THE EFFECT OF CORPORATE TAX ON FOREIGN DIRECT INVESTMENT

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ABSTRACT

This paper primarily investigates the effect of corporate tax on foreign direct investment inflows using data from a panel of 35 countries over the period between 2005 and 2016. The paper finds that the impact of corporate tax rates on foreign direct investment inflows is significantly negative. Also, the paper calculates relative efficiency scores and potential recovery rates of 35 countries by using Data Envelopment Analysis in order to help policymakers about how to change corporate tax rates so that FDI becomes efficient. The results show that there are 15 countries efficient for maximizing FDI by using corporate tax rate while 20 countries are inefficient and the average efficiency scores range from 100% to 30.93%.

Keywords: Corporate Tax, FDI, Panel Data, DEA, Efficiency Score.

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KURUMLAR VERGİSİNİN DOĞRUDAN YABANCI SERMAYE YATIRIMLARI ÜZERİNDEKİ ETKİSİ

ÖZ

Bu çalışma ilk olarak kurumlar vergisi oranlarının doğrudan yabancı sermaye yatırımlarına etkisini araştırmaktadır. Bu kapsamda çalışmada 2005- 2016 yılları için 35 ülkeye ait panel veri seti kullanılmıştır. Çalışmada kurumlar vergisi oranlarının doğrudan yabancı sermaye girişlerine olan etkisinin istatistiksel olarak anlamlı ve negatif olduğu görülmektedir. Bu çalışmada ikinci olarak, göreli olarak daha etkin doğrudan yabancı sermaye girişleri elde edebilmek için kurumlar vergisi oranının nasıl değiştirilmesi konusunda yol gösterebilmek amacıyla ülkelerin göreli etkinlik puanları ve potansiyel iyileştirme oranları hesaplanmıştır. Sonuçlar, kurumlar vergisi oranını kullanarak etkin doğrudan yabancı sermaye girişleri elde edebilen 15, elde edemeyen 20 ülkenin olduğunu göstermektedir. Ülkelerin ortalama etkinlik puanları % 100 ile % 30.93 arasında değişmektedir.

Anahtar Kavramlar: Kurumlar Vergisi, DYY, Panel Veri, VZA, Etkinlik Değerleri

INTRODUCTION

From a policy perspective, foreign direct investment (FDI) is widely considered to be beneficial for the host country because FDI is thought to provide new growth opportunities, higher wages and employment, larger tax revenues, and a higher welfare level (Becker, Fuest and Riedel, 2012). FDI is vital to have financial stability, promote economic development, enhance the wellbeing of societies, help host countries to develop local businesses, support international trade through access to markets, and contribute to technology and know-how transfer. Moreover, FDI has an impact on the development of labor and financial markets and economic performance (OECD, 2008). Thus, in terms of policy makers, attracting foreign direct investors is considered valuable for a host country (Becker et. al., 2012). It is clear that corporate taxes play an important role in the policy instruments that will attract foreign direct investment. For this reason, many countries have changed their corporate tax rates significantly to attract FDI (Barrios, Huizinga, Laeven and Nicodème, 2009; Becker et al., 2012; Coughlin, Terza and Arromdee, 1991; Hartman, 1984; Lawless, McCoy, Morgenroth and O'Toole, 2014; Loretz, 2008; Merz, Overesch and Wamser, 2017; Nielson, Asmussen and Weatherall, 2017). Empirical research measures the effects of these tax reforms and find that there is indeed a strong and robust impact of corporate tax on FDI, but the sign of the relationship between corporate taxes and FDI is still controversial because empirical approaches also create ambiguity (Alfaro, Chanda, Kalemli-Ozcan and Sayek,

2004; Barrios et al., 2009; Coughlin et al., 1991; Devereux and Maffini, 2007; Lawless et al., 2014; Merz et al., 2017; Nielson et al., 2017).

Understanding the link between corporate taxes and FDI is still a matter of intense interest to policymakers and academics. However, it is difficult to know which empirical models are robust and which are fragile (Chanegriha, Stewart and Tsoukis, 2017). Thus, this paper contributes to the literature by exploring whether corporate tax is one of the robust determinants of FDI. Therefore, this research seeks an answer to the following question:

Is the relationship between corporate taxes and FDI significantly negative or positive?

Also, the following hypothesis is tested:

Corporate income taxes have a significant negative effect on FDI inflow.

In the light of the points mentioned above, we use a larger sample and a more widespread set of variables. We include the most possible determinants of FDI as control variables, which is suggested by previous literature on FDI. Second, we use panel data set, which refers to data containing at least two dimensions: cross-section and time series. In our panel data regression, we use the fixed effects estimator with country and year-fixed effects as indicated by F test, LM test and Hausman test for econometric specifications.

This study has some limitations such as data unavailability since data are not available for all countries. For this reason, the present paper uses 35 countries whose effective tax rate data are available for the relevant period. These 35 countries include 28 EU countries, 2 EU candidates, 2 other European countries and 3 OECD countries for the period from 2005 to 2016. The sample of the countries employed in this study have 15% of the world population, produce 62% of the world GDP, have 58% FDI inflow and 76% FDI outflow. Moreover, the paper calculates relative efficiency scores and potential recovery rates of 35 countries by using Data Envelopment Analysis (DEA) in order to help policymakers about how to change corporate tax rates so that FDI becomes efficient.

The rest of the paper is set up as follows. In Section 2, we give a literature review as a theoretical review and empirical review. The characteristic of the data, model and the implications of our empirical findings are given in Section 3. Finally, Section 4 concludes.

I. LITERATURE REVIEW

A. THEORETICAL REVIEW

Tobin's q and Ownership Location and Internalization (OLI) are two alternative theories that explain the channels through which corporate tax rates may affect FDI. The Tobin's q explains how taxation might affect FDI in a

neoclassical school of thought setting (Jorgeson, 1963; Mudenda, 2015; Romer, 2012) while OLI explains this relationship in an Eclectic paradigm (Dunning, 2001; Mudenda, 2015). According to Tobin's q theory, there is an indirect effect of taxes on investment. In other words, corporate taxes have a significant impact on the cost of capital and then the cost of capital has a significant impact on investment. According to OLI Paradigm, FDI flow arises if companies have ownership, location and internalization advantages.

There are some other studies on the theories of FDI in the literature that investigates the effect of corporate tax on foreign direct investment. For example, one of the first pioneer papers in this area is authored by Hartman (1984), who investigates this relationship in the US for the period between 1965 and 1979. He divides the source of FDI into two parts: retained earnings and transfers from abroad. Furthermore, Hartman concludes that FDI is financed by both and that retained earnings and transfers from abroad are affected by tax policy.

Moreover, empirical findings suggest a negative relationship between FDI financed by retained earnings and tax rate. Although all the model coefficients are significant and have expected sign, the model does not explain transfers from abroad as well as retained earnings.

Boskin and Gale (1987) extend Hartman's (1984) paper by using a revised tax rate, rate of return data and longer time-series from the period 1956-1984. As a result, they support the empirical evidence of Hartman's (1984) paper specifically for retained earnings.

Young (1988) modifies Hartman's (1984) model by making some data revisions and focusing on the period between 1953 and 1984 for the US. For retained earnings, Young (1988) supports the empirical evidence of Hartman (1984) and Boskin and Gale (1987).

Murthy (1989) criticizes the estimation method of Young's paper (1988) since there is no autocorrelation test in that study. Thus, Murthy uses maximum likelihood estimator in order to solve the autocorrelation problem. Although Murthy's estimation results, especially the significance of parameters, differ from Young's (1988) paper, the conclusions remain the same.

Earlier studies in the literature mainly use the FDI series, as measured by the Bureau of Economic Analysis. For instance, while Hartman (1984) and Boskin and Gale (1987) use annual BEA data, Young (1988) uses revised BEA data. However, Slemrod (1990) points out that the FDI data comes from BEA, which is constructed from benchmark surveys. Forward and backward estimations are obtained by using benchmark data, and unreliable estimations appear. Therefore, Slemrod (1990) adds some dummy variables and correct unreliability in the FDI series. In addition, Slemrod uses alternative tax rate measurement, namely the marginal effective tax rate and includes explanatory

variables in the model. Slemrod concludes that there is a negative effect of US taxation on total foreign direct investment. In contrast to what Hartman and others suggest, there is a negative relationship between US taxation and transfer of funds, but not on retained earnings. Another contribution of the paper is about the effect of home country taxation on FDI in the US. Seven major investing countries -Canada, France, Italy, Japan, the Netherlands, the UK, West Germany- are used to determine home country effect. Slemrod (1990) argues that the home country tax rate is not an important determinant of FDI, whereas there are other papers in the literature that claim the opposite (Cummins and Hubbard, 1995).

B. THE EMPIRICAL REVIEW

A wide range of empirical research confirms theoretical literature by suggesting a negative relationship between tax rate and FDI. For example, Coughlin et al. (1991) focus on the location decision of FDI within the US for the period 1981-1983. They conclude that higher taxes deter FDI. Hines (1996b) shows that tax rates affect the location of FDI negatively. Gastanaga, Nugent and Pashamova (1998) examine the relationship between host country policies and FDI inflows. They use 49 less-developed countries over the period between 1970 and 1995. They find that corporate tax rates have a significantly negative and linear effect on FDI flows. Also, Merz et al. (2017) investigate the relationship between location decision and financial sector FDI. Their findings suggest a negative relationship between taxes and financial sector FDI.

On the other hand, it is possible to find some studies that cannot capture any significant relationship between corporate tax rate and FDI (Hunady and Orviska, 2014; Wheeler and Mody, 1992).

Swenson (1994) attempts to improve upon previous studies by arguing that the average tax rates might have a better proxy tax effect than effective tax rates do on aggregate FDI inflows. She uses aggregate FDI inflows data for 18 industries between 1979 and 1991. The main finding of the study is that there is a positive relationship between tax rates and FDI.

The link between tax rates and FDI are commonly investigated in the literature by using meta-analysis, and this meta-analysis area has been developed in many different ways. For example, De Mooij and Ederveen (2003) perform meta-analysis by comparing 25 studies and find that the median value of tax rate elasticity of FDI is -3.3. In other words, tax rate affects FDI negatively, and when there is 1% change in the tax rate, FDI changes by 3.3%. De Mooij and Ederveen (2005, 2006) extend De Mooij and Ederveen's (2003) meta-analysis by including additional new studies and paying more attention to control variables. As a result, the tax rate elasticity of FDI changes while the main findings remain the same. Feld and Heckemeyer (2011) also extend De Mooij and Ederveen's meta-analyses in several ways. First, they use 16 additional new

studies, which means that the total number of studies increases to 45. Also, they add additional control variables, which play an important role in capturing significant relationship between FDI and tax rate. Finally, they choose a much more robust methodology than the previous one. The main findings of the paper are consistent with both papers and indicate that taxation is significant for FDI.

A variety of follow-up studies test this relationship focusing on different groups of countries, methods, types of taxes, and periods, etc. For example, Desai, Foley and Hines Jr. (2004) focus on how the indirect taxes and corporate income tax of a host country affect FDI by American firms. They find that there is a negative relationship between all types of taxes and FDI. Benassy-Quere, Fontagne and Lahreche-Revil (2005) construct a panel of 11 OECD countries over the period between 1984 and 2000 and investigate how tax policies affect FDI. They show that high corporate taxation affects FDI negatively. Becker et al. (2012) use 22 European multinationals and the period between 2000 and 2006, and they report that the 1% increase in the corporate tax rates decreases the investment approximately 1.6%. Beck and Chaves (2011) use taxes on consumption, labor and capital income and construct a panel of 25 OECD countries over the period between 1975 and 2006. They focus on the bilateral FDI outflow. They find that there is a positive relationship between capital income tax rates and FDI outflows. Higher labor income tax rates affect FDI outflow negatively, whereas the effect of consumption taxes is insignificant.

In a more recent study, Nielson et al. (2017) investigate the location decision of FDI and review 153 quantitative studies during the period 1976-2015. For taxes, an equal amount of studies examine the positive and negative correlation of tax rates on foreign direct investment, and three studies find no correlation. Furthermore, Tian (2018) investigates the optimal policy for attracting FDI and compares investment cost subsidy policy and tax rate reduction policy. He concludes that when the growth rate and the volatility of the profit are higher and the discount rate is lower, the tax rate reduction is preferable for the host government to attract FDI.

On the other hand, there are controversial findings in the literature about which control variable to add as a determinant of FDI. There are various study results about the effect of many different determinants of FDI such as trade openness, government expenditures, reel GDP, GDP per capita, growth, labor force, reel exchange rate, interest rate, inflation, corruption, and public debt.

It is clear that trade openness provides a positive investment platform and there is a significant amount of empirical research suggesting a positive relationship between openness and FDI (Aziz, 2018; Aziz and Mishra, 2016; Boateng, Hua, Nisar and Wu, 2015; Chakrabarti, 2001; Chanegriha et. al., 2017; Helmy, 2013; Hunady and Orviska, 2014).

Government expenditures represent the size of government in the total economy. When government expenditures increase, it means that public sector competes with the private sector. In other words, the crowding-out effect may occur and FDI may be negatively affected. As a matter of fact, there are studies that find a negative relationship between government expenditures and FDI (Chanegriha et al., 2017; Edwards, 1990). However government expenditures have numerous categories such as education expenditures or investment in infrastructures, and that kind of expenditures may affect FDI positively. To sum up, several studies find positive and significant relations (Caetano and Galego, 2009; Coughlin et al., 1991; Yuan, Chen and Wang, 2010).

Real GDP and GDP per capita are the important determinants of FDI. Real GDP or market size may be decisive for investors. Higher host country GDP means higher market demand, and higher demand means higher profits for investors. There are various studies in the literature that show a positive relationship (Benassy-Quere et. al., 2005; Boateng et. al., 2015; Edwards, 1990). However, contrary to the studies mentioned above, Villaverde and Maza (2012) analyze the regional distribution of FDI in Spain during the period 1995-2005 and they find that market size, which is made up of GDP and total population, and FDI are statistically insignificant.

In addition to market size, growth possibilities of the host economy could be another significant determinant of FDI. Aziz and Mishra (2016) investigate the determinants of FDI inflows in Arab countries over the period from 1984 to 2012, and their findings show that GDP and GDP growth are the positive and statistically significant determinants of FDI. Also, Gastagana et al. (1998) show that growth is a significant determinant of FDI and there are positive relations between growth and FDI. Regarding GDP per capita, it reflects the consumption potential, and high consumption potential (or high GDP per capita) provide high market demand and, consequently, high FDI. There are many studies in the literature that show a positive relationship between GDP per capita and FDI (Chakrabarti, 2001; Coughlin et al., 1991; Helmy, 2013).

Investors' decision is affected by labor force. Therefore, in the case of high unemployment, workers are willing to work with low wages to keep their jobs. Thus, unemployment is expected to be positively correlated with FDI flows (Habib and Zurawicki, 2002). However, there are controversial empirical results. For example, while Coughlin et al. (1991) find a positive relationship, Boateng et. al. (2015) find a negative relationship. Nevertheless, there are also studies (Seyoum, 2011; Slemrod, 1990) that find no significant relationship.

The real exchange rate is a proxy for purchasing power, and local currency indicates the economic condition of the host country. An unstable currency of the host country may mean more risk and uncertainty for investors. In this case, the host country may attract less FDI. While Slemrod (1990), Klein and Rosengren (1994) and Cassou (1997) find a negative relationship between

real exchange rate and FDI, others such as Aziz and Mishra (2016), Boateng et al. (2015), and Edwards (1990) find a positive relationship between real exchange rate and FDI.

Interest rates are another important determinant of FDI inflows and there is currently no consensus on this relationship in the literature. For example, Yang, Groenewold and Tcha (2000) find a positive relationship between interest rates and FDI in Australia. On the other hand, Drabek and Payne (2002) and Boateng et al. (2015) show that an increased interest rate of the host country reduces the attractiveness of FDI.

The relationship between inflation and FDI is controversial, too. It is expected that low inflation rates attract more capital flows and there are some studies that find a negative relationship (Boateng et al., 2015; Yang et al., 2000). However, Campos and Kinoshita (2003) find a positive relationship. Nevertheless, Aziz and Mishra (2016) find a relationship that is both positive and insignificant. When using GDP as one of the independent variables, there is a positive relationship between inflation and FDI. On the other hand, when GDP is replaced by GDP growth as one of the independent variables, the relationship between inflation and FDI return is insignificant.

Corruption is defined by the World Bank (1997) as the abuse of public office for private gain. Given the adverse effects of corruption in areas such as economic growth, tax structure and the rule of law (Transparency International, 2014), a negative relationship between corruption and FDI is expected (Aziz and Mishra, 2016; Barassi and Zhou, 2012; Habib and Zurawicki, 2002). Moreover, Helmy (2013) find that an increase in the corruption variable (it means less corruption) decreases FDI in MENA countries over the period from 2003 to 2009. In other words, FDI varies positively with corruption. Wheeler and Mody (1992) find no significant relationship between the risk variable (it contains variables such as quality of the legal system, corruption, bureaucracy, political stability, etc.) and FDI.

Another controversial determinant of FDI is public debt. For example, Hunady and Orviska (2014) suggest a positive relationship between public debt and FDI, which suggests that higher public debt brings higher public expenditures that determine the quality of public services. On the other hand, Chanegriha et al. (2017) show a negative relationship between public debt and FDI, which suggests that higher public debt brings about higher future taxes.

High technology products are defined as goods and services that are produced by high research and development intensity, innovative and advanced technology companies and industries. Level of high technology exports can be used as a proxy for the technological intensity of a country. Technological infrastructure of countries may be the reason for the preference of foreign investors. On the other hand, a higher level of high technology exports can be

used as a proxy for better position growth and development level of countries (Baldwin, 1963). Also, FDI has a significant and positive effect on high technology exports (Tebaldi, 2011). Therefore, it is essential to determine whether high technology exports have an impact on foreign direct investment or not.

This paper differs from common literature in terms of emphasizing robust empirical evidence supporting the significant negative relationship between corporate tax and FDI. Moreover, the paper calculates relative efficiency scores and potential recovery rate of 35 countries by using DEA and, therefore, contributes to the literature by helping policymakers about how to change corporate tax rate so that FDI becomes efficient.

II. DATA AND MODEL

Corporate tax rates have declined over the last 12 years in most of the countries (see Table 1). An important question of this study is whether decreasing corporate tax rate results in increased FDI flows into the countries.

Table 1. Effective Average Corporate Tax Rates in the Countries

Country	2005-2008	2009-2012	2013-2016	Country	2005-2008	2009-2012	2013-2016
Turkey	20.12	17.90	15.90	Luxembourg	26.05	24.95	25.50
Austria	23.00	22.85	23.03	Malta	32.20	32.20	32.20
Belgium	26.38	25.55	27.32	the Netherlands	25.33	22.20	22.30
Bulgaria	11.02	8.90	9.00	Poland	17.25	17.50	17.50
Croatia	16.50	16.50	16.50	Portugal	24.15	26.13	27.50
Cyprus	10.60	11.43	14.67	Romania	14.75	14.80	14.78
Czech R.	20.78	16.90	16.70	Slovak R.	16.80	16.80	19.72
Denmark	23.83	22.45	21.38	Slovenia	21.32	17.98	15.50
Estonia	17.67	16.50	16.10	Spain	35.07	32.47	32.38
Finland	24.50	23.85	19.55	Sweden	24.60	23.20	19.40
France	34.60	33.65	37.43	the UK	28.95	27.20	22.42
Germany	33.75	28.10	28.20	Switzerland	18.77	18.70	18.60
Greece	24.13	21.63	25.73	Macedonia	11.55	7.90	8.80
Hungary	17.97	19.30	19.30	Norway	26.42	26.50	25.00
Ireland	14.37	14.40	14.25	Canada	33.92	28.15	24.92
Italy	30.67	26.25	24.18	Japan	41.50	41.20	36.93
Latvia	14.18	12.50	13.75	the United States	37.85	36.73	36.50
Lithuania	14.15	13.72	13.60				

Source: Taxation Trends in the EU (2016); Spengel, Christoph et al. (2016), Effective Tax Levels Using the Devereux/Griffith Methodology, ZEW Final Report 2016.

The paper investigates the effect of corporate tax rate on FDI. For this reason, the paper collects data from the period from 2005 to 2016 and 35[1] countries including 28 EU countries, 2 EU candidates, 2 other European countries and 3 OECD countries. The following panel data model is used to test this relationship [see Equation 1].

We add GDP as a proxy for market size, GDP per capita as a proxy for a country's development level, GDP growth as a proxy for future potential of market, corruption as a proxy for governance institutions, government expenditures as a proxy for the size of government, real exchange rate as a proxy for purchasing power, inflation as a proxy for macroeconomic stability, interest rate as a proxy for the opportunity cost of capital, unemployment as a proxy for labor availability, openness as a proxy for trade volume, public debt as a proxy for debt stock, and high technology exports as a proxy for better position growth and development level of countries.

We run seven different regressions with different sets of independent variables in each. We do this to see the robustness of our estimates to the inclusion of different sets of control variables.

$$FDI_{it} = \beta_0 + B_1 TR_{it} + \sum_{k=2}^{n} \beta_k CV_{it} + \varepsilon_{it} \qquad \text{[Equation 1]}$$

where $\sum_{k=2}^{n} \beta_k CV_{it} = B_2 SG_{it} + B_3 C_{it} + B_1 GD_{it} + B_1 HTE_{it} + B_1 U_{it} + B_1 ICP_{it} + B_1 G_{it} + B_1 GDP_{it} + B_1 GDP\text{-}per_{it} + B_1 O_{it} + B_1 RIR_{it} + B_1 RER_{it}$

where for country i in year t, FDI stands for foreign direct investment inflows as % of official GDP. We use effective average corporate tax rate as an independent variable. We also use 12 sets of control variables in our regressions: effective average corporate tax rate (TR_{it}), size of government as % of official GDP (SG_{it}), corruption (C_{it}), central government debt as % of official GDP (CGD_{it}), high technology exports as % of total export (HTE_{it}), unemployment as % of total labor force (U_{it}), inflation consumer prices (ICP_{it}), growth (G_{it}), gross domestic product (GDP_{it}), GDP per capita ($GDP\text{-}per_{it}$), openness (O_{it}), real interest rate (RIR_{it}), and real effective exchange rate (RER_{it}). We report heteroscedasticity-consistent ordinary least squares estimates. In our regression, we use the fixed effects estimator with country and year-fixed effects as indicated by F test, LM test and Hausman test for econometric specifications[2].

[1] The countries covered in this study are Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, the United Kingdom, Macedonia, Turkey, Norway, Switzerland, Canada, Japan, and the United States.

[2] Endogeneity occurs when a variable, observed or unobserved, that is not included in our models is related to a variable we incorporate in our model. The cross-section regression probably suffers from endogeneity bias in the form of omitted variable bias. In order to deal with endogeneity

Table 2. Variables and Sources

Variable	Definition	Source
FDI	Foreign direct investment inflows (% of GDP)	World Bank Database
TR	Effective average corporate tax rate	Taxation Trends in the EU (2016); Spengel, Christoph et al. (2016), Effective Tax Levels Using the Devereux/Griffith Methodology, ZEW Final Report 2016.
C	Corruption (The index uses a scale of 0 to 10. where 0 is highly corrupt and 10 is very clean)	Transparency International, Corruption Perception Index
SG	Size of government (General government final consumption expenditure (% of GDP)	World Bank Database
CGD	Central government debt, total (% of GDP)	World Bank Database
HTE	High technology exports (% of total export)	World Bank Database
U	Unemployment, total (% of total labor force)	World Bank Database
ICP	Inflation consumer prices (annual %)	World Bank Database
G	Growth	World Bank Database
GDP	GDP (constant 2010 US$)	World Bank Database
GDP-per	GDP per capita ,PPP	World Bank Database
O	Openness, (Export+import)/GDP	World Bank Database
RIR	Real interest rate (%)	World Bank Database
RER	Real effective exchange rate	World Bank Database

Once foreign direct investment inflow (FDI_{it}) is regressed on the set of different control variables in model 1 to model 7 (see Table 2), we expect to observe a negative relationship between corporate tax rate (TR_{it}) and foreign direct investment (FDI_{it}) (see Becker et al., 2012; Benassy-Quere et al., 2005; Desai et al., 2004; De Mooij and Ederveen 2003, 2005, 2006; Hartman, 1984). It is not the main subject of this study, but in terms of control variables, we also expect a negative relationship between foreign direct investment (FDI_{it}) and corruption (see Aziz and Mishra, 2016; Barassi and Zhou, 2012; Habib and Zurawicki, 2002) while we expect a positive relationship between foreign direct investment (FDI_{it}) and openness, GDP, GDP-per capita, GDP growth, high technology export (see Aziz and Mishra, 2016; Benassy-Quere et al., 2005; Chakrabarti, 2001; Coughlin et al., 1991; Gastagana et al., 1998; Helmy, 2013).

problem, we use panel data regression by accepting the identifying assumption as unobservable factors that might simultaneously affect the LHS and RHS of the regression are time-invariant. Then we have a powerful tool for removing omitted variable bias. This tool is known as fixed effects regression, and it exploits within-group variation over time. Across-group variation is not used to estimate the regression coefficients because this variation might reflect omitted variable bias.

On the other hand, research on the subject provides findings about the variables that are controversial (e.g. government expenditures, unemployment, real interest rate, real exchange rate, inflation, public debt) (Boateng et al., 2015; Caetano and Galego, 2009; Campos and Kinoshita, 2003; Cassou, 1997; Chanegriha et al., 2017; Coughlin et al., 1991; Hunady and Orviska, 2014; Yang et al., 2000).

III. EMPIRICAL FINDINGS

The paper reports the estimation results in Table 3a and Table 3b. We run seven different regressions with different sets of independent variables in each. We do this to see the robustness of our estimates to the inclusion of different sets of control variables.

For all the regression models, we observe that corporate tax rate is significantly and negatively correlated with FDI. A wide range of empirical literature also provides similar results on the relationship between corporate tax rate and FDI.

Regarding the control variables, we observe that debt, high technology export, GDP, trade openness, and corruption[3] are significantly and positively correlated while unemployment is significantly and negatively correlated with FDI.

When we interpret the empirical findings for individual models, we see that model-1 without GDP and GDP-per suggests that a percentage increase in the current corporate tax rate will reduce FDI by 2.09%. Model-2 without Growth and GDP-per suggests that a percentage increase in the current corporate tax rate will reduce FDI by 2.11%. Next, model-3 without Growth and GDP suggests that a percentage increase in the current corporate tax rate will reduce FDI by 2.12%. Also, model-4 without size of government, corruption, debt, high technology exports, unemployment, inflation, GDP Per, openness, real interest rate, and real exchange rate suggests that a percentage increase in the current corporate tax rate will reduce FDI by 1.12%. Then model-5 without size of government, unemployment, inflation, growth, GDP, GDP Per, real interest rate, and real exchange rate suggests that a percentage increase in the current corporate tax rate will reduce FDI by 2.01%. Model-6 without corruption, high technology export, inflation, Growth, GDP Per, openness, real interest rate, and real exchange rate suggests that a percentage increase in the current corporate tax rate will reduce FDI by 0.85%. Finally, model-7 without corruption, debt, high technology export, unemployment, inflation, Growth, GDP Per, real interest rate, and real exchange rate suggests that a percentage increase in the current corporate tax rate will reduce FDI by 1.14%.

[3] If the corruption variable increases, it means that the index is getting close to 10, which represents a very clean situation.

Table 3a. The Regression Results

Dep. Var: FDI Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
TR.(Tax Rate)	-2.090***	-2.113***	-2.118***	-1.124***
	(0.608)	(0.626)	(0.618)	(0.298)
Size of Government	1.817	1.249	0.801	-
	(1.757)	(2.751)	(1.729)	
Corruption	14.131***	13.719***	13.869**	-
	(5.286)	(5.283)	(5.392)	
Central Government Debt	1.162***	1.159***	1.145***	-
	(0.236)	(0.237)	(0.227)	
High Technology Export	5.321***	5.204***	5.210***	-
	(0.738)	(0.875)	(0.889)	
Unemployment	0.404	0.146	-0.109	-
	(1.197)	(1.220)	(1.489)	
Inflation	-0.042	-0.164	-0.143	-
	(1.066)	(1.075)	(1.055)	
Growth	77.825	-	-	-111.5927
	(114.912)			(95.2705)
GDP	-	2.09E-12	-	7.62E-12**
		(1.42E-11)		(3.5E-12)
GDP Per	-	-	-0.000	-
			(0.002)	
Openness	0.001**	2.26E-11	2.62E-11**	-
	(0.00018)	(2.38E-11)	(1.35E-11)	
Real Interest Rate	-0.324	-0.513	-0.474	-
	(0.573)	(0.381)	(0.312)	
Real Exchange Rate	0.163	0.087	0.095	-
	(0.209)	(2.243)	(0.236)	
c	-229.889	-203.445	-166.401	28.5151
	(59.472)	(93.507)	(90.210)	(0.2980)***
R-Square	0.685	0.684	0.684	0.399
Obs	267	267	267	418
Heteros. Test	12.196	5358.83	12684.94	7.6e+08
	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Autocorr. Test	0.487	0.592	0.559	0.352
	[0.4918]	[0.4493]	[0.4620]	[0.5572]
Hausman Test	207.8641	194.677	223.3737	7.4621
	[0.0000]	[0.0000]	[0.0000]	[0.0585]

Heteros. The test represents a Modified Wald test for Groupwise heteroskedasticity. Autocorr. Test represents Wooldridge test for autocorrelation in panel data. We also consider testing for the presence of heteroscedasticity in the Within estimated models. We do this by using Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980. 1986) correction to increase efficiency for all the models.

Table 3b. The Regression Results

Dep. Var: FDI Independent Variable	**(5)**	**(6)**	**(7)**
TR.(Tax Rate)	-2.006***	-0.845**	-1.143***
	(0.602)	(0.388)	(0.327)
Size of Government	-	2.181	-0.269
		(1.573)	(1.381)
Corruption	11.048***	-	-
	(2.601)		
Central Government Debt	0.994***	1.076***	-
	(0.175)	(0.199)	
High Technology Export	5.130***		-
	(0.846)		
Unemployment	-	-1.423***	-
		(0.493)	
Inflation	-	-	-
Growth	-	-	-
GDP	-	1.26E-12	-7.11E-12
		(4.36E-12)	(4.91E-12)
GDP Per	-	-	-
Openness	1.80E-11*	-	2.24E-11**
	(9.50E-12)		(1.12E-11)
Real Interest Rate	-	-	-
Real Exchange Rate	-	-	-
c	-126.024	-67.313	-
	(23.271)	(38.650)	
R-Square	0.600	0.544	0.395
Obs	350	350	415
Heteros. Test	37953.10	1.4e+05	8.3e+05
	[0.0000]	[0.0000]	[0.0000]
Autocorr. Test	0.269	0.344	0.221
	[0.6077]	[0.5615]	[0.6416]
Hausman Test	127.4540	100.1710	70.0394
	[0.0000]	[0.0000]	[0.0000]

Heteros. The test represents a Modified Wald test for Groupwise heteroskedasticity. Autocorr. Test represents Wooldridge test for autocorrelation in panel data. We also consider testing for the presence of heteroscedasticity in the Within estimated models. We do this by using Modified Wald test for groupwise heteroskedasticity. The null hypothesis is rejected for all the models. Therefore, we take heteroscedasticity into account and make White (1980. 1986) correction to increase efficiency for all the models.

In order to help policymakers about how to change corporate tax rate so that FDI becomes efficient, the paper calculates efficiency scores and potential recovery rate of 35 countries for the period between 2005 and 2016 by using DEA. DEA is a linear programming-based technique for measuring the relative performance of units where the presence of multiple inputs and outputs makes comparison difficult (Boussofiane, Dyson and Thanassoulis, 1991). For this reason, the paper uses the CCR model to maximize output. This is the most widely used and best-known DEA model that uses constant returns to scale (Charnes, Cooper, and Rhodes 1978).

CCR-Dual Output oriented model is displayed as follows:

$$\max \alpha_j = \sum_{r=1}^{s} u_r x_{rj} \quad \text{[Equation 2]}$$

subject to

$$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 1.\ j = 1.2.3\ldots,n$$

$$\sum_{i=1}^{m} v_i y_{ij} = 1$$

$$u_r \geq 0.\ r = 1.2\ldots,s$$

$$v_i \geq 0.\ i = 1.2\ldots,m$$

The potential recovery rate is calculated as follows:

$$X_2 = (X_1) - [(X_1)*(1- \alpha)] \quad \text{[Equation 3]}$$

Where X_2 is the amount of input required, and X_1 is the amount of actual input used. Therefore, the potential recovery rate is:

$$(\theta) = (X_2 - X_1) / X_1 \quad \text{[Equation 4]}$$

The calculated potential recovery rates demonstrate the level of needed increases output or decreases input to make the corresponding country efficient. Variables used in DEA come from the significance of the panel regression models.

Inputs: Effective average corporate tax rate

Control Variables as An Input: Corruption, Unemployment, Inflation, consumer prices, Central government debt.

Table 4. Efficiency Scores

Country	Efficiency Score (α)	Country	Efficiency Score (α)
Greece	100	Bulgaria	88.87
Croatia	100	Cyprus	85.93
Denmark	100	Slovak Republic	76.68
the Netherlands	100	Germany	73.77
Norway	100	the United Kingdom	67.47
Japan	100	France	65.21
Macedonia. FYR	100	Belgium	64.12
The United States	100	Latvia	62.13
Ireland	100	Austria	61.44
Estonia	100	Canada	61.2
Switzerland	100	Slovenia	56.54
Czech R.	100	Romania	54.74
Hungary	100	Italy	49.89
Luxembourg	100	Poland	45.28
Malta	100	Turkey	37.1
Lithuania	98.08	Spain	34.45
Finland	97.5	Portugal	30.93
Sweden	89.53		

Table 4 shows the efficiency scores. The efficiency scores are measured based on α from Equation-2. According to the table, if the efficiency scores are close to 100, that indicates relatively higher corporate tax rate efficiency performance on FDI than the others. As can be seen in Table 4, there are 15 countries efficient for maximizing their FDI by using corporate tax rate while 20 countries are inefficient and average efficiency scores range from 100% to 30.93%.

Table 5. Potential Improvements Rate

Country	Actual FDI	Target FDI	PIR-FDI	Actual TR	Target TR	PIR-TR
Lithuania	2.74	10.19	271.7	13.82	13.56	-1.9
Finland	2.65	2.95	11.2	22.63	14.67	-35.2
Sweden	3.01	3.01	0	22.4	18.34	-18.1
Bulgaria	9.99	14.55	45.7	9.64	8.57	-11.1
Cyprus	24.17	24.17	0	12.23	10.51	-14.1
Slovak Republic	3.52	19.01	439.9	17.77	13.63	-23.3
Germany	1.77	4.14	133.9	30.02	22.14	-26.2
United Kingdom	4.78	4.78	0	26.19	17.67	-32.5
France	1.82	7.94	335.2	35.22	22.97	-34.8
Belgium	11.92	15.58	30.8	26.42	16.94	-35.9
Latvia	3.88	14.47	272.7	13.48	8.37	-37.9
Austria	3.96	7.68	93.8	22.96	14.11	-38.6
Canada	3.4	7.04	106.8	29	17.75	-38.8
Slovenia	1.72	17.51	915.8	18.27	10.33	-43.5
Romania	3.74	6.06	61.9	14.77	8.09	-45.3
Italy	1.18	11.73	893.4	27.03	13.49	-50.1
Poland	3.34	9.21	175.3	17.42	7.89	-54.7
Turkey	1.98	8.65	337.3	17.98	6.67	-62.9
Spain	2.8	10.75	283.5	33.31	11.47	-65.6
Portugal	4.15	10.45	151.8	25.93	8.02	-69.1

The paper uses the non-parametric method (DEA) for calculating relative efficiency. Table 4 shows the relative efficiency scores of the countries. The relative efficiency score of an individual country indicates relatively higher corporate tax rate efficiency performance on FDI than the other countries. Using relative efficiency score, it is possible to calculate the potential recovery rate for inefficient countries [see Equation 4], which helps policymakers about how to change corporate tax rate so that FDI becomes efficient. It is clear that the nonparametric method (DEA) allows us to compare inefficient countries to a convex combination of efficient countries. Thus, we can clearly calculate the target value of inefficient countries by using efficiency scores. Table 5 shows the potential recovery rate of inefficient countries. Columns 1 and 4 and Columns 2 and 5 in Table 5 represent an actual value and a target value of FDI and TR, respectively.

For example, as shown in Table 5, Turkey has 1.98 for FDI and 17.98 for TR. However, in order to be an efficient frontier, Turkey should have 8.75 for FDI and 6.67 for TR. Therefore, it is clear that Turkey should decrease its corporate tax rate by 62.9% and increase its FDI rate by 337.3%.

This would be very helpful for policymakers about how to change policy tools in order to become efficient.

CONCLUSIONS

FDI is an important tool for policymakers to increase financial stability, promote economic development, and enhance the wellbeing of societies. Moreover, FDI helps host countries to develop local businesses, support international trade through access to markets, and contribute to technology and know-how transfer. Thus, there is an overwhelming interest to policymakers to increase the level of FDI.

This concern of FDI by policymakers also brings about different tax arrangements for countries such as offering tax holidays, giving tax incentives and setting up optimal tax rates to potential investors. The question here is "To what extent FDI flows are influenced by the level and mechanism of taxation?" Interestingly, there is no consensus on how corporate tax affects FDI. In order to find an answer to this question, the paper investigates the effect of corporate tax on FDI using data from a panel of 35 countries over the period between 2005 and 2016. Therefore, the paper specifically tests the hypothesis that corporate income taxes have a significant negative effect on FDI inflow.

According to the empirical results, we accept the null hypothesis and show that the impact of corporate tax rates on FDI inflows is significantly negative. It is obviously concluded that corporate tax rate is one of the significant determinants of FDI. Combining various control variables confirms robustness of our results. These findings are consistent with economic theory.

Regarding the control variables, debt, high technology export, GDP, trade openness, and corruption are significantly positively correlated with FDI, whereas unemployment is significantly and negatively correlated with FDI. The results may help to improve the implementation of fiscal policy in terms of taxation.

It is obvious that the corporate tax rates have declined over the last 12 years in most of the countries. An important finding of this study is that decreasing the corporate tax rate will increase the FDI inflow into the country. In order to help policymakers about how to change the corporate tax rate so that FDI becomes efficient, the paper calculates efficiency scores and potential recovery rates. The results show that there are 15 countries efficient for maximizing their FDI by using corporate tax rate while 20 countries are inefficient. It is also recommended for these inefficient countries to make potential improvements calculated in the paper in order to become efficient.

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