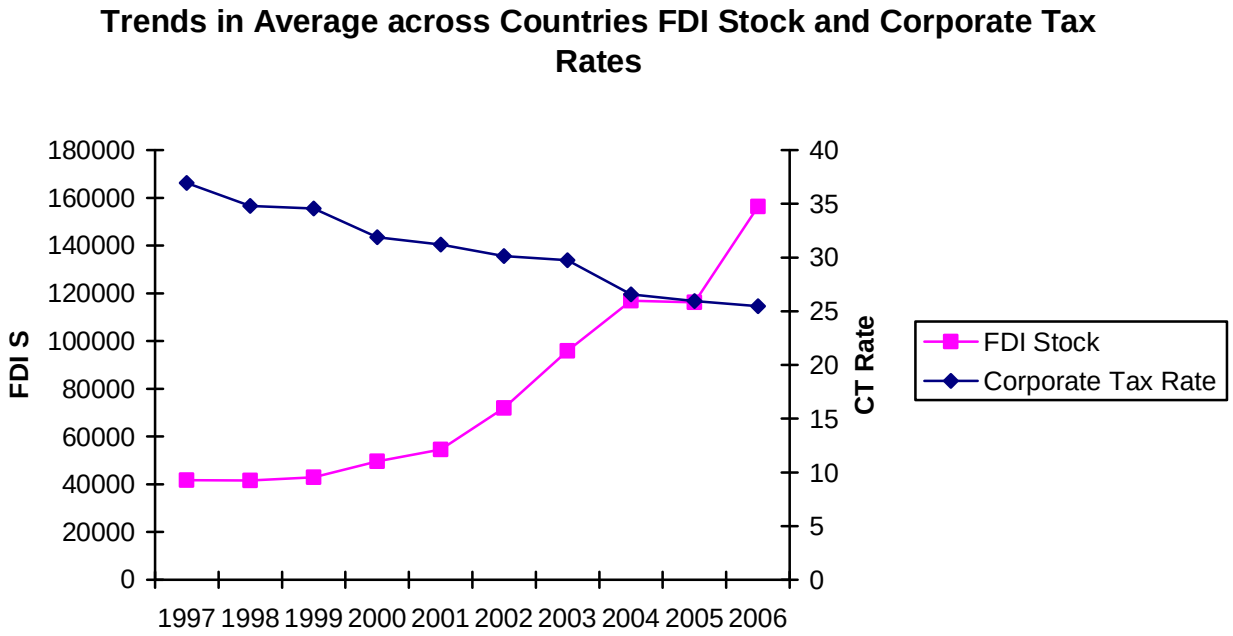
APPENDIX

Table 1 - Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FDI stock	461	17293.46	49773.08	0	463455
user cost	560	.0327678	.0473875	-.091488	.209657
corporate tax rate (%)	640	30.72663	7.660144	16	53.2
unemployment (%)	640	10.55022	4.212598	3.925	20.8
population	640	23.04977	18.4498	5.38157	58.982
per capita GDP	640	12.85822	7.707335	3.67692	33.16684
regulatory quality	448	.9774865	.2341341	.2192426	1.35



Value of FDI Stock in ‘000 USD per Industry: