Taxation and the quality of institutions: asymmetric effects on FDI

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European Commission

2010

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This version: June 2010.

Abstract

Economic integration has intensified international competition to attract productive capital. This paper analyzes, both theoretically and empirically, the effect of tax policies and institutional quality on the allocation of FDI – two aspects that the economic literature has extensively investigated, though only in isolation. I build a simple two-country partial equilibrium model to study competition among governments vying for potential investors whose location choices are driven by both the quality of institutions and the corporate tax rate. Modeling good governance as a public good, it is shown that the jurisdiction providing better institutions is able to levy a higher tax on capital. Moreover, provided firms are sensitive enough to institutional quality, it attracts a larger share of investment than the low-quality/low-tax location. The main predictions of the model are tested on FDI stocks to 63 economies using a "simple difference gravity" equation derived from discrete choice theory of firms' location. Using a pair of destination countries as the unit of analysis eliminates the need to control for multilateral interdependence among receiving countries, a source of possible bias in the traditional gravity specification in the levels. The empirical

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evidence corroborates the claim that the sensitivity of foreign investment to the tax rate varies significantly between host countries characterized by different levels of institutional quality. The findings are robust to a number of sensitivity checks and to the use of instrumental variables to tackle endogeneity of institutional quality and tax rates.

Keywords: foreign direct investment, fiscal competition, institutions, public goods.

JEL classification: H7, F21, F23, K00.

< *All tables and figures placed at end* >

1. Introduction

International mobility of productive capital has increased significantly in the past decades. In the globalized economy, the issue of what drives international investment is becoming increasingly pressing for national governments willing to attract multinational enterprises. Among policy makers it is commonly believed that corporate taxation plays a paramount role in the international allocation of investment. Hence, following the integration of capital and product markets, there have been growing concerns that the intensified competition for mobile investment be conducive to a race to the bottom in corporate tax rates. This process would ultimately result in underprovision of public goods, potential distortions in firms' location decisions and an increasingly unsustainable pressure on national public finances[1]. Within the European Union (EU), for instance, the slashing of tax rates in many countries of Central and Eastern Europe has been repeatedly blasted by governments of the old member States. Hence, many in the policy arena have advocated a cooperative response in the form of international tax coordination. In fact, in the 1990s, both the OECD and the EU have proposed initiatives designed to oppose what they regard as harmful tax competition[2].

[1] These fears have been recently echoed by IMF Deputy Director Murilo Portugal (2007) stating "there is equally little doubt that globalization is likely to have a substantial effect on countries' ability to sustain tax revenues". It is expected that such problems of long-term fiscal sustainability be exacerbated by the recent expansionary budgetary policies put in place in response to the global economic and financial crisis.

[2] Interestingly, both these initiatives envisage other measures than the harmonization of company tax rates. In particular, the EU has introduced a Code of Conduct for business taxation (European Communities, 1998) which aims to ban discriminatory corporate tax policies, e.g. those favoring multinational enterprises over firms considered less mobile internationally. The parallel initiative of the OECD (1998) has the same purpose of eliminating preferential tax

Against this background, it is rather surprising that, according to the *Ernst & Young* European Attractiveness Survey 2008, the tax rate on corporate income levied by the potential destination country does not figure in the top five most important factors determining location choices. As a matter of fact, international investors claim to value the most the "transparency, stability and predictability of the political, legal and regulatory environment", together with the provision of physical infrastructure (54% of respondents). It is not difficult to find paradigmatic examples of the importance of market-fostering institutions on investment. Portugal, Greece and Spain experienced an unprecedented surge in FDI inflows after joining the EU. More recently, Turkey has registered an analogous boom in inward investment coincident with its accession negotiations to the EU[3]. According to the Wall Street Journal (2005), thanks to these official entry negotiations Turkey has been forced to become more similar to the EU countries in its banking sector, antitrust laws, regulation, and policies, with a positive feedback on attracting foreign investment. In fact, major institutional reforms and constitutional changes have been undertaken, including the 2003 FDI law reducing the regulatory burden on foreign investors. Multinational companies such as Metro, Peugeot Citroėn PSA, Vodafone PLC, and France Telecom have been increasing their presence in Turkey, arguing that the investor protection and overall investment climate improved considerably as a result of these reforms. Overall, average FDI flows, which were well below 1 billion USD in the 1990s, peaked to 7.7 billion USD in the period 2000-2007.

Clearly, an important distinction has to be made between overall institutional improvements and policies aimed at attracting FDI. Consider for instance the case of Tanzania's recent efforts to lure foreign capital by implementing a program of major liberalization policies. Although successful in attracting average FDI inflows in the period 2000-2007 more than three times as large as those in the 1990s (415 vs. 120 million USD), such interventions have been regarded as vastly insufficient against the background of enduring scarce protection of property rights. In fact, according to international investors, the lack of integrity in the court and justice system still acts as a "constraint on the establishment and profitable operation of new business ventures in the country" (UNCTAD, 2002).

In this paper we propose to look at both sides of government activity in the analysis of international business location. Our contention is that governments

regimes worldwide.

[3] Turkey became a candidate country to accession in 1999 and an official accession country on October 3, 2005.

providing good governance infrastructures have the capacity to levy higher taxes on corporate income, and still be attractive to international investors. Thus, once the general quality of the business environment is taken into account, the fiscal variable may turn out much less relevant for investment location than commonly thought. We formalize this idea building a simple two-country partial equilibrium model of fiscal competition in which institutional quality is treated as a public good targeted to firms. The large variable cost associated with the provision of better institutions leads the government in the high quality jurisdiction to levy a correspondingly high tax on corporate income. Moreover, if institutional quality has a sufficiently strong impact on firms' revenues, the low-quality/low-tax country attracts less capital than its counterpart, in spite of the lower fiscal burden.

In some respects, this work adopts the same approach as in Johnson, Kaufmann and Shleifer (1997) as to the joint modelling of tax policies and institutional infrastructure. Their main interest lies however in the interaction between the formal and the informal sector in the transition from centrally planned to market economies. Like them, on the other hand, we consider setting up market-supporting institutions as having immediate implications for public finances. The idea that institutions and policy choices like taxation are linked has been recently developed by Besley and Persson (2009) in a political economy model of growth. In their framework, good enforcement of contracts and property rights lead to fiscal state capacity, i.e. enable countries with better institutions to tax personal income more heavily compared to governments providing poor institutions. The logic underlying the treatment of market-fostering institutions as a public good is straightforward. Although not formally modelled so, this idea can be implicitly found in Douglass North's (1990) discussion on how formal rules and conventions that regulate and facilitate economic transactions have emerged and evolved in historical perspective. His rather broad and abstract view of institutions as "a set of economic rules of the game (with enforcement)" can be immediately given more shape in the light of what constitutes a public good. Easily interpretable laws as well as effective judicial systems and efficient courts are necessary elements to ensure enforcement of contracts and protection of property rights, which are commonly used as paradigmatic examples of good governance. Similarly, in a less narrow interpretation, non byzantine regulations governing the functioning of financial, labor and product markets, together with a well functioning and competent bureaucracy to implement them, can be regarded as essential aspects enhancing the quality of the economic environment.

The relationship between public good provision and fiscal competition has recently received renewed attention in the theoretical literature. In particular, in contrast to the traditional public finance view of identical preferences and technologies, several papers have focused on the interaction between public good provision and tax competition highlighting the effects of firms' heterogeneity[4]. Such heterogeneity in the use of the public input allows competing jurisdictions to differentiate endogenously with respect to the provision of public services (Zissimos and Wooders, 2008). In doing so, countries can avoid wasteful tax competition, i.e. the result of "race to the bottom" in corporate tax rates found in the traditional literature on fiscal competition (Oates, 1972). In treating institutions as a public good we follow this strand of the literature, adopting a richer modelling strategy that applies discrete choice theory to firm location decisions (Coughlin et. al, 1991; Guimaraes et al., 2003).

On the other hand, the relationship between institutions and capital flows has been so far considered mainly an empirical research question. In fact, institutional underdevelopment has been found a determining factor in explaining the Lucas paradox of why capital does not flow from rich to poor countries (Papaioannou, 2009). Analyzing aggregate flows over the period 1970-2000, Alfaro, Kalemli-Ozcan and Volosovych (2008) identify a causal effect of institutional quality on the direction of such flows. Their results are robust to the inclusion of other possible determinants, such as the level of development and human capital in the recipient country. Other contributions have focussed more narrowly on FDI flows only (Daude and Stein, 2007; Bénassy-Quéré et al., 2007). Since FDI is a very large share of capital formation in poor countries, the FDI-promoting effect of good institutions might be an important channel of their overall effect on growth and development (IMF, 2003).

The empirical literature has also dealt extensively with the effects of taxation on international investment using different methodologies (see for instance Bénassy-Quéré et al., 2005; Razin and Sadka, 2008). De Mooij and Ederveen (2003) provide a meta-analysis of the main results found in this strand of the literature. None of these contributions, however, has considered the joint effect of taxes and institutional quality on foreign investment. The aim of the empirical part of this paper is indeed to fill this gap[5]. Somewhat more related to our

[4]The effect of heterogeneity in the context of the provision of public goods is not a new issue; in fact, diversity in tastes for the public good drives the results of efficient sorting of consumers across jurisdictions in Tiebout (1956) models.

[5]Recently, Desai and Dharmapala (2009) have investigated empirically the effects of taxation and institutions on foreign investment choices by US investors. The focus of their analysis is

analysis is the paper by Mutti and Grubert (2004) investigating empirical asymmetries in the effect of taxation on foreign operations by US multinationals. In their econometric analysis, the authors find that investment into developing countries is significantly more responsive to corporate taxation compared to investment into advanced economies. The reasons behind this result are left unexplained however, since the proposed explanations, based on higher provision of physical public goods and infrastructures characterizing developed countries, turn out not to be borne by the data. As those countries have overall a better governance infrastructure, the framework of this paper provides a theoretically founded rationale to the observed pattern.

The rest of the paper is organized as follows. Section 2 presents a simple model of fiscal competition with institutional quality provided as a public good. In section 3 we derive the empirical model and describe the data used in the analysis. The regression results, together with robustness checks and instrumental variables estimates, are discussed in Section 4. Finally, section 5 concludes.

2. Taxation and the quality of institutions: a theoretical framework

This section describes the economic environment and analyzes the non-cooperative game between two policy-makers setting corporate tax rates while institutional quality is provided as a public good to attract productive capital. Competition among jurisdictions is modelled as a non-cooperative stage game in which governments sequentially choose institutional quality (Stage 1 and Stage 2). In Stage 3, having observed the levels of institutional quality, they set simultaneously their tax rates. Finally, after policy choices have been made, firms take tax rates and institutional quality as given and locate in the jurisdiction where profits are maximized.

The choice on institutional quality is a long term policy objective, whereas tax rates can be readily adjusted in the short run. These features are captured indeed by hypothesizing commitment on the level of institutional quality. Moreover, modelling the choice on quality as Stackelberg game reflects important differences among countries, which in turn affect their capabilities to compete for mobile

the composition of outbound capital flows, however. In particular, they ask whether direct investment to low-tax countries is penalized by the worldwide tax regime employed by the U.S., whereas weak investor protection in foreign countries may in principle increase the value of control, creating an incentive to use FDI rather than portfolio investment.

capital on the international stage. One could naturally think of a general framework where a developed country (or an old EU member State) competes with a developing economy (a new member State in Central and Eastern Europe). The subgame perfect equilibrium is obtained by backward induction.

Firms

In the economy there is a set of firms of measure N. Each firm can invest only in one of the two competing jurisdictions, and cannot set up multiple subsidiaries. Moreover, each producer is able to sell a single unit of its product locally, and does not export[6]. When locating in country j, profits to firm i are as follows:

$$\pi_{ij} = p - w_j - \tau_j + \theta_i a_j + \varepsilon_{ij} \tag{1}$$

The profit function of the investor follows the modelling strategy of Wooders and Zissimos (2008), but, in addition to the deterministic component, is also composed of a stochastic part. In equation 1, p is the product price, while w_j is the per-unit production cost. Throughout, we will assume that w_j is equalized across countries, and fixed at level w. Moreover, in order to focus on the location decision, the mark-up over production costs, $p - w$, is assumed sufficiently high to ensure that the firm makes positive profits. When producing in country j, firm i pays taxes at a rate τ_j; the tax can be thought of as a lump sum tax or a sales tax (since each firm produces and sells only a single unit of the good). The effect of institutions on profits is captured by the term $\theta_i a_j$, where a_j is the level of institutional quality in country j and θ_i is a strictly positive parameter reflecting the importance of quality for firm i. The idea behind this formulation is very simple and intuitive: providing market-fostering institutions (e.g. a well functioning bureaucracy, effective protection of property rights, etc.) is equivalent to granting a subsidy to the firms. Stated from the opposite perspective, by increasing the cost of doing business, poor institutions impose an additional implicit burden on producers compared to a high quality business environment[7]. Following a recent literature on trade and institutions, θ_i can be thought of expressing important

[6] This restriction is consistent with MNEs investing abroad to service local markets, a pattern which has been found in the data. For example, Braconier et al. (2005) document that 56% of total sales of US multinationals are local sales.

[7] In the international trade literature, Anderson and Young (1999) develop a model in which, under risk neutrality, imperfect contract enforcement in the importing country turns out equivalent to a tariff. More intuitively, corruption can be considered as a paradigmatic example of poor institutional quality associated with an explicit and quantifiable cost to firms, i.e. bribe

technological differences among firms (and sectors), with institutionally dependent industries being characterized by larger θ_i. This source of heterogeneity would have important implications for the *sectoral composition* of inward investment in the two countries[8]. However, also with a view to the empirical tests, here we choose to look only at the *aggregate measure* of inward investment. Consequently, we take θ_i to be a constant imposing the normalization $\theta_i = \theta$. This assumption is not too restrictive once one recalls that in this context institutional quality should be considered as a composite measure of overall good governance; as such, it should not be identified only with protection of property rights and enforcement of contracts, whose relevance can markedly differ across sectors.

Finally, following Coughlin et al. (1991), the random component of the profit function is modelled as an additive term, ε_{ij}, denoting the unobservable unique profit advantages to firm i from investing in country j. The stochastic term is identically and independently distributed across firms and locations following a double exponential (Type I extreme value) distribution. The cumulative distribution takes therefore the form $\mathrm{F}(x) = \exp(-\exp(-x/\mu))$, with μ the (positive) scale parameter. The variance is equal to $\mu^2\pi^2/6$, and the mean is zero. Hence, μ is proportional to the variance of the distribution of the stochastic term. As such, the scale parameter captures firms' heterogeneity with respect to the gains associated with choosing a specific location.

Firms are not strategic. They take institutional quality and taxes in each country as given and locate in the jurisdiction where their net profits are higher.

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payments. Successful efforts to control and fight corruption fight would therefore immediately reduce firms' costs. See Wei (2000) for a first quantitative analysis of the effect of corruption on OECD international investors and Hakkala et al. (2008) for an assessment on Swedish multinational firms.

[8] Recent contributions have analyzed the impact of institutions, namely protection of property rights and contract enforcement, on international trade. Building on the literature of incomplete contracts, Levchenko (2007) proposes a two-country model in which institutional differences - exogenously assumed - are an important source of comparative advantage. He also finds evidence of the "institutional content of trade", i.e. institutional differences are an important determinant of the composition of trade flows. Similarly, Nunn (2007) investigates the impact of contract enforcement on the pattern of trade focusing on one specific transmission channel through which institutions affect comparative advantage: under-investment in relationship-specific investments. Berkowitz et al. (2006) argue that good institutions exporting countries can enhance international trade, particularly trade in complex products, i.e. products that are highly differentiated and whose characteristics are difficult to fully specify in contracts. Thus, as for those products contracts will be more incomplete than for simple products, countries with better institutions will have a comparative advantage in producing such goods. It is found that this production cost channel is stronger than the international transaction cost channel.

In a two-jurisdiction setting, the probability of firm i locating in country 1 against country 2 is therefore given by:

$$\begin{aligned} s_{i1} &= \text{prob}(\pi_{i1} \geq \pi_{i2}) \\ &= \text{prob}((\varepsilon_{i2} - \varepsilon_{i1} \leq \mathrm{E}(\pi_{i1}) - \mathrm{E}(\pi_{i2})) \\ &= \text{prob}(\varepsilon \leq \mathrm{E}(\pi_{i1}) - \mathrm{E}(\pi_{i2})) \end{aligned}$$

where $\mathrm{E}(\pi_{i1})$ has been defined as the non-stochastic component of the profit function, or the expected profits; and ε is set equal to the difference $\varepsilon_{i2} - \varepsilon_{i1}$. Given the distributional assumptions on the individual ε_{ij}'s, ε will follow a logistic distribution. Therefore, using the result in McFadden (1974), the choice probabilities are binomial logit[9]. With this in mind, the expected measure of firms locating in country 1 and 2 is, respectively:

$$X_1 = N \underbrace{\left(\frac{\exp\left[\left(\theta a_1 - \tau_1\right)/\mu\right]}{\exp\left[\left(\theta a_1 - \tau_1\right)/\mu\right] + \exp\left[\left(\theta a_2 - \tau_2\right)/\mu\right]} \right)}_{\equiv s_1} \tag{2}$$

$$X_2 = N \underbrace{\left(\frac{\exp\left[\left(\theta a_2 - \tau_2\right)/\mu\right]}{\exp\left[\left(\theta a_1 - \tau_1\right)/\mu\right] + \exp\left[\left(\theta a_2 - \tau_2\right)/\mu\right]} \right)}_{\equiv s_2} \tag{3}$$

Equations 2 and 3 show the advantages of the hypothesized distributional assumptions. The logit choice probabilities (s_j, in the parentheses) assume indeed a closed form solution and are readily interpretable. The effect of firms' heterogeneity emerges clearly. When $\mu \to \infty$, and consequently the variance of the stochastic term tends to infinity, the variables affecting firms' profits have no predictive power: the two alternative locations have the same probability of being chosen by the investors. For $\mu \to 0$, on the other hand, all the relevant information driving location is in the non stochastic part of the profit function. The choice model is therefore deterministic, with $s_1 = 1$ if $\mathrm{E}(\pi_1) - \mathrm{E}(\pi_2) > 0$, and $s_1 = 0$ otherwise.

[9] Anderson, De Palma and Thisse (1992, p.40) note that, when only two alternatives are considered, other distributions satisfy the property of generating a logistic distribution in the difference. However, if the choice set is enlarged, the double exponential is both a sufficient and a necessary condition to generate multinomial choice probabilities.

Governments

Revenues to governments are given by the taxes levied on the capital employed within their borders. Like any other public goods, the institutional infrastructure is supplied at a cost. The total cost of providing institutional quality a_j has two components: i) a fixed quality-dependent cost $C(a_j)$; ii) a cost proportional both to the expected measure of firms locating in the jurisdiction and to the quality level, $\beta a_j X_j$[10]. β is the cost parameter, and it is assumed $0 < \beta < 1$[11].

Rents to governments are thus given by tax revenues net of the cost of providing institutional quality. The functions to be maximized take the form:

$$R_j = (\tau_j - \beta a_j) X_j - C(a_j) \tag{4}$$

2.1. Tax rates

At Stage 3, governments simultaneously and non-cooperatively set their tax rates taking the quality levels of their institutions as given[12]. As shown by Anderson, De Palma and Thisse (1992), functions like 4 are strictly quasi-concave, so that the first order conditions characterize best responses. The existence of a unique equilibrium in taxes is guaranteed by the result in Caplin and Nalebuff (1991). The maximization exercise gives:

$$\begin{aligned} \frac{\partial R_j}{\partial \tau_j} &= X_j + \frac{\partial X_j}{\partial \tau_j}\tau_j - \beta a_j \frac{\partial X_j}{\partial \tau_j} = \\ &= X_j - \frac{1}{\mu} X_j (1 - s_j)(\tau_j - \beta a_j) = 0. \end{aligned}$$

[10] As an example, consider the quality of the bureaucracy. This formulation of the cost function implies that a fixed cost, dependent on the quality level, has to be paid to set up the bureaucratic structure of the country. In addition, a variable cost, still proportional to quality, is incurred for its functioning (e.g. salary of the civil servants). The proportionality with respect to the number of firms follows from the fact that, absent consumers from the model, the public good is interely targeted to the productive sector.

[11] A further restriction which will be imposed for the derivation of the SPNE for the full game is that $\beta < \theta$. The reason for this assumption will be made clear once the comparative statics results are derived and discussed.

[12] Appendix A illustrates an extension where the effects of agglomeration economies on the fiscal competititon outcome are analyzed.

The system of FOCs is non-linear in the tax rates. Then, the equilibrium τ_j is implicitly given by:

$$\tau_j^* = \frac{\mu}{(1 - s_j)} + \beta a_j. \tag{5}$$

From this, it is possible to calculate the slope of the best response function of country j with respect to the tax rate of the competing jurisdiction (labelled $-j$). Applying the implicit function theorem one obtains:

$$\frac{\partial \tau_j}{\partial \tau_{-j}} = -\frac{\partial^2 R_j / \partial \tau_j \partial \tau_{-j}}{\partial^2 R_j / \partial \tau_j^2} = \frac{s_j s_{-j}}{1 - s_{-j}} > 0.$$

Thus, given the level of institutional quality, tax rates are strategic complements. This property is in accordance with the traditional models of fiscal competition; in such framework, strategic complementarity is indeed the driving force behind the "race to the bottom" in corporate tax rates.

Before analyzing the effect of quality on tax rates, we first characterize the symmetric equilibrium in which both countries provide the same level of institutional quality. Suppose $a_1 = a_2$. Thus, from equation 5 it follows that $\tau_1 = \tau_2$. Clearly, as the two jurisdictions are perfectly symmetric, in this case $X_1 = X_2 = N/2$. Therefore, when countries do not differ in the quality of their institutions, they also set equal taxes; as a result, firms split equally among the two locations.

Proposition 1. *When institutional quality is the same, countries set equal taxes and producers split equally among the two jurisdictions.*

Given the assumed symmetry between countries, only quality differentiation can drive diversity in tax rates and consequently shift business location. Moreover, in this framework, taxes are not driven to zero, for two reasons. First, there is the parameter μ, which is proportional to the variance of the stochastic term in the profit function. As long as $\mu > 0$, there is a positive contribution of firms' heterogeneity to the tax rate. In other words, governments can tax away part of the rents from which producers benefit thanks to their unobservable location advantages. In addition to that, there is the vertical component related to the qualitative dimension. Here the tax rate depends positively on the quality of institutions because providing better governance infrastructure implies a larger variable cost that calls for financing through higher tax rates.

Comparative statics

How do changes in quality affect the equilibrium? To answer this question, start from the symmetric situation and suppose that a_1 increases, while a_2 is kept constant. The effect on equilibrium taxes can be found by totally differentiating equation 5 (the full computations can be found in Appendix C). Define $\sigma_1 \equiv X_1/X_2$, as the ratio of the expected number of firms investing in country 1 over those locating in 2. Then, it holds that:

$$\frac{d\tau_1}{da_1} = \frac{\beta + \beta\sigma_1 + \theta\sigma_1^2}{1 + \sigma_1 + \sigma_1^2} > 0 \tag{6}$$

Hence, the provision of higher institutional quality results in a higher tax on capital. To quantify the relative magnitude of such increase, recall first that $\beta < 1$. Then, a sufficient condition for $d\tau_1/\, da_1 < 1$ is that $\theta < 1$. Intuitively, the impact of institutional quality on profits does not have to be too large in order for the tax rate to increase less than proportionately with institutional quality. If this is the case, in other words, an increase in institutional quality is not fully transmitted into higher taxes.

The effect of the quality increase on the tax levied by the competing jurisdiction is found by taking the total differential of the FOC for country 2, which gives:

$$\frac{d\tau_2}{da_1} = \frac{\beta - \theta}{1 + \sigma_1 + \sigma_1^2}. \tag{7}$$

The sign of the differential crucially depends on the relative size of the parameters β and θ. In particular, the equilibrium tax rate decreases in the institutional quality of the competing country if and only if $\beta < \theta$. Before commenting on this, we first derive the total effect of an improvement in institutional quality in country 1 on investor location choices, as follows:

$$\frac{d\sigma_1}{da_1} = \frac{\partial\sigma_1}{\partial a_1} + \frac{\partial\sigma_1}{\partial\tau_1}\frac{d\tau_1}{da_1}.$$

Recalling the definition of σ_1, it can be easily checked that, at the equilibrium, the following equality holds $\sigma_1 = \exp\left[\left(\tau_2^* - \tau_1^* + \theta\left(a_1 - a_2\right)\right)/\, \mu\right]$. Hence, the differential is as follows:

$$
\begin{aligned}
\frac{d\sigma_1}{da_1} &= \exp\left[\left(\tau_2^* - \tau_1^* + \theta\left(a_1 - a_2\right)\right)/\,\mu\right]\frac{1}{\mu}\frac{d\left(\tau_2^* - \tau_1^* + \theta\left(a_1 - a_2\right)\right)}{da_1} = \qquad (8) \\
&= \sigma_1 \frac{1}{\mu}\left(\frac{d\tau_2^*}{da_1} - \frac{d\tau_1^*}{da_1} + \theta\right) = \\
&= \sigma_1 \frac{1}{\mu}\left(\frac{\sigma_1\left(\theta - \beta\right)}{1 + \sigma_1 + \sigma_1^2}\right).
\end{aligned}
$$

where the third line uses the differentials derived in 6 and 7. Again, a sufficient and necessary condition for $d\sigma_1/\,da_1 > 0$ is that $\beta < \theta$. Once more, the sensitivity of firms' profits to the institutional quality variable is crucial; in particular, this sensitivity has to be higher than the variable cost parameter associated with the provision of institutional quality. If this is the case, then, at equilibrium, the low quality jurisdiction has to lower its tax rate as a response to better institutions in the competing country. Moreover, the effect on profits is sufficiently high to lead more firms to locate in the high quality country, notwithstanding higher corporate taxation. The opposite is true when $\beta > \theta$. In this case, it holds that $d\tau_2/da_1 > 0$. However, due to higher variable costs associated with better institutions, taxes increase more in country 1, or $d\tau_1/da_1 > d\tau_2/da_1$. Thus, it is $d\sigma_1/da_1 < 0$. Notice that the logit formulation implies that a country's gain comes to the detriment of the competitor. In other words, as the total number of investors is fixed, firms simply reshuffle between locations when relevant decision variables change (Schmidheiny and Brülhart, 2009).

Proposition 2. *Assume $\beta < \theta$. Then in the case of asymmetric institutional quality, the country providing better institutions levies a higher tax and attracts more firms than the country with low quality institutions.*

2.2. Quality of institutions

This section describes and solves the Stackelberg sub-game in which governments set the quality of their institutions[13]. Institutional quality is modelled as a discrete variable, which can assume two values: a^H and a^L, for high and low quality, respectively. Recall from Section 2 that government revenues to be maximized are:

$$R_j = \left(\tau_j - \beta a_j\right) X_j - C\left(a_j\right)$$

[13] Appendix B provides an extension of the game dealing with the particular arrangement of subsidized institutional quality.

where $\beta a_j X_j + C(a_j)$ is the total cost associated with institutional quality provision. We assume throughout that $\beta < \theta$, where θ is a parameter measuring the sensitivity of firms' profits to institutional quality. Recalling the comparative statics results in Section 2, it is indeed easy to see that without this restriction there would be no incentives for governments to invest in high institutional quality.

The follower's problem

At stage 2 the follower observes the quality choice made by country 1 and set its best response choosing the quality level that yields the highest net revenues. Let $R_2\left(a^H, a^L\right)$ be the rents to the government of country 2 when they choose a low quality level, a^L, whereas country 1 has chosen a high quality a^H. In order to reduce the burden of notation in the analysis of the different cases, define σ as the ratio between the mass of firms locating in the high-quality country and the measure of producers in the low-quality jurisdiction. Hence, by definition, using the result in Proposition 2, it always holds that $\sigma > 1$. The payoff functions to country 2 are as follows:

$$\begin{aligned} R_2\left(a^H, a^H\right) &= \mu N - C\left(a^H\right) \\ R_2\left(a^H, a^L\right) &= \mu \tfrac{1}{\sigma} N - C\left(a^L\right) \\ R_2\left(a^L, a^H\right) &= \mu \sigma N - C\left(a^H\right) \\ R_2\left(a^L, a^L\right) &= \mu N - C\left(a^L\right) \end{aligned}$$

Let $\Delta C(a)$ be the incremental fixed cost of quality, $\Delta C(a) \equiv C\left(a^H\right) - C\left(a^L\right) > 0$. The best responses for the follower, $r^*\left(q^k\right)$, $k = H, L$, are then:

$$r^*\left(a^H\right) = \begin{cases} a^H & \text{if} \quad \Delta C(a) < \mu\left(1 - \frac{1}{\sigma}\right) N \\ a^L & \text{if} \quad \Delta C(a) > \mu\left(1 - \frac{1}{\sigma}\right) N \end{cases}$$

and

$$r^*\left(a^L\right) = \begin{cases} a^H & \text{if} \quad \Delta C(a) < \mu(\sigma - 1) N \\ a^L & \text{if} \quad \Delta C(a) > \mu(\sigma - 1) N \end{cases}.$$

The leader's problem

At the first stage of the game, country 1 takes government 2's sub-game perfect strategy as given and chooses the institutional quality that grants the highest rents. As the best response of the follower depends on the incremental cost of quality, $\Delta C(a)$, so does the strategy of the leading country. In particular, one can distinguish three different scenarios depending on the magnitude of $\Delta C(a)$. Since $(\sigma - 1) > \left(1 - \frac{1}{\sigma}\right)$, these are:

Case *i*). Low incremental cost of quality: $\Delta C(a) < \mu \left(1 - \frac{1}{\sigma}\right) N$.

In this case the lagging country will always choose a high quality level. It is easy to check that for the leading jurisdiction it holds $R_1 \left(a^H, a^H\right) > R_1 \left(a^L, a^H\right)$. Hence, it will also choose a high quality.

Case *ii*). Intermediate incremental cost of quality: $\mu \left(1 - \frac{1}{\sigma}\right) N < \Delta C(a) < \mu (\sigma - 1) N$.

In this cost range the lagging country always chooses to differentiate its quality provision from that of the competing jurisdiction. Therefore, this latter has to compare $R_1 \left(a^H, a^L\right)$ with $R_1 \left(a^L, a^H\right)$. It can be verified that $R_1 \left(a^H, a^L\right) > (<) R_1 \left(a^L, a^H\right)$ when $\Delta C(a) < (>) \mu \left(\sigma - \frac{1}{\sigma}\right) N$. Since $\left(\sigma - \frac{1}{\sigma}\right) > (\sigma - 1)$, country 1 will always set a high quality.

Case *iii*). High incremental cost of quality: $\Delta C(a) > \mu (\sigma - 1) N$.

In this cost range the lagging country will always set a low quality. It is easy to see that $R_1 \left(a^H, a^L\right) > R_1 \left(a^L, a^L\right)$.

Subgame Perfect Nash Equilibrium

The magnitude of the fixed cost of quality gives rise to three possible equilibria. Taking into account equilibrium taxes derived in Section 3, they are fully characterized in the following proposition.

Proposition 3. *The subgame perfect equilibrium is as follows:*

- *For low incremental cost, $\Delta C(a) < \mu \left(1 - \frac{1}{\sigma}\right) N$, both countries provide high institutional quality ("race to the top"). Equilibrium taxes are $\tau_1^*|_{(H,H)} = \tau_2^*|_{(H,H)} = 2\mu + \beta a^H$.*

- *For intermediate incremental cost, $\mu \left(1 - \frac{1}{\sigma}\right) N < \Delta C(a) < \mu (\sigma - 1) N$, there is quality differentiation, with the leading country setting high quality ("first mover advantage"). Equilibrium taxes are $\tau_1^*|_{(H,L)} = \mu (1 + \sigma) + \beta a^H$ and $\tau_2^*|_{(H,L)} = \mu \left(1 + \sigma^{-1}\right) + \beta a^L$.*

- *For high incremental cost, $\Delta C(a) > \mu (\sigma - 1) N$, both countries provide low quality ("race to the bottom"). Equilibrium taxes are $\tau_1^*|_{(L,L)} = \tau_2^*|_{(L,L)} = 2\mu + \beta a^L$.*

Both symmetric and asymmetric equilibria are possible. The type of equilibrium depends on the fixed cost differential of setting high vs. low quality institutions. Symmetric equilibria are realized at the extremes of the cost range. In such cases, if the incremental cost if quality is low (high) both jurisdictions set high (low) institutional quality; as a result, they levy the same tax on capital. Due to the costs associated with institutional quality, rents to governments are clearly higher in the symmetric equilibrium with low quality institutions. When the cost differential is intermediate, there is an asymmetric equilibrium, with the developed country having a first mover advantage. Since it sets high quality institutions, it can levy a higher tax than its competitor, $\tau_1^*|_{(H,L)} > \tau_2^*|_{(H,L)}$. Consequently, it attracts a larger share of firms and realizes higher rents, $R_1\left(a^H, a^L\right)$ $> R_2\left(a^H, a^L\right)$.

Finally, using the FOC in 5, it is possible to compare the implicit equilibrium taxes in all the alternative cases corresponding to different levels of institutional quality. Hence, one gets the following inequality:

$$\tau_2^*|_{(H,L)} < \tau_i^*|_{(L,L)} < \tau_i^*|_{(H,H)} < \tau_1^*|_{(H,L)},$$

where $\tau_1^*|_{(H,L)}$ is defined as the implicit tax rate in country 1 in the asymmetric equilibrium in which country 1 is high quality and country 2 is low quality. As expected, taxes are always higher in the jurisdiction(s) providing high institutional quality compared to alternative low quality locations ($\tau_i^*|_{(L,L)} < \tau_i^*|_{(H,H)}$ and $\tau_2^*|_{(H,L)} < \tau_1^*|_{(H,L)}$). In the asymmetric equilibrium, however, there is also a strategic effect at work. The tax rate in the high (low) quality is higher (lower) than the corresponding tax rate in the symmetric equilibrium ($\tau_1^*|_{(H,L)} > \tau_i^*|_{(H,H)}$ and $\tau_2^*|_{(H,L)} < \tau_i^*|_{(L,L)}$).

Overall, the results say that countries with a better business environment are characterized by higher taxes compared to low-quality jurisdictions; notwithstanding the higher fiscal burden on corporate income, if the effect of market-fostering institutions on firms' profits is large enough, they are able attract a higher share of firms. Finally, as discussed above, in the asymmetric equilibrium net revenues from corporate taxation are larger in the high quality country.

3. Empirical evidence

The stripped-down two-country model described in the previous sections illustrates the consequences of fiscal competition when institutional quality is taken into account and considered as a public good having a cost reducing effect on firms' profits. First of all, a high level of institutional quality is always coupled with high corporate taxes. Secondly, if the sensitivity of firms to the institutional variable is sufficiently high, the country providing better institutions attracts more productive capital than its low-tax/low-quality competitor. This finding suggests that the responsiveness of foreign investment to the fiscal variable does change across countries characterized by different levels of institutional quality. The aim of the empirical exercise is to test this prediction, thus highlighting the importance of considering both sides of government action when analyzing corporate location choices.

To obtain a model that can be taken to the data the baseline framework described above needs to be modified and enriched to account for a plurality of investing and recipient countries, as well as for other decision variables relevant for the choice of investment allocation. To this purpose, we adapt the modelling strategy used by Head and Ries (2008) to analyze cross-border M&As. In the economy there are N investing firms, with N_c being the number of investors in country c. Let J be the number of host countries. Given the enlarged choice set, the probability for a firm from country c to invest in country j is given by the multinomial logit formula[14]:

$$s_{cj} = \frac{\exp(A_{cj})}{\sum_l \exp(A_{cl})} \tag{9}$$

where A_{cj} is the non-stochastic part of the profit function, which includes only characteristics affecting profits that are specific to the host country (e.g institutional quality and corporate tax rates) and to the dyad cj. Consistently with the findings of the empirical literature on FDI, we include in A_{cj} an additional cost component summarizing transaction and information costs related to the investment in country j. Such costs are captured by several measures of dissimilarity between investing and recipient country, as well as by their geographical distance.

Define K_j as the total stock of assets in country j that are available to foreign investors[15]; moreover, let $n_c \equiv N_c/N$ be the fraction of firms in country c. The

[14] In this specification the variance of the stochastic component in the profit function has been normalized with respect to the parameter μ. Such normalization is equivalent to normalizing the scale of the profits that generate the logit choice probabilities. Clearly, it has no effects on the relative ordering of choices. On this point, see Train (2003, ch. 3).

[15] The assumption of a fixed capital stock in the host country is fully consistent with FDI taking place through M&As, which entail essentially a change in the ownership structure of

expected bilateral stock of assets in country j owned by investors from c is then:

$$E\left[FDI_{cj}\right] = n_c s_{cj} K_j. \tag{10}$$

Substituting 9 into 10, expected bilateral stocks can be expressed as[16]:

$$E\left[FDI_{cj}\right] = n_c \frac{\exp(A_{cj})}{\sum_l \exp(A_{cl})} K_j \tag{11}$$

In order to move from the expected values $E\left[FDI_{cj}\right]$ to the bilateral stocks actually observed, define $\eta_{cj} \equiv FDI_{cj}/\mathrm{E}[FDI_{cj}]$ as the ratio of actual to observed bilateral FDI stocks. It holds that $\mathrm{E}\left[\eta_{cj}\right] = 1$. Equation 11 becomes then:

$$FDI_{cj} = E\left[FDI_{cj}\right]\eta_{cj} = n_c \frac{\exp(A_{cj})}{\sum_l \exp(A_{cl})} K_j \eta_{cj} \tag{12}$$

After imposing $B_{cl} \equiv \sum_l \exp(A_{cl})$, 12 becomes further:

$$FDI_{cj} = n_c \exp(A_{cj}) B_{cl}^{-1} K_j \eta_{cj} \tag{13}$$

This expression has many resemblances with the multiplicative gravity equation derived in the international trade literature (Anderson, 1979). In a similar way, the FDI stock from country c to country j is determined by all the variables affecting firms' profitability. Moreover, there is a positive relationship with both the size of the investing economy (proxied by the share of investors n_c) and the size of the receiving country (measured by the value of assets, K_j). B_{cl} is a measure of the potential competition faced by country j in attracting the investment of country c. Indeed, note that it depends negatively on the taxes levied in all other recipient countries, as well as on the measures of bilateral distance between those countries and the investor. As such, it resembles the *multilateral resistance* terms proposed by Anderson and Van Wincoop (2003) for international trade flows. In that context, those terms capture the fact that bilateral trade flows do not only depend on bilateral trade barriers but also on trade barriers across all trading

existing assets. It can be reconciled with de-novo entry by assuming divestitures or depreciation of assets.

[16] The model is static in nature and therefore does not specify the sequence of FDI flows which would lead to the expected stock. Modelling such flows would require taking into account also divestitures of assets (i.e. negative flows) as well as adjustment costs associated with the transition to the desired FDI levels.

partners. Similarly, in our case, the term B_{cl} implies, speaking loosely, that bilateral predictions concerning FDI stocks do not readily extend to a multilateral world because of complex indirect interactions linking all the investing and recipient economies. Such interdependence has to be somehow controlled for in the gravity equation to obtain consistent estimates. Several studies aim at doing so by including origin- and destination-specific fixed effects (Head and Ries, 2008; Coeurdacier et al. 2009). Alternatively, ad hoc remoteness indices have been introduced (Alfaro et al., 2008), even if there is no theoretical foundation to such approach (Head, 2003)[17]. The problem can be tackled in a different way. Consider country c's investment in country m, which can be derived from equation 13, *mutatis mutandis*:

$$FDI_{im} = n_c \exp(A_{cm}) B_{cm}^{-1} K_m \eta_{cm} \tag{14}$$

Taking the ratio of 13 to 14, and noting that $B_{cj} = B_{cm}$, one gets:

$$\frac{FDI_{cj}}{FDI_{cm}} = \frac{\exp(A_{cj}) K_j}{\exp(A_{cm}) K_m} \eta_{cjm}. \tag{15}$$

where $\eta_{cjm} \equiv \eta_{cj}/\eta_{cm}$. Hence, considering relative FDI stocks originating from the same investor eliminates the multilateral term, as those stocks depend only on the relevant bilateral variables. This pattern of substitution among alternatives is known as the Independence from Irrelevant Alternatives (IIA) property. That is, in the logit model, the relative odds of choosing country j over m are the same no matter what the other alternative locations, or their attributes, are (Train, 2003). In general, the IIA property is rather restrictive, and, as such, unlikely to hold across all the possible destination country pairs. Nonetheless, more restrictions can be introduced in order to make it an appropriate representation of MNEs' foreign investment choices. Specifically, the estimating strategy depends on choosing dyads of receiving countries that belong to the same regional trade agreement. There is a twofold rationale for this choice. Firstly, it entails considering only country pairs located in the same geographical area, recognizing that physical proximity makes different locations more comparable as to the relative fiscal cost to foreign investors. In other words, we explicitly take into account the well-known fact that fiscal competition for mobile capital has a strong local dimension (on this point see for instance Crabbe and Vandenbussche, 2008).

[17] Such "distantness" indices are constructed as GDP-weighted average distances. In the context of international capital flows, using GDP as a proxy for financial development, they would ideally capture financial remoteness.

Secondly, by a similar reasoning, it features the pattern of close substitutability for multinational firms among recipient countries linked by tariff-reducing agreements. This is true both for investment aimed at servicing local demand in a certain area and for export-platform FDI, as the same tariff barriers will be faced in foreign markets (Ekholm at al., 2007). Restricting the number of country pairs in this way is consistent with a nested logit approach, in which location decisions are taken on a partitioned set of alternatives[18]. Using this criterion leads to a total of 452 pairs of destination countries.

Taking logs of both sides of 15 yields an equation that can be estimated using linear regression techniques. Several papers in international trade have recently used similar approaches based on difference gravity equations. Anderson and Marcoullier (2002) have proposed a gravity model in differences with respect to a base country to analyze the effect of insecurity on the patterns of trade flows. The bilateral differencing technique among exporting countries is adopted by Djankov, Freund and Pham (2009) in order to quantify the impact of time delays on trade flows. Hanson and Xiang (2004) focus on how the home-market effect vary with industry characteristics using both bilateral differencing and a difference-in-difference gravity specifications.

3.1. Specification and variables

The basic log-linearized simple difference gravity equation to be estimated looks like:

$$\begin{aligned} \ln\left(\frac{\mathrm{FDI}_{cj}}{\mathrm{FDI}_{cm}}\right) &= \alpha + \alpha_0 \ln\left(\frac{\mathrm{GDP}_j}{\mathrm{GDP}_m}\right) + \alpha_1 \ln\left(\frac{\mathrm{dist}_{cj}}{\mathrm{dist}_{cm}}\right) + (\mathbf{D}_{cj} - \mathbf{D}_{cm})\,\boldsymbol{\delta} + \\ & \phi_1\left(\mathrm{tax}_j - \mathrm{tax}_m\right) + \phi_2\left(\mathrm{I}_j - \mathrm{I}_m\right) + \varepsilon_{cjm} \end{aligned} \tag{16}$$

The dependent variable is given by the value of FDI stocks from country c to country j relative to the stock from the same country to m. The effect of the relative size of the host countries is captured by the log-ratio of their GDPs. In keeping with the standard gravity literature, other controls include variables summarizing transaction and information costs commonly found to impede foreign

[18] Assuming a particular structure of correlation for the random terms, in a nested logit model the set of alternatives can be partitioned into subsets in such a way that the IIA property holds within each nest but, in general, not across nests (Train, 2003). This approach is adopted by Head and Mayer (2004) to analyze the effect of "market potential" on the location decisions of Japanese multinationals into the European Union. The estimation of a nested logit is required as they observe variables relevant for profitability both at the national and at the regional levels.

investment. Hence, $\ln(\mathrm{dist}_{cj}/\mathrm{dist}_{cm})$ is the log-ratio of the geographical distance between the investor and the recipients; $(\mathbf{D}_{cj} - \mathbf{D}_{cm})$ is the vector difference of two dummies, whose components take the value of 1 if the investor and the relevant destination country share a common language and have been linked by colonial ties in the past[19].

The main interest lies in the coefficients ϕ_1 and ϕ_2. The effect of the fiscal cost is captured by the differential $(\mathrm{tax}_j - \mathrm{tax}_m)$. If taxes do matter in the allocation of foreign investment, then countries associated with higher corporate taxes should receive lower relative inward investment, keeping all other determinants constant. Thus, the semi-elasticity of the tax differential should be negative, or $\phi_1 < 0$. $(\mathrm{I}_j - \mathrm{I}_m)$ measures the difference in institutional quality in the two host countries. *Ceteris paribus*, economies with better institutions attract more foreign investment; hence, it should be $\phi_2 > 0$.

The main prediction from the theoretical model sketched above is that the responsiveness of FDI to taxation should change with the level of institutional quality. In order to test this, first of all, we differentiate countries with respect to the quality of their institutions. Specifically, we select as high quality countries those economies for which the measure of institutional quality is in the top three deciles of the distribution of this indicator. The remaining countries are treated as low quality[20]. We choose the threshold to be not too restrictive in order to retain sufficient variability of the quality variable among the high-quality countries. Moreover, inspection of the distribution shows that the variable "jumps" in correspondance with the chosen cutoff (see table E-4 in Appendix E).

Consequently, based on the institutional level associated with the host country pairs, we can differentiate among three occurrences: two symmetric cases, where countries j and m are both high quality or both low quality destinations, and one asymmetric group. In this latter case, we construct the dependent variable (and, hence, the controls) taking the high quality economy as the numerator country j and the low quality host as the denominator country m[21]. Moreover, to capture how institutional quality affects the relationship between FDI and corporate taxation we include in the estimating equation a (demeaned) interaction

[19] Hence, the difference is equal to one (negative one) if the associated dummy in the numerator country is one (zero) and the associated dummy in the denominator country is zero (one), and zero otherwise.

[20] The high quality countries are: Japan, France, Spain, Belgium, Ireland, Australia, United States, Germany, Canada, New Zealand, United Kingdom, Austria, Singapore, Denmark, Sweden, Finland, Netherlands, Norway and Switzerland.

[21] Clearly, each country pair enters only once in the estimation.

term as follows:

$$\ln\left(\frac{\mathrm{FDI}_{cj}}{\mathrm{FDI}_{cm}}\right) = \alpha + \alpha_0 \ln\left(\frac{\mathrm{GDP}_j}{\mathrm{GDP}_m}\right) + \alpha_1 \ln\left(\frac{\mathrm{dist}_{cj}}{\mathrm{dist}_{cm}}\right) + \left(\mathbf{D}_{cj} - \mathbf{D}_{cm}\right)\boldsymbol{\delta} + \\ +\phi_1\left(\mathrm{tax}_j - \mathrm{tax}_m\right) + \phi_2\left(\mathrm{I}_j - \mathrm{I}_m\right) + \\ +\phi_3\left[\left(\mathrm{tax}_j - \mathrm{tax}_m\right) - \overline{\left(\mathrm{tax}_j - \mathrm{tax}_m\right)}\right]\left[\left(\mathrm{I}_j - \mathrm{I}_m\right) - \overline{\left(\mathrm{I}_j - \mathrm{I}_m\right)}\right] + \varepsilon_{cjm} \quad (17)$$

Thus, we estimate equation 17 separately on the three sub-samples. Following the theoretical predictions, the allocation of FDI to high quality countries should be less sensitive to (relative) tax rates compared to the low quality host countries. Hence, the coefficient estimate of ϕ_1 is expected lower in absolute value in the high quality sub-sample than in the low quality sub-sample. In addition, a positive coefficient on the interaction term implies that the negative effect of taxation on FDI is less strong for country characterized by a high level of institutional quality.

3.2. Data

This section discusses briefly the main data used in the analysis. The analysis is cross-sectional for a number of reasons mainly related to the nature and availability of data[22]. A detailed description of all the data and sources is found in Table E-2 in Appendix E. FDI is measured as the average stock of FDI in a sample of 63 destination economies from 17 OECD countries over the 2003-2005 period. Data are drawn from the OECD reports.

Quality of institutions

Measures on the quality of institutions are taken from Kaufmann, Kraay and Mastruzzi (2007). The authors constructed several composite indicators applying an unobserved components methodology to survey data and expert polls (for 2007 there were 33 data sources). The surveys are conducted with biannual frequency, 1996 being the first year in which data are available. To construct our institutional quality variable we consider only those indicators that are more consistent with the suggested interpretation of institutions as a public good. Specifically, they are:

[22] The explanatory power of the model comes purely from the cross-section, which is sensible given the focus on capital stocks and the fact that the independent variables of interest - taxation and institutions - are mostly changing little over time. Using the cross-section, moreover, makes it possible to maximize the number of countries for which measures of effective tax rates are available.

- Rule of law: measuring perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

- Government effectiveness: measuring perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

Consistently with the theoretical approach, we are interested in the overall effect of institutional quality on foreign investment, and we will not try to isolate the different channels through which institutions affect economic outcomes (Acemoglu and Johnson, 2005). Therefore, we build the variable for institutional quality by averaging the two indices above, and assigning them equal weight. In order to smooth out the effects of potential measurement error, we use the three-period average over the years 1996-2000[23]. We rescale the indicator, that originally ranges between -2.5 and +2.5, as to vary on a 0 - 1 scale; in all cases, a higher score is indicative of better institutions.

Tax rates

Two different measures of the tax burden on corporations are employed in the analysis. First, we use the statutory tax rates. This is indeed the most immediate and readily available measure of the fiscal burden[24]. However, a possible shortcoming of statutory tax rates when analyzing a cross-section of countries is that

[23]Employing lagged values of the institutional variable helps somewhat to reduce possible problems of simultaneity with FDI. As Daude and Stein (2007) note, the feedback effect from FDI and institutions could arise from two sources. First, it might be that foreign investors become a constituency and ask for better institutions. Second, as the indicators of institutional quality are in part based on survey data, poll respondents could give a biased judgement observing higher levels of FDI.

[24]As Benassy-Quère et al. (2007) point out, an exact measure of the tax burden on corporations would be given by the so-called apparent tax rate, i.e. the ratio of tax receipts to the generated surplus. This provides an *ex-post* measure of effective taxation, as both variables are in fact computed from the data. However, for the same reason, an upward bias could arise for tax-friendly countries attracting multinational corporations. Moreover, Nicodème (2001) finds evidence that apparent tax rates tend to move cyclically; in econometrics terms, that would raise problems of endogeneity with FDI. Tax measures derived directly from the statutes can be used to circumvent such problems. *Ex-ante* measures of effective tax rates have been developed based on the provisions of the national tax codes. Effective, average or marginal tax

they do not take into account the definition of the tax base. In fact, as found by Devereux and Griffith (2003) for several OECD countries, the reduction in statutory tax rates in the past years has been partially compensated by a broader definition of taxable corporate income. Similarly, Hines (2005) finds that despite downward pressures from international competition corporate income around the world continues to be taxed at significant rates. Average statutory corporate income tax rates fell from 46 percent in 1982 to 33 percent in 1999, though tax bases simultaneously broadened; as a result average corporate tax collections actually rose from 2.1 percent of GDP in 1982 to 2.4 percent of GDP in 1999.

As an alternative tax variable, we include the effective tax rates (ETRs) drawn from the Doing Business Project of the World Bank (see Djankov et al., 2008). These measures are derived from a newly constructed database based on a survey, conducted jointly with PricewaterhouseCoopers, of all taxes imposed on "the same" standardized mid-size domestic firm (called TaxpayerCo). The principal corporate income tax measure is the effective tax rate that TaxpayerCo pays if it complies with its country's laws, defined as the actual corporate income tax owed by the company relative to pre-tax profits. The reference year is 2004. Since it is assumed that TaxpayerCo is a new company, both the effective tax rate at the end of the 1st year, and the tax rate applicable in the 5th year of activity - which takes into account the present value of depreciation and other deductions - are available. Hence, by construction, these tax rates circumvent the problems arising from different definitions of the tax base across countries. Hence, they offer a measure of the fiscal burden which is immediately comparable in the cross-section. One could question the use of domestic tax rates to model the incentives faced by multinational investors. Although foreign firms in some countries receive tax holidays, those tend to be relatively short term, however, and the rates that apply to domestic firms are hence highly correlated with those on foreign ones.

Figure 1 depicts average tax rates for high and low quality countries, the former being defined as those with institutional quality in the top three deciles of the distribution for this indicator (see previous section). Taken at face value, it shows that effective tax rates can be markedly lower than statutory rates. More interest-

rates, calculated in a series of papers following King and Hines (1984), are often used as better suited to reflect the incentives for mobile firms to react to the fiscal variable. Their construction, however, hinges upon a series of assumptions regarding the cost of capital, way of financing the affiliates, etc. Moreover, According to Devereux, Griffith and Klemm (2002) discrete choice decisions on location are influenced by statutory tax rates or average effective tax rates, whereas incremental investment should react to the marginal effective tax rate. FDI data do not allow for disentangling between the motivation underlying the investment, however.

ingly, it provides evidence that countries with better institutions are on average characterized by higher corporate taxes than low quality countries, whatever the tax measure used in the comparison.

[Figure 1 around here]

4. Results

I start by estimating the basic specification of the difference gravity equation 16 on the full sample of host country dyads belonging to the same regional trade agreement. Standard errors are adjusted for clustering on recipient pairs as each dyad will be associated with a plurality of investors (Wooldridge, 2001). The results are shown in Table 1.

[Table 1 around here]

A first important check concerns the size of the coefficients. All standard gravity estimates are reasonably similar to what is usually found in the literature. We take this as a reassuring indication as to the validity of the first difference methodology employed.

Turning to the variables of interest, the coefficients on institutional quality have the expected positive sign and are highly significant (at 1% confidence level), with the point estimates fairly stable across the different specifications. Better institutions are associated with a higher relative stock of inward productive capital. The numerical effect is overall remarkably large. Holding all the other factors constant, the estimates suggest that an increase equivalent to one grade in the institutional quality indicator (measured in the original scale) is associated with a stock of FDI around 60% larger[25]. Also the tax differential has a statistically significant negative impact on FDI. The estimates imply that a 10 percent increase in the tax differential is associated to an increase in the stock of inward foreign investment by about 35% on average, all else equal. Table 2 reports additional specifications showing that the institutional quality variable is not capturing the effect of other omitted controls often introduced in the gravity literature. In particular, we check the explanatory power of GDP per capita and human capital.

[25] From equation 16 one can derive the percentage change in FDI as $\exp\left(\gamma_2 \Delta\left(\mathrm{I}_j - \mathrm{I}_m\right)\right) - 1$, where Δ indicates the change in the relevant variable. From that, the estimated proportional change in the stock of FDI can be obtained by noting that a change of one grade corresponds to 0.20 in the rescaled institutional quality variable.

When introduced alone, GDP per capita enters the regression with a positive and borderline insignificant coefficient. By including simultaneously the institutional quality variable the coefficient is driven into negative range, and becomes significantly different from zero. Econometrically, this result is evidently an effect of the high correlation between GDP per capita and institutional quality (around 0.88). Institutional quality, on the other hand, retains significant explanatory power in the augmented regression[26]. Similarly, schooling is not a significant determinant of relative FDI stocks when included in isolation, whereas it turns significantly different from zero and with a negative sign in the case of joint inclusion of institutional quality. A final check concerns the role of physical public goods. If there are complementarities between public and private capital, the former can be considered an additional omitted factor of production affecting the productive opportunities of an economy. We use the percentage of paved roads on toal roads as a proxy for public infrastructures. The variable enters the estimating equation with a negative and statistically significant coefficient, which remains unaffected by the inclusion of the institutional quality variable. Overall, we take those findings as supporting the baseline specification.

[Table 2 around here]

In the next step, equation 17 augmented with the (demeaned) interaction term is estimated on the three sub-samples of host country dyads. The results are reported in Table 3. In the low quality sub-sample (left hand side panel), the coefficient on the institutional quality variable is estimated, always very precisely, around 2.4 on average. The estimated semi-elasticity with respect to differences in corporate taxation ranges from about -3, when the effective rate after 5 years is used, to -2.3. The interaction term has the expected positive sign, and is of sizeable magnitude in the specification with the effective tax rates. It is however not estimated with precision.

[Table 3 around here]

Turning to the high quality sub-sample, significant differences emerge with respect to the estimated effects of both variables of interest. The coefficient on institutional quality, which in the presence of the interaction term measures the

[26] The point estimate increases substantially in magnitude as a consequence of multicollinearity.

effect of institutional differences at the average level of differences in taxes, is insignificantly different from zero. The lack of precision in the estimates is far from surprising. The variable is built as bilateral differences among the top 19 countries ranked based on the quality of their institutions. As such, it shows a rather low variability. In fact, the standard deviation is around 0.050, almost three times smaller than the standard deviation in the low quality subsample. Both measures of the effective tax burden turn insignificant in explaining relative FDI stocks, which would lend support to the contention that FDI to high quality countries is relatively insensitive to the fiscal cost. The semi-elasticity with respect to the statutory tax rate is however strongly significant, and twice as large as the coefficient estimates in the low quality sub-sample. This result can be reconciled with the theory looking at the cross-term, which is positive and around three times as large as the tax coefficient in absolute value. Although its t-statistics is not significant, the joint significance of both the tax coefficients cannot be rejected at 1 per cent level. The F-test of the joint hypothesis is $F(2, 69) = 5.08$, with an associated p-value of 0.0087. Hence, the marginal effect of the statutory tax rate depends on the differences in institutional quality.

Finally, the right hand side panel reports the estimates on the asymmetric sub-sample. The direct effects of both taxation and institutional quality differences are estimated with high precision. The cross-term is always positive and, in the case of effective tax rates, around two standard deviations above zero. The F test for the joint significance of the taxation coefficients is highly significant in all three specifications. Overall, higher corporate taxes are associated with lower relative FDI. This relationship, however, is significantly influenced by the difference in institutional quality, even after controlling for the direct effect of this latter variable. Specifically, the estimates using the effective tax rate after 1 year suggest that at the average difference in institutional quality a one percent higher tax differential decreases FDI stocks by 3.2 percentage points. Figure 2 depicts the total coefficient on the tax rate across different values of the (demeaned) institutional quality difference, together with 95% confidence bands. As can be seen in the top panel, the estimates imply that the tax rate has a negative effect on FDI stocks for all the values of the institutional quality index up to around 1.4 standard deviations above zero[27]. This range covers almost 90 percent of the sub-sample observations. For the remaining observations the effect of the fiscal

[27] Here we refer to the demeaned difference in the institutional quality variable as the "institutional quality index", measured along the horizontal axis in the figure. By construction, it has zero mean.

variable even turns positive, although statistically insignificant. Overall, the tax rate acts as a significant deterrent to foreign investment for 65 percent of the observed bilateral stock holdings in the sub-sample, namely those for which the institution quality index is below 0.025. The bottom panel in Figure 2 plots the total effect of the effective tax rate after 5 years. The estimated semi-elasticity at the average difference in institutional quality is equal to -6.8. To get a quantitative grasp of the dampening effect of better governance on the sensitivity of FDI to the fiscal variable it is useful to examine different points along the distribution of the institutional quality index. Consider, as an example, the value of -0.0726, which corresponds to the 25th percentile. At this point, the estimated marginal effect of the tax rate is approximately equal to -8.3 percentage points. At the 75th percentile (coincident with the value of 0.0795), a one percent increase in the tax rate reduces FDI stocks only by 5 percentage points. The effect is also statistically significant. In other words, moving from a pair of destination countries that are very different in terms of institutional quality (in the top quartile of the distribution) to a dyad of recipients that are rather similar (in the bottom quartile) increases the tax sensitivity of FDI stocks by approximately 60 percent. Overall, the negative effect of the tax rate is statistically significant for 85 percent of the observations in the sub-sample, up to a value of the institutional quality index equal to 0.125. At such point the estimated marginal effect is -4.2, roughly half as large as the value at the 25th percentile.

[Figure 2 around here]

As discussed previously, estimating a gravity equation in first difference has the advantage of eliminating multilateral factors which are very hard to control for adequately, raising the concern of an omitted variable bias in the estimates from the standard bilateral equation in the levels. The cost of this strategy is that not all the investors have positive FDI stocks in the same country pairs, while the variables of interests vary indeed at the country pairs level. To check the robustness of the bilateral results, we also estimate the difference gravity with aggregate stocks, pooling FDI originating from all the 17 investors. As noted by Djankov, Freund and Pham (2008), the drawback of this strategy is however that the control group in not as clearly defined as before, as investor-specific variables drop out of the estimating equation. The results for the whole sample are presented in Table 4.

[Table 4 around here]

Compared to the bilateral specification, coefficient estimates for institutional quality are fairly stable, whereas the tax semi-elasticities show some variation. Specifically, the point estimate for the statutory measure is remarkably smaller (in absolute value) than in the bilateral equation, while the opposite occurs to the effective rate after 1 year. This pattern is confirmed when looking at the asymmetric sub-sample (Table 5). Moreover, in the low quality case, the semi-elasticity of the statutory tax rate is not significantly different from zero. Overall, the effect of taxation on FDI is still significantly influenced by institutional quality, with the stronger indirect effect being found not surprisingly among asymmetric receiving country pairs. Figure 3 plot the total effect of the effective tax rates across different levels of the institutional quality variable, together with the 95% confidence intervals. Inspection of the two panels gives results that are fairly comparable to the bilateral equations.

[Table 5 around here]
[Figure 3 around here]

4.1. Sensitivity analysis

A major concern regarding the previous results is that they might be driven by the substantial variability between developed and developing countries. This is particularly relevant for the asymmetric subsample. To address this issue, in this section I perform a sensitivity analysis with respect to alternative samples and the removal of influential observations. Table 6 reports the coefficient estimates for tax and the interaction term with institutional quality. In the upper panel I restrict the asymmetric subsample to country pairs belonging to the same income group according to the World Bank definition[28]. This dramatically reduces the number of observations, now roughly halved with respect to the baseline estimation. Nevertheless, the results still point to a strong and significant influence of institutional quality on the effect of taxation on FDI.

[Table 6 around here]

Next, I check whether the baseline results are driven by influential observations. Rather than resorting to graphical inspection of the residuals, I adopt a

[28] Based on their income per capita, countries are classified in the following categories: Low-income, below $825; lower-middle income, $825-$3,255; upper-middle income, $3,255-$10,065; high income, above $10,065.

more systematic approach to outliers detection. Specifically, I use the Cook's and Welsch distances (Belsley, Kuh and Welsch, 1980). Those are destructive regression diagnostics that judge unusually influential observations according to different thresholds. In particular, the threshold defined by the Cook's distance is $4/N$, where N is the number of observations in the original regression. The decision rule of the Welsch distance is $3\sqrt{K}$, where K is the number of estimated parameters in the estimating equation. The lower panels report the relevant coefficient estimates obtained from the subsamples after removal of such observations. As shown, overall, the results remain robust to these sensitivity checks.

4.2. Endogeneity and measurement error

There are several issues to be discussed that suggest the use of extreme caution in the causal interpretation of the regression coefficients in the previous sections. Let us consider first institutional quality. As already anticipated, a major concern is reverse causation running from FDI to institutional quality. This can arise for two main reasons. First, foreign investors might exert pressures (directly or via their governments) to implement institutional reforms in host countries. Secondly, as the indicators of institutional quality are partly based on survey data, observing high foreign investment might lead poll respondents to give a biased judgement on the quality of the institutional infrastructure. A further problem is that institutional quality can capture the effect of other omitted variables that are relevant in attracting FDI[29]. Finally, a third important concern is measurement error. Since it is impossible to summarize in a single variable all dimensions of the institutional environment, institutional quality is likely measured with noise, which in turn would result in inconsistent and biased OLS estimates. Given these possibilities, the OLS estimates might be bised either upwards or downwards. In particular, in the presence of reverse causality the previous estimates will be inflated, while if measurement error dominates then the estimates will be attenuated[30]. A further complication is that assuming measurement error has consequences on the definition of the threshold used to split the sample of receiving country pairs on the

[29] For instance, Guiso, Sapienza and Zingales (2009) find that cultural aspects such as bilateral trust have a positive and significant effect on the cross-border investment among European countries.

[30] In the previous sections those possible problems have been tackled using a three-period average of the institutional quality measure, lagged with respect to the dependent variable. Given the sluggish nature of FDI stocks, this strategy might prove insufficient to restore consistency and unbiasedness of the OLS estimates, however.

basis of their levels of institutional quality.

For the very same reasons discussed above, one cannot rule out a feedback effect from FDI to taxation either. Particularly in capital-importing countries, the level of the fiscal burden on corporations might be influenced, directly or indirectly, by the lobbying efforts of foreign investors. Similarly, investment decisions might be taken in anticipation of future lower taxes in the destination country. Again, the direction of the bias in the OLS estimates is uncertain. In the first scenario, they will be biased upwards, whereas the second scenario will result in a downward bias. All in all, the previous discussion shows that treating both the variables of interest - institutional quality and tax rates - as exogenous is not without problems, also in the light of the theoretical model where they are jointly determined. In this section we try to circumvent those caveats by using instrumental variables techniques to obtain exogenous variation in both institutional performance and tax rates.

In choosing the set of instruments, we follow a well-established literature and consider a country's legal origin as an exogenous determinant of current institutional performance[31]. La Porta *et al.* (1998, 1999) show that legal systems differ systematically for their effect on investor's protection, court efficiency and legal formalism. In particular, they find that English common law countries turn out on average superior when it comes to protection of shareholders and creditor rights, whereas French civil law countries offer the weakest legal protection and the worst legal enforcement. In addition, legal systems originated in the Socialist and in the French tradition exhibit the worse performance in terms of public sector efficiency and bureaucratic quality[32]. Since our unit of observation is a country pair, we

[31] Recently, Acemoglu and Johnson (2005) have isolated a large, precisely estimated, and robust effect on several measures of contracting institutions. Property rights institutions, on the other hand, would be mainly influenced by the colonization strategy adopted by the Europeans. In fact, in a seminal paper, Acemoglu, Johnson and Robinson (2001) propose to use European settler mortality in the colonies as an instrument for institutional quality, which is regarded as having long term persistence. The underlying hypothesis is that extractive institutions were set up in countries plagued with higher mortality. By construction, this variable is available only for colonized countries. For this reason, coupled with the fact that having country pairs as the unit of analysis results in even fewer observations, we cannot use such variable as an instrument for institutional quality. Moreover, the results in Acemoglu, Johnson and Robinson have been recently challenged on the grounds of the hypotheses used in the construction of the mortality variable (Albouy, 2010).

[32] There is still debate in the literature on the exct mechanisms through which legal origin affects institutions, whether through political institutions, legal efficiency or regulatory practices. Since we are using a composite measure of institutional quality, the fact that there can be

define the instrument as the difference between two dummies that take the value of one in case of English legal origin.

Recent results from the economic theory can provide useful indications as to finding sources of exogenous varation for tax rates. We follow Da Rin, Di Giacomo and Sembenelli (2010) in underpinning our choice of instruments with the political economy literature on the effects of polical variables on fiscal policy outcomes (see, for instance, Persson and Tabellini, 2004 – on constitutional forms; Castanheira, Nicodème and Profeta, 2010 – on the implementation of tax reforms). In partucular, we add to the list of excluded instruments: a variable capturing the (differences in the) margin of majority, defined as the fraction of seats held by the government; a (difference) dummy variable for right-wing ideological orientation of the main government party; a (difference) dummy variable for the presence of a constitutional limit to the number of years the executive can serve. Instruments are drawn from the Political Institutions Database of the World Bank. Preliminary inspection of the first stage regressions for tax rates and institutions shows that legal origin has a strong effect on institutional quality and little effect on tax rates, whereas political variables have a large effect on tax rates, and impact the measure of institutional quality mainly insignificantly. As the interaction term between taxes and institutional quality in equation 17 is effectively endogenous as well, the set of instruments includes also interactions between the dummy for English legal origin and the political variables.

[Table 7 around here]

The instrumental variable analysis is performed using the generalized method of moments estimator (GMM-IV), which allows for heteroscedasticity of unknown forms. The results are reported in table 7. Panel A shows that both institutional quality and taxation retain their effect on FDI, and the size of their coefficients increases roughly twofold with respect to the estimates in table 1. The interaction term is positive and statistically significant in all the three specifications with statutory and effective tax rates. The first stage regressions, reported in Panel B, show that the instruments are indeed strongly related to the endogenous variables. To address formally the issue of potential weak correlation - which would result in biased IV estimates and misleading standard errors - the F statistics proposed by Angrist and Pischke (2009) is computed and reported among the diagnostics in Panel C. This test can be used to test the weak identification of individual

different channels is not a big concern.

regressors in the presence of multiple endogenous variables. It is constructed by partialling-out linear projections of the remaining endogenous regressors. This test statistic can be compared to the critical values reported in Stock and Yogo (2005). In all cases, the values of the test are above the threshhold recommended by these authors. Instrument validity is assessed using the Hansen J statistics for over-identifying restrictions. The p-values associated with the statistics suggest that the null hypothesis of instrument validity cannot be rejected.

5. Conclusion

This paper analyzes the joint effect of taxes and institutional quality on the allocation of international investment. Modelling institutional quality as a public good in a two-country framework, it is shown that the jurisdiction providing better institutions is able to levy a higher tax on capital and to attract more productive investment compared to the low-quality/low-tax location, provided firms' profits are sufficiently responsive to the institutional quality variable. This suggests that there might be significant differences in the sensitivity of FDI to the fiscal variable between countries characterized by different levels of institutional quality.

This contention has been taken to the data using FDI stocks to 63 economies. The results from a difference gravity equation point to a significant responsiveness of FDI stocks to taxation in countries with low quality institutions. On the other hand, effective tax rates do not seem to be a determinant of investment directed to high quality economies. Moreover, it is found that the fiscal variable plays a major role in the allocation of investment between countries with different levels of institutional quality, although the overall effect of taxation depends on the differences in institutional quality.

In summary, high taxes do not seem to be a deterrent to investing into advanced economies as commonly feared, while at the same time a low fiscal burden on corporations might prove insufficient to attract productive capital in the absence of market-supporting institutions. These findings may create an important distinction to be made in estimating empirical relationships and drawing policy inferences. In order to do so, however, further investigations are necessary within an extended modelling framework to take into account all the other factors - like profit shifting and the design of national taxation policies towards cross-border profits - that concur in determing the actual fiscal burden on multinational corporations.

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Appendix

A. Extension: fiscal competition in the presence of agglomeration economies

Agglomeration economies have been recognized as an important driving factor for firms' location decisions. A recent theoretical literature has studied the implications for strategis tax setting among jurisdictions competing for mobile productive capital. Models of the "new economic geography" models, in particular, can accommodate situations in which, in contrast to the standard tax competition literature, a "race to top" in corporate taxes emerges. In a "core-periphery" configuration in which the industry is concentrated in one location, an agglomeration rent accrues to investment in the core region. Hence, the core jurisdiction can in principle tax away part of such rent without inducing outflows of capital (Borck and Pflüger, 2006). On the other hand, in an alternative setting, agglomeration externalities can increase the sensitivity of capital to tax differentials. When a firm's location decision can trigger further inflows of capital, governments might be forced to reduce the fiscal burden to maintain their attarctiveness for corporations (Konrad and Kovenock, 2009). In this section we propose a simple extension to the baseline model to study the effects of agglomeration externalities on the fiscal competition outcome.

Following Brülhart et al. (2008), agglomeration economies can be modelled in a simple way by explicitly including an agglomeration rent in the profit function. From equation 1 profits to firm i locating in country j are as follows:

$$\pi_{ij} = p - w - \tau_j + \theta a_j + \gamma \hat{X}_j + \varepsilon_{ij} \tag{18}$$

In 18, $\hat{X}_j$ is the measure of firms locating in j, whereas $\gamma > 0$ is a parameter capturing the strenght of agglomeration economies. All the other terms are the same as before, with ε_{ij}, in particular, i.i.d. and distributed according to the double exponential. The probability of choosing country 1, given $\hat{X}_1$ and $\hat{X}_2$, is:

$$s_1 = \frac{\exp\left[\left(\theta a_1 - \tau_1 + \gamma \hat{X}_1\right)/\mu\right]}{\exp\left[\left(\theta a_1 - \tau_1 + \gamma \hat{X}_1\right)/\mu\right] + \exp\left[\left(\theta a_2 - \tau_2 + \gamma \hat{X}_2\right)/\mu\right]} \tag{19}$$

Hence, the number of firms locating in each country will be given by the solution to the system of two equations:

$$\hat{X}_i = Ns_i \qquad i = 1, 2.$$

Rearranging 19, and using the equality $\hat{X}_1 + \hat{X}_2 = N$, one gets the following (implicit) expression for the number of firms in country 1:

$$\hat{X}_1 = N\left[1 + \exp\left(\left(\tau_1 - \tau_2 + \theta a_2 - \theta a_1 + \gamma\left(N - 2\hat{X}_1\right)\right)/\mu\right)\right]^{-1}. \tag{20}$$

It is possible to show that 20 has a unique solution for $\hat{X}_1$ if $\gamma < 2\mu/N$[33]. Intuitively, the effect of the agglomeration economies on profits does not have to be too strong; otherwise, taxes and institutional quality do not provide enough incentives to drive a firm's location decision, given the relevance of other firms' choices. In this case, multiple allocations of firms across the two jurisdictions for a given level of quality and taxes would be possible.

Following equation 4 in the text, government revenues net of the costs of institutional quality for country 1 are:

$$\hat{R}_1 = (\tau_1 - \beta a_1)\hat{X}_1 - C(a_1)$$

Maximization with respect to the tax rate gives the first order condition as:

$$\begin{aligned} \frac{\partial \hat{R}_1}{\partial \tau_1} &= \hat{X}_1 + (\tau_1 - \beta a_1)\frac{\partial \hat{X}_1}{\partial \tau_1} = \\ &= \hat{X}_j - (\tau_1 - \beta a_1)\hat{X}_1(1 - s_1)\left[\mu - N\gamma 2s_1(1 - s_1)\right]^{-1} = 0, \end{aligned} \tag{21}$$

where the second line uses the fact that $\partial\hat{X}_1/\partial\tau_1 = -\hat{X}_1(1 - s_1)\left[\mu - N\gamma 2s_1(1 - s_1)\right]^{-1}$ by virtue of the rule for derivatives of implicit functions[34]. Rearranging the FOC in 21 gives:

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[33] To see that the equation $\hat{X}_1 = Ns_1\left(\hat{X}_1\right)$ has a unique solution, one can derive the following properties from 19: *i)* $s_1(0) > 0$; *ii)* $s_1(N) < 1$ and *iii)* $ds_1/d\hat{X}_1 = 2\gamma s_1(1 - s_1)\mu^{-1}$. As $s_1(1 - s_1) \leq 1/4$, it follows that $ds_1/d\hat{X}_1 \leq \gamma/2\mu$. Thus, if $\gamma < 2\mu N$ it holds that $d(Ns_1)/d\hat{X}_1 < 1$. The latter inequality together with properties *i)* and *ii)* shows that $\hat{X}_1 = Ns_1\left(\hat{X}_1\right)$ has a unique solution.

[34] Given the implicit function $F\left(\hat{X}_1, \tau_1\right) \equiv \hat{X}_1 - \Psi_1\left(\hat{X}_1, \tau_1\right) = 0$, where $\Psi_1\left(\hat{X}_1, \tau_1\right)$ is the right hand side of 20, the following differentiation rule holds: $\partial\hat{X}_1/\partial\tau_1 = -\partial F/\partial\tau_1/\partial F/\partial\hat{X}_1$.

$$\tau_1^{\text{aggl}} = \frac{\mu}{(1-s_1)} + \beta a_1 - N\gamma 2 s_1 \tag{22}$$

Imposing symmetry, the implicit solution becomes[35]:

$$\tau^{\text{aggl}} = 2\mu + \beta a - N\gamma. \tag{23}$$

It is easy to check that, given the level of institutional quality, the tax rate in 23 is lower than the corresponding symmetric tax rate in the case without agglomeration economies. Moreover, such tax rate decreases monotonically with both the agglomeration parameter and the total measure of firms, $\partial\tau^{\text{aggl}}/\partial\gamma < 0$ and $\partial\tau^{\text{aggl}}/\partial N < 0$. Hence, the fact that firms benefit from the externalities from other producers exacerbates tax competition between the two jurisdictions.

Straightforward comparative statics can be derived to examine how changes in institutional quality affect equilibrium taxes in the presence of agglomeration economies. The full expressions are reported in the Appendix D, where it can be easily verified that, not surprisingly, $d\tau_1^{\text{aggl}}/da_1 > 0$ and $d\tau_2^{\text{aggl}}/da_1 < 0 \Leftrightarrow \theta > \beta$. More interesting is the comparison of the magnitude of such effects with respect to the case without agglomeration economies. From 29 and 30 in Appendix D it can be easily seen that:

$$\text{sign}\left[\frac{d\tau_1}{da_1} - \frac{d\tau_1^{\text{aggl}}}{da_1}\right] = \text{sign}\left[\beta - \theta\right],$$

and

$$\text{sign}\left[\frac{d\tau_2}{da_1} - \frac{d\tau_2^{\text{aggl}}}{da_1}\right] = -\text{sign}\left[\beta - \theta\right].$$

The size of the variable cost parameter β relative to θ, which measure the sensitivity of the profit function to institutional quality, is crucial in determining the relative size of the differentials. In particular, if $\theta > \beta$, in the presence of agglomeration economies tax rates are more responsive to institutional quality compared to the baseline scenario. Hence, in equilibrium, the high quality country can levy a correspondingly higher tax on capital, whereas the competing jurisdiction has to decrease substantially the fiscal burden to be still able to attract investment.

[35] By using the result in Proposition 7.5 in Anderson, de Palma and Thisse (1992), the existence of a symmetric equilibrium is guaranteed if $\gamma < 1.6875\mu/N$.

On the other hand, when $\theta < \beta$, the rise in taxes for country 1 is dampened in the case with agglomeration economies because corporate profits are scarcely responsive to institutional quality. For the same reason, the low quality jurisdiction can impose a more pronounced tax increase.

B. Extension: subsidizing institutional quality

The analysis in section 2 shows that the level of fixed cost of institutional quality is crucial for the equilibrium outcome of the game. In particular, high quality institutions can be implemented by the developed country only if the incremental fixed cost with respect to the low quality alternative is not excessively high. The lagging jurisdiction, on the other hand, can achieve high quality institutions for a more restrictive range of such fixed costs. This would motivate a policy intervention aimed at subsidizing institution building. In fact, international organizations such as the World Bank provide various forms of aid to developing countries in this field, including direct financing. Similarly, financial assistance to adequate the national regulatory and institutional frameworks to the required standards is envisaged in the accession process to the European Union.

An easy way to include subsidization to promote institution building in the model is having the leading country paying a fraction of the fixed cost of institutional quality incurred by the laggard. Rents to the two governments are now:

$$\begin{aligned} R_1 &= (\tau_1 - \beta a_1) X_1 - C(a_1) - \lambda C(a_2) \\ R_2 &= (\tau_2 - \beta a_2) X_2 - (1-\lambda) C(a_2) \end{aligned} \tag{24}$$

where λ is part of fixed cost subsidized by the developed country.

It is easy to see that the tax competition sub-game in the third stage is not affected in this new arrangement. Hence, the implicit equilibrium tax rate is still given by the expression in 5. The sequential sub-game in quality can be solved as usual starting from the problem of the lagging country. The sub-game perfect Nash equilibrium of the full game is characterized in the following proposition.

Proposition 4. *The SPNE of the game with subsidized institutional quality is as follows:*

- *for $\Delta C(a) < \mu \left(1 - \frac{1}{\sigma}\right) N$, both countries provide high quality ("race to the top");*
- *for $\mu \left(1 - \frac{1}{\sigma}\right) N < \Delta C(a) < \mu \left(1 - \frac{1}{\sigma}\right) N(1-\lambda)^{-1}$, there is quality differentiation with the lagging country setting a high quality ("second mover advantage");*
- *for $\mu \left(1 - \frac{1}{\sigma}\right) N(1-\lambda)^{-1} < \Delta C(a) < \mu (\sigma - 1) N(1-\lambda)^{-1}$, there is quality differentiation with the leading country setting a high quality ("first mover advantage");*

- *for $\Delta C\,(a) > \mu\,(\sigma - 1)\,N(1-\lambda)^{-1}$, both countries provide low quality ("race to the bottom").*

Several comments are in order. First, introducing a subsidizing scheme from the developed to the developing country has no effects on the symmetric high quality equilibrium. The cost range in which such equilibrium can be sustained is indeed the same as in the game with no subsidization. Second, *ceteris paribus*, the scope for a "race to the bottom" is reduced; the cost range that gives rise to a low equilibrium is smaller than in the baseline case. Finally, some interesting conclusions can be drawn for the case of asymmetric equilibria. Overall, there is a larger scope for sustaining such equilibria. The cost range in which there is a first mover advantage shifts to the right, i.e. it can be sustained at higher costs compared to the baseline case. Moreover, the possibility of a second mover advantage arises, with the lagging country setting high quality institutions and the leading country choosing instead low quality. The rationale is easily understood by recalling that the developed country is now financing part of the fixed cost incurred by the competitor. When the fixed incremental cost decrease to $\mu\left(1 - \frac{1}{\sigma}\right)N(1-\lambda)^{-1}$, the developing country finds it profitable to set high institutional quality in response to the high quality chosen by the leader. This latter, however, would be facing an excessive additional cost for high quality. Hence, it will switch to providing low quality in its own jurisdiction, leaving the other with higher taxes and a higher fraction of investing firms.

C. Total differential of equilibrium taxes

The total differential of the first order conditions of the tax sub-games can be found as follows. First, note that the derivative properties: $\frac{\partial X_i}{\partial \tau_i} = -\frac{1}{\mu} X_i (1 - s_i) < 0$; $\frac{\partial X_i}{\partial \tau_j} = \frac{1}{\mu} X_i s_j > 0$, $\frac{\partial X_i}{\partial a_i} = \frac{1}{\mu} X_i s_j \theta > 0$. The implicit solution for the tax rate of country 1 is:

$$G^1 = \tau_1 - \frac{\mu}{(1 - s_1)} - \beta a_1 = 0$$

The total differential is $G^1_{\tau_1} d\tau_1 + G^1_{\tau_2} d\tau_2 + G^1_{a_1} da_1 = 0$. Recalling the definition $\sigma_1 \equiv X_1 / X_2$, it is easy to show that

$$G^1_{\tau_1} = 1 - \frac{\mu}{(1 - s_1)^2} \frac{\partial s_1}{\partial \tau_1} = 1 + \sigma_1$$

Moreover, $G^1_{\tau_2} = -\sigma_1$ and $G^1_{a_1} = -(\sigma_1 + \beta)$. Substituting in the total differential gives:

$$(1 + \sigma_1) d\tau_1 - \sigma_1 d\tau_2 - (\sigma_1 + \beta) da_1 = 0 \tag{25}$$

Mutatis mutandis, the total differential of the implicit equilibrium tax rate for country 2 is $G^2_{\tau_1} d\tau_1 + G^2_{\tau_2} d\tau_2 + G^2_{a_1} da_1 = 0$. It can easily shown that the following conditions hold: $G^2_{\tau_1} = -(1/\sigma_1)$, $G^2_{\tau_2} = (1 + 1/\sigma_1)$ and $G^2_{a_1} = 1/\sigma_1$. Substitution in the total differential gives:

$$-\frac{1}{\sigma_1} d\tau_1 + \left(1 + \frac{1}{\sigma_1}\right) d\tau_2 + \frac{1}{\sigma_1} \theta da_1 = 0 \tag{26}$$

Finally, combining 25 and 26 gives the expressions 6 and 7 in the text.

D. Total differential of equilibrium taxes with agglomeration economies

The total differential of equilibrium taxes is found as follows. As before, it is useful to derive first the derivative properties: $\frac{\partial s_i}{\partial \tau_i} = -\frac{1}{\mu} s_i (1 - s_i) Z^{-1} < 0$; $\frac{\partial s_i}{\partial \tau_j} = \frac{1}{\mu} s_i s_j Z^{-1} > 0$, $\frac{\partial s_i}{\partial a_i} = \frac{1}{\mu} s_i s_j \theta Z^{-1} > 0$, with $Z \equiv [\mu - 2\gamma N s_i (1 - s_i)]$. Given the restriction on the value of γ required for a unique solution to s_i, it is easy to check that $Z > 0$. The implicit solution for the tax rate of country 1 is:

$$G^1 = \tau_1 - \frac{\mu}{(1 - s_1)} - \beta a_1 + 2\gamma N s_1 = 0$$

The total differential is therefore $G^1_{\tau_1} d\tau_1 + G^1_{\tau_2} d\tau_2 + G^1_{a_1} da_1 = 0$. Recalling that $\sigma_1 \equiv X_1/X_2 = s_1/s_2$, and defining $\varphi_1 \equiv s_1 (1 - s_1)$, it is easy to show that:

$$G^1_{\tau_1} = 1 - \sigma_1 \mu Z^{-1} + 2\gamma N \varphi_1 Z^{-1},$$
$$G^1_{\tau_2} = -\mu \sigma_1 Z^{-1} - 2\gamma N \varphi_1 Z^{-1},$$

and

$$G^1_{a_1} = -\theta \mu \sigma_1 Z^{-1} - \beta - 2\gamma N \varphi_1 \theta Z^{-1}.$$

Mutatis mutandis, the total differential of the implicit equilibrium tax rate for country 2 is $G^2_{\tau_1} d\tau_1 + G^2_{\tau_2} d\tau_2 + G^2_{a_1} da_1 = 0$. It can easily shown that the following conditions hold:

$$G^2_{\tau_1} = -\mu (\sigma_1 Z)^{-1} - 2\gamma N \varphi_1 Z^{-1},$$
$$G^2_{\tau_2} = 1 + \mu (\sigma_1 Z)^{-1} + 2\gamma N \varphi_1 Z^{-1}$$

and

$$G^2_{a_1} = \theta \mu (\sigma_1 Z)^{-1} + 2\gamma N \varphi_1 \theta Z^{-1}.$$

After substitution in the relevant total differentials, tedious but straightforward algebraic manipulations give the following comparative statics expressions:

$$\frac{d\tau_1^{\text{aggl}}}{da_1} = \frac{\beta\mu (1 + \sigma_1) + \theta \mu \sigma_1^2 + 2\gamma N \theta \sigma_1 \varphi_1}{\mu (1 + \sigma_1 + \sigma_1^2) + 2\gamma N \sigma_1 \varphi_1}, \tag{27}$$

and

$$\frac{d\tau_2^{\text{aggl}}}{da_1} = \frac{(\beta - \theta)(\mu + 2\gamma N \sigma_1 \varphi_1)}{\mu (1 + \sigma_1 + \sigma_1^2) + 2\gamma N \sigma_1 \varphi_1}. \tag{28}$$

By comparing these differential with those derived in the baseline model without agglomeration economies (see equations 6 and 7 in the text) one gets:

$$\frac{d\tau_1}{da_1} - \frac{d\tau_1^{\text{aggl}}}{da_1} = (\beta - \theta)\,\Omega \tag{29}$$

$$\frac{d\tau_2}{da_1} - \frac{d\tau_2^{\text{aggl}}}{da_1} = -\,(\beta - \theta)\,\Omega \tag{30}$$

where $\Omega \equiv 2\,(\sigma_1 + 1)\,N\sigma_1\gamma\varphi_1\left[\left(\mu\left(1 + \sigma_1 + \sigma_1^2\right) + 2N\sigma_1\gamma\varphi_1\right)\left(\sigma_1 + \sigma_1^2 + 1\right)\right]^{-1} > 0$.

E. Data appendix

Table E-1: Countries Coverage

European Union and Associated Countries				
Austria (i)	Belgium	Bulgaria	Croatia	Cyprus
Czech Republic	Denmark (i)	Finland (i)	France (i)	Germany (i)
Estonia	Greece	Hungary	Ireland	Italy (i)
Latvia	Lithuania	Malta	Netherlands (i)	Poland
Portugal (i)	Romania	Slovakia	Slovenia	Spain (i)
Sweden	United Kingdom (i)			
Andean Community	*ASEAN (plus Three)*		*MERCOSUR*	
Bolivia	Indonesia	Philippines	Argentina	
Ecuador	Singapore	Thailand	Brazil	
Peru	Japan (i)	China	Uruguay	
Venezuela	Malaysia	Hong Kong		
CER	*EFTA*	*SAFTA*		
Australia (i)	Norway* (i)	India		
New Zealand	Switzerland (i)	Republic of Korea (i)		
CIS	*Euro-Med*		*NAFTA*	
Armenia	Egypt	Morocco	Canada (i)	
Georgia	Jordan	Tunisia	Mexico	
Kyrgyzstan	Israel		United States (i)	
Russia	Lebanon			
Ukraine	Turkey			

Notes: (i) denotes that the country is observed also as an investor.

* Norway is also considered part of the EU and Associated countries as a member of the European Economic Area.

Table E-2: Variables and data sources

Variables	Description
FDI	Stock of outward FDI 2003-2005 (mio USD). Source: OECD - International Direct Investment Database.
GDP	Gross Domestic Product 2003-2005 (mio USD). Source: World Bank - World Development Indicators.
GDP per capita	Gross Domestic Product 2003-2005 (USD). Source: World Bank - World Development Indicators.
Distance	Greater circle distance between economic centers in investor-recipient country pairs. Source: CEPII (www.cepii.fr).
Colony	Dummy equal to one for investor-recipient country pairs linked by colonial ties. Source: CEPII (www.cepii.fr).
Language	Dummy equal to one for investor-recipient country pairs sharing a common language. Source: CEPII (www.cepii.fr).
School	Average years of schooling for population aged 25 and over. Source: Barro and Lee, 2000.
Roads	Percentage of paved roads in 2003. Source: World Bank - World Development Indicators.
Institutional quality	Simple average of Government effectiveness and Rule of law indicators. Average of biannual data for the 1996-2000 period. Rescaled on 0-1 using (Index+2.5)/5. Source: Kaufmann et al., 2008.
English legal origin	Dummy for English legal origin. Source: La Porta et al., 1999.
Margin of majority	Fraction of seats held by the government. Source: World Bank - Political Institutions Database.
Right-wing orientation	Dummy for right-wing ideological orientation of the main government party. Source: World Bank - Political Institutions Database.
Limits to term	Dummy for the presence of a constitutional limit to the number of years the executive can serve. Source: World Bank - Political Institutions Database.
Measures of Corporate Taxation	
Statutory tax rate	Statutory corporate tax rate (highest income bracket) in 2004. Sources: OECD Tax Database; Djankov et al., 2008.
1st year Effective tax rate	Total corporate tax divided by pretax earnings of a standardized enterprise at the end of the 1st year of operations. Source: Djankov et al., 2008.
5th year Effective tax rate	Present-discounted value of the total corporate tax over five years divided by the present-discounted value of the pretax earnings of a standardized enterprise. Source: Djankov et al., 2008.

Table E-3: Summary Statistics

	Mean	Standard Deviation	# of country pairs
ln(FDI)	1.166	3.152	452
Institutional quality	0.114	0.165	452
Statutory tax rate	0.037	0.102	452
Effective tax rate (Y1)	0.034	0.085	452
Effective tax rate (Y5)	0.034	0.072	452
ln(GDP)	0.968	2.171	452

Notes: All variables are in first differences.

Table E-4: Quantiles for Institutional Quality Variable

Percentile	Value
10	0.3953
20	0.4610
30	0.4894
40	0.5486
50	0.6269
60	0.6674
70	0.7469
80	0.8547
90	0.8787

Tables

Table 1: Difference Gravity

	(1)	(2)	(3)
ratio_GDP	0.985***	0.920***	0.941***
	(0.027)	(0.039)	(0.038)
ratio_Distance	-1.348***	-1.353***	-1.360***
	(0.042)	(0.054)	(0.053)
Common language	0.633***	0.549***	0.511***
	(0.100)	(0.107)	(0.104)
Colonial ties	1.006***	1.019***	1.013***
	(0.099)	(0.111)	(0.111)
diff_Institutions	2.303***	2.378***	2.668***
	(0.359)	(0.417)	(0.410)
diff_Tax	-3.765***	-2.351***	-4.474***
	(0.552)	(0.870)	(1.066)
Constant	-0.089	-0.099	-0.081
	(0.059)	(0.069)	(0.069)
Observations	5,184	4,389	4,389
R-squared	0.617	0.568	0.573

Notes: Dependent variable is log-difference of bilateral FDI stocks from 17 investing countries to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors clustered on host country dyads in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 2: Difference Gravity - Adding Other Variables

	(1)	(2)	(3)	(1)	(2)	(3)
ratio_GDP pc	0.140**	0.125*	0.153**	-0.574**	-0.664***	-0.646***
	(0.058)	(0.071)	(0.070)	(0.099)	(0.113)	(0.110)
diff_Institutions				5.557***	6.122***	6.320***
				(0.627)	(0.695)	(0.665)
diff_Tax	-3.644***	-1.753*	-3.273***	-3.789***	-3.266***	-5.078***
	(0.600)	(0.947)	(1.157)	(0.559)	(0.861)	(0.993)
Observations	5,184	4,389	4,389	5,184	4,389	4,389
R-squared	0.607	0.554	0.557	0.625	0.582	0.587
ratio_Yschool	-0.318	-0.004	0.057	-0.807***	-0.563**	-0.524**
	(0.203)	(0.227)	(0.219)	(0.187)	(0.221)	(0.205)
diff_Institutions				2.768***	2.783***	3.080***
				(0.365)	(0.442)	(0.433)
diff_Tax	-4.086***	-1.781*	-3.081***	-4.679***	-2.786***	-4.959***
	(0.653)	(1.005)	(1.191)	(0.561)	(0.895)	(1.076)
Observations	5,092	4,297	4,297	5,092	4,297	4,297
R-squared	0.608	0.553	0.556	0.624	0.572	0.578
ratio_Roads	-0.190**	-0.515***	-0.487***	-0.274***	-0.584***	-0.569***
	(0.084)	(0.117)	(0.119)	(0.080)	(0.119)	(0.113)
diff_Institutions				2.303***	2.310***	2.537***
				(0.374)	(0.473)	(0.441)
diff_Tax	-4.949***	-5.447***	-7.540***	-4.801***	-5.032***	-7.634***
	(0.668)	(0.974)	(1.214)	(0.574)	(0.901)	(1.081)
Observations	3,036	2,423	2,423	3,036	2,423	2,423
R-squared	0.649	0.593	0.600	0.658	0.606	0.616

Notes: Dependent variable is log-difference of bilateral FDI stocks. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors clustered on host country dyads in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 3: Difference Gravity - Sub-samples

Country pairs	Low quality			High quality			Asymmetric		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ratio_GDP	1.021***	1.015***	1.005***	1.040***	0.822***	0.892***	0.973***	0.885***	0.952***
	(0.038)	(0.056)	(0.056)	(0.102)	(0.102)	(0.100)	(0.046)	(0.071)	(0.065)
ratio_Distance	-1.350***	-1.398***	-1.408***	-1.345***	-1.281***	-1.316***	-1.388***	-1.331***	-1.353***
	(0.090)	(0.133)	(0.130)	(0.109)	(0.109)	(0.110)	(0.052)	(0.067)	(0.067)
Common language	0.614***	0.276	0.277	0.866***	1.050***	0.995***	0.555***	0.471***	0.429***
	(0.231)	(0.242)	(0.252)	(0.158)	(0.181)	(0.169)	(0.140)	(0.140)	(0.136)
Colonial ties	0.903***	0.953***	0.978***	0.204	0.309	0.258	1.354***	1.406***	1.344***
	(0.140)	(0.162)	(0.161)	(0.204)	(0.219)	(0.219)	(0.148)	(0.163)	(0.161)
diff_Institutions	2.412***	2.457***	2.702***	2.322	0.342	2.797	3.267***	3.910***	4.154***
	(0.546)	(0.661)	(0.703)	(2.618)	(3.452)	(3.796)	(0.749)	(0.876)	(0.888)
diff_Tax	-2.330***	-2.270**	-3.010**	-5.405***	1.226	-2.137	-4.261***	-3.189**	-6.768***
	(0.823)	(1.130)	(1.489)	(1.736)	(3.289)	(3.396)	(0.846)	(1.327)	(1.446)
diff_Tax *diff_Institutions	0.513	6.525	8.858	17.62	32.88	20.47	6.045	23.34**	20.62*
	(5.573)	(5.524)	(7.892)	(41.46)	(73.41)	(61.44)	(8.749)	(9.429)	(11.36)
Constant	0.017	0.035	0.042	-0.138	-0.393*	-0.295	-0.345*	-0.475**	-0.452**
	(0.072)	(0.081)	(0.084)	(0.153)	(0.203)	(0.187)	(0.200)	(0.221)	(0.224)
Observations	1,837	1,415	1,415	932	932	932	2,415	2,042	2,042
R-squared	0.590	0.575	0.575	0.460	0.442	0.444	0.516	0.491	0.501
F-statistics Tax variables	5.58	2.02	2.10	5.08	0.15	0.23	14.79	6.57	12.77
(prob > F)	(0.0045)	(0.1369)	(0.1265)	(0.0087)	(0.8632)	(0.7937)	(0.0000)	(0.0018)	(0.0000)

Notes: Dependent variable is log-difference of bilateral FDI stocks from 17 investing countries to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors clustered on host country dyads in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 4: Aggregate Difference Gravity

	(1)	(2)	(3)
ratio_GDP	0.928***	0.968***	0.956***
	(0.032)	(0.035)	(0.034)
diff_Institutions	2.958***	3.186***	3.398***
	(0.343)	(0.349)	(0.354)
diff_Tax	-1.818***	-4.645***	-5.544***
	(0.695)	(0.794)	(0.950)
Constant	-0.005	0.058	0.073
	(0.063)	(0.066)	(0.067)
Observations	452	374	374
R-squared	0.799	0.786	0.787

Notes: Dependent variable is log-difference of aggregate FDI stocks to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 5: Aggregate Difference Gravity

Country pairs	Low quality			High quality			Asymmetric		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ratio_GDP	0.880***	0.995***	0.962***	0.954***	0.771***	0.816***	0.897***	0.961***	0.971***
	(0.044)	(0.051)	(0.052)	(0.115)	(0.109)	(0.111)	(0.055)	(0.063)	(0.057)
diff_Institutions	1.778***	2.618***	2.629***	-1.593	-2.604	-0.683	1.850**	3.024***	3.250***
	(0.587)	(0.584)	(0.645)	(2.771)	(3.798)	(4.157)	(0.757)	(0.763)	(0.795)
diff_Tax	0.736	-4.173***	-3.547***	-5.261***	-0.890	-3.010	-2.586**	-5.726***	-7.685***
	(0.932)	(0.996)	(1.301)	(1.793)	(3.402)	(3.378)	(1.042)	(1.246)	(1.384)
diff_Tax*diff_Institutions	-2.109	3.427	1.029	6.404	17.84	3.735	4.325	27.75***	26.32**
	(6.582)	(5.086)	(7.261)	(36.12)	(68.47)	(57.97)	(9.364)	(8.363)	(10.74)
Constant	-0.049	0.096	0.117	-0.153	-0.319	-0.254	0.491**	0.180	0.206
	(0.082)	(0.082)	(0.087)	(0.158)	(0.232)	(0.214)	(0.219)	(0.211)	(0.221)
Observations	176	134	134	70	70	70	206	170	170
R-squared	0.786	0.817	0.806	0.528	0.485	0.491	0.651	0.695	0.687
F-statistics Tax variables	0.32	10.65	4.37	4.43	0.10	0.41	3.24	18.27	17.82
(prob > F)	(0.7285)	(0.0001)	(0.0145)	(0.0154)	(0.9062)	(0.6680)	(0.0410)	(0.0000)	(0.0000)

Notes: Dependent variable is log-difference of aggregate FDI stocks to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 6: Sensitivity Analysis for Asymmetric Country Pairs

	(1)	(2)	(3)
Including only countries in the same income group			
diff_Tax	-3.196***	-4.645**	-8.974***
	(1.105)	(1.884)	(2.046)
diff_Tax*diff_Institutions	32.88*	32.95**	18.38
	(17.00)	(15.17)	(20.13)
F-statistics	9.76	8.92	11.13
(prob > F)	(0.0001)	(0.0003)	(0.0000)
Observations	1,489	1,146	1,146
Omitting influential observations: Cook's distance			
	(1)	(2)	(3)
diff_Tax	-4.784***	-2.768**	-6.182***
	(0.602)	(1.126)	(1.209)
diff_Tax*diff_Institutions	10.36*	20.08***	16.29**
	(5.616)	(6.635)	(7.853)
F-statistics	43.80	7.25	14.55
(prob > F)	(0.0000)	(0.0010)	(0.0000)
Observations	2,295	1,950	1,945
Omitting influential observations: Welsch distance			
	(1)	(2)	(3)
diff_Tax	-3.990***	-2.981**	-6.640***
	(0.844)	(1.263)	(1.402)
diff_Tax*diff_Institutions	10.10	27.16***	23.86**
	(8.591)	(8.681)	(11.00)
F-statistics	14.27	7.91	13.41
(prob > F)	(0.0000)	(0.0005)	(0.0000)
Observations	2,408	2,034	2,033

Notes: Dependent variable is log-difference of bilateral FDI stocks from 17 investing countries to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. Robust standard errors in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Table 7: Instrumental variables

Panel A: GMM-IV estimates				
	(1)	(2)	(3)	
ratio_GDP	0.952***	0.822***	0.787***	
	(0.059)	(0.073)	(0.069)	
ratio_Distance	-1.304***	-1.224***	-1.255***	
	(0.049)	(0.066)	(0.064)	
Common language	0.541***	0.376***	0.330***	
	(0.116)	(0.109)	(0.110)	
Colonial ties	0.987***	1.003***	1.046***	
	(0.107)	(0.131)	(0.127)	
diff_Institutions	3.970***	6.615***	6.996***	
	(0.992)	(1.137)	(1.074)	
diff_Tax	-5.031***	-6.316***	-6.818***	
	(1.357)	(2.264)	(2.413)	
diff_Tax*diff_Institutions	37.48*	29.80**	39.22**	
	(22.22)	(13.91)	(17.85)	
Panel B: First stage estimates				
	(1)	(2)	(3)	(4)
English legal origin	-0.076***	-0.015**	-0.009	0.132***
	(0.008)	(0.006)	(0.007)	(0.021)
Margin of majority	0.007	-0.177***	-0.164***	-0.049
	(0.025)	(0.022)	(0.022)	(0.062)
Right wing orientation	0.039***	0.024***	0.025***	0.055***
	(0.005)	(0.005)	(0.005)	(0.013)
Limits to term	-0.001	0.014	0.005	-0.040
	(0.035)	(0.016)	(0.018)	(0.038)
Panel C: Diagnostics				
R-squared in first stage	0.516	0.480	0.452	0.318
Angrist-Pischke F test	29.00	63.84	28.97	11.25
OID test	0.587	6.578	6.583	
p-value	[0.965]	[0.160]	[0.160]	
Observations	4,807	4,041	4,041	

Notes: Dependent variable is log-difference of bilateral FDI stocks from 17 investing countries to 452 pairs of destination countries. In column (1) the tax differential uses the statutory corporate tax rate; columns (2) and (3) report the tax differentials built with the effective tax rates after 1 year and after 5 years, respectively. First stage regressions include interactions between legal origin and the political variables. Column (4) contains the first stage regression for the institutional quality variable. The OID test is the Hansen J-statistic (overidentification test of all instruments). Robust standard errors clustered on host country dyads in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.

Figures

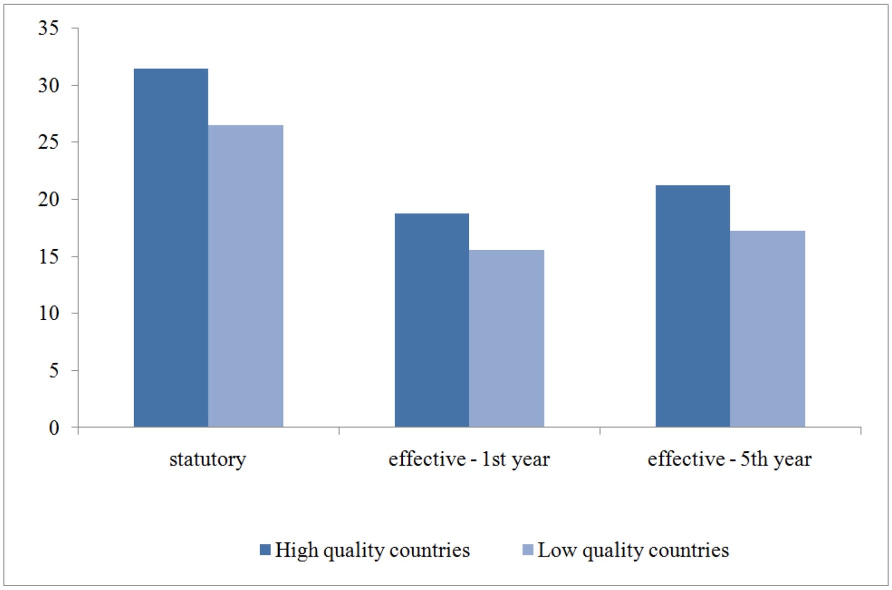

Figure 1: Average corporate tax rates

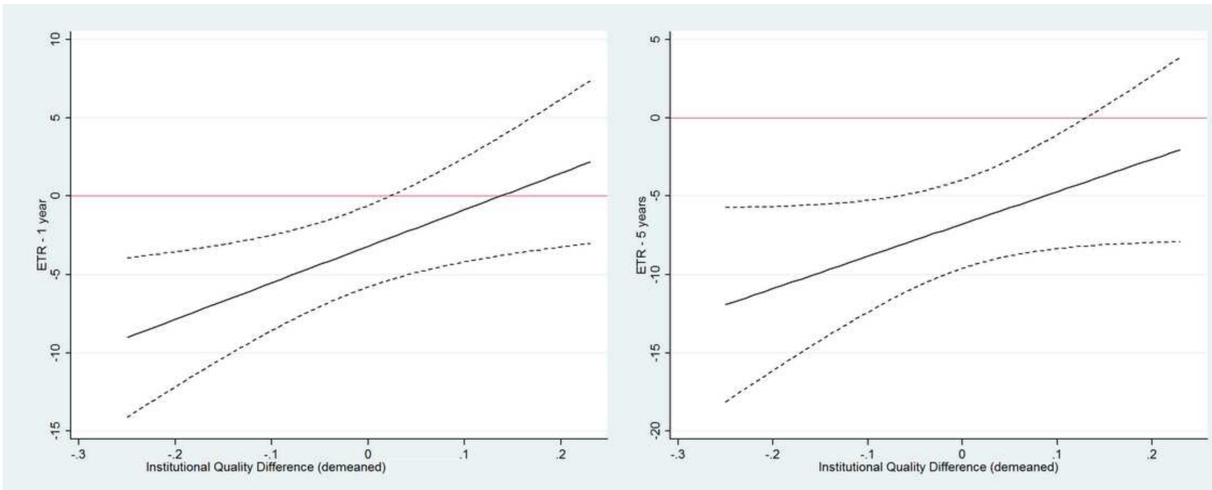

Figure 2: Tax Coefficient and Institutional Quality in the Asymmetric Sub-sample - Bilateral Difference Gravity

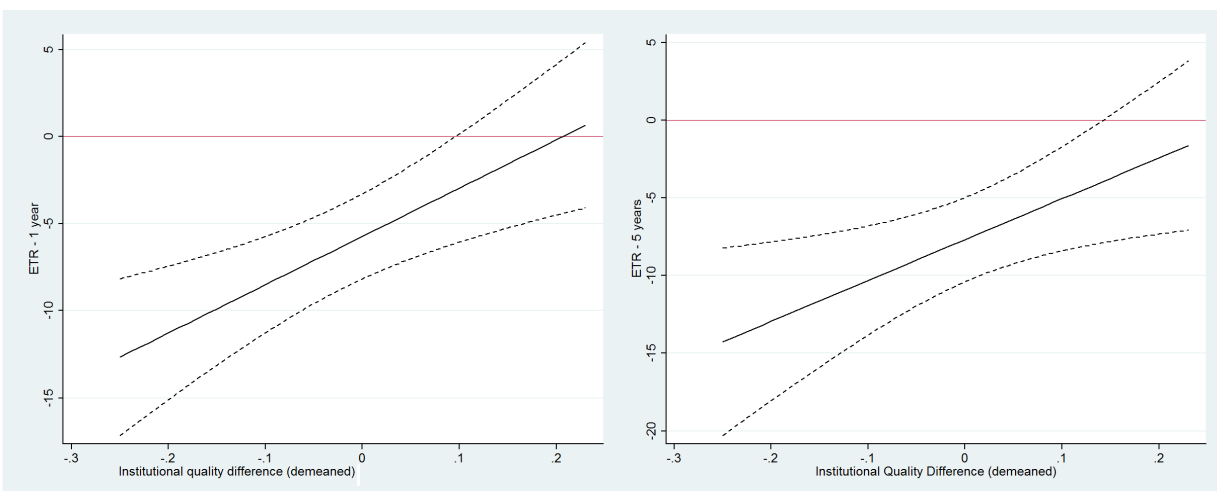

Figure 3: Tax Coefficient and Institutional Quality in the Asymmetric Sub-sample - Aggregate Difference Gravity