Taxation and the quality of institutions: asymmetric effects on FDI

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Abstract

Economic integration has intensified international competition to attract productive capital. This paper analyzes the effect of both 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. It is shown that, provided firms are sensitive enough to the quality variable, the jurisdiction providing better institutions is able to levy a higher tax on capital, and to attract more investment, compared to the low-quality/low-tax location. Empirical evidence using a difference gravity specification on FDI stocks to 63 economies supports the claim that the sensitivity of foreign investment to the tax rate varies significantly between host countries with different levels of institutional quality.

Keywords: foreign direct investment, fiscal competition, institutions.

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1 Introduction and motivation

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 and policy makers willing to attract multinational enterprises. According to the Ernst & Young European Attractiveness Survey 2008, international investors value most the transparency, stability and predictability of the political, legal and regulatory environment, together with the provision of physical infrastructure (54% of respondents). Slightly less significant in determining location choices (46% of respondents) is the tax rate on corporate income levied by the potential destination country.

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 European Union (EU). More recently, Turkey has registered an analogous boom in inward investment coincident with its accession negotiations to the EU\(^1\). 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 Citroën 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 attract foreign capital 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

\(^{1}\) Turkey became a candidate country to accession in 1999 and an official accession country on October 3, 2005.
operation of new business ventures in the country" (UNCTAD, 2002).

The other factor surveyed as playing a major role in the international allocation of investment is business taxation. Following the international integration of capital and product markets, there are 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. Within the EU, for instance, the slashing in 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, both the OECD and the EU have proposed initiatives in the 1990s designed to oppose what they regard as harmful tax competition.

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

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

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2Interestingly, 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 regimes worldwide.

3The idea that institutions and policy choices like taxation are linked has been recently developed by Besley and Persson (2007) 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.
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.

2 Related literature

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. 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 I 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 inclu-

\textsuperscript{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.
sion 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. Somewhat more related to my analysis is the paper by Mutti and Grubert (2004) who investigate empirical asymmetries in the effect of taxation on foreign operations by US multinationals. Specifically, the authors find a greater sensitivity of investment to corporate taxation in developing countries than in advanced economies. As the latter countries have overall a better governance infrastructure, the framework of this paper provides an explanation to such result which was missing in their analysis.

The rest of the paper is organized as follows. Section 3 sketches a simple model of fiscal competition with institutional quality. In section 4 I analyze the empirical evidence. Section 5 concludes.

3 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. Here only the equilibrium of the fiscal competition subgame will be derived and discussed, together with the main comparative statics results, whereas the level of institutional quality is exogenously given. In the Appendix, fiscal competition is analyzed in the framework of a three-stage game in which countries can also choose their institutional quality in the long run. Thus, the full game shows the conditions under which both symmetric and asymmetric equilibria in taxes and institutional quality can
be attained$^5$.

## 3.1 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:

$$\pi_{ij} = p - w_j - \tau_j + \theta_j a_j + \varepsilon_{ij}$$

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, I 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 $\tau_j$; 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 $\theta_j a_j$, where $a_j$ is the level of institutional quality in country $j$ and $\theta_i$ 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

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$^5$As taxes are readily adjustable in the short term, in the full three-stage game fiscal competition takes place at the third stage. On the other hand, institutional quality is endogeneized in the framework of a Stackelberg interaction.

$^6$This is consistent with MNEs investing abroad to service local markets; it is a pattern found in the data. For example, for US multinationals 56% of total sales are local sales (Braconier et al., 2005).

$^7$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 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
on institutions and trade, $\theta_i$ can be thought of expressing important technological differences among firms (and sectors), with institutionally dependent industries being characterized by larger $\theta_i$. This source of heterogeneity would have important implications for the sectoral composition of inward investment in the two countries. However, also with a view to the empirical tests, here I choose to look only at the aggregate measure of inward investment. Consequently, I take $\theta_i$ to be a constant imposing the normalization $\theta_i = \theta$.

Following Coughlin et al. (1991), the random component of the profit function is modelled as an additive term, $\varepsilon_{ij}$, 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 $F(\varepsilon_i) = \exp(\exp(-\varepsilon_i))$. The variance is equal to $\mu^2 \pi^2 / 6$, and the mean is zero.

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

$$s_{i1} = \text{prob}(\pi_{i1} \geq \pi_{i2}) = \text{prob}(\varepsilon_{i2} - \varepsilon_{i1} \leq E(\pi_{i1}) - E(\pi_{i2})) = \text{prob}(\varepsilon \leq E(\pi_{i1}) - E(\pi_{i2}))$$

where $E(\pi_{i1})$ has been defined as the non-stochastic component of the profit function, or the expected profits; and $\varepsilon$ is set equal to the difference $\varepsilon_{i2} - \varepsilon_{i1}$. Given the distributional assumptions on the individual $\varepsilon_{ij}$’s, $\varepsilon$ will follow a logistic distribution. Therefore, using the result in McFadden (1974), the choice probabilities are binomial logit. With this in mind,

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8Recent contributions have analyzed the impact of institutions 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.

9Anderson, De Palma and Thisse (1992, p.40) note that, when only two alternatives are considered, other
the expected measure of firms locating in country 1 and 2 is, respectively:

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

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

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. As discussed in Train (2003), \(\mu\) is a parameter proportional to the variance of the distribution of the stochastic term. As such, it captures firms' heterogeneity with respect to the gains associated with a particular location.

### 3.2 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 quality level, \(\beta a_j X_j\). \(\beta\) is the cost parameter, and it is assumed \(0 < \beta < 1\).

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:

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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 is that \(\beta < \theta\). The reason for this assumption will be made clear once the coomparative statics results are derived.
\[ R_j = (\tau_j - \beta a_j) X_j - C(a_j) \] (4)

\[ \frac{\partial R_j}{\partial \tau_j} = X_j + \frac{\partial X_j}{\partial \tau_j} \tau_j - \beta a_j \frac{\partial X_j}{\partial \tau_j} = X_j - \frac{1}{\mu} X_j (1 - s_j) (\tau_j - \beta a_j) = 0. \]

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

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

From this, one can calculate the slope of the best response of country \( j \) with respect to the tax rate of country \( k \), with \( j \neq k \). Applying the implicit function theorem one obtains:

\[ \frac{\partial \tau_j}{\partial \tau_k} = - \frac{\partial^2 R_j / \partial \tau_j \partial \tau_k}{\partial^2 R_j / \partial \tau_j^2} = \frac{s_j s_k}{1 - s_j} > 0. \]

Hence, given the level of institutional quality, tax rates are strategic complements. The property of strategic complementarity is in accordance with the traditional models of tax competition; in such framework, it is the driving force behind the result of a race to the bottom in corporate tax rates.

Before analyzing the effect of quality on tax rates, I 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 model would be then
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 \( \mu \), 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. Similar to Zissimos and Wooders (2008), differentiation in the presence of firms heterogeneity enables governments to extract positive rents from producers. In addition to that, there is the vertical qualitative dimension. Here the tax rate depends positively on the quality of institutions through the variable cost component.

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 of this change on equilibrium taxes can be found by totally differentiating equation 5 (the full computations can be found in Appendix B). Define \( \sigma_1 \equiv \frac{X_1}{X_2} \), 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 increase 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:
\[
\frac{d\tau_2}{da_1} = \frac{\beta - \theta}{1 + \sigma_1 + \sigma_1^2}.
\]  
(7)

Hence, the equilibrium tax rate decreases in the institutional quality of the competing country if and only if \( \beta < \theta \). Before commenting on this, I first derive the total effect of an improvement in institutional quality in country 1 on investor location choices, \( \frac{\sigma_1}{da_1} = \frac{\partial \sigma_1}{\partial a_1} + \frac{\partial \sigma_1}{\partial \tau_1} \frac{d\tau_1}{da_1} \). Recalling its definition, \( \sigma_1 \equiv \frac{x_1}{x_2} \), it can be easily seen that, at the equilibrium, \( \sigma_1 \equiv \exp \left[ \left( \tau_2^* - \tau_1^* + \theta (a_1 - a_2) \right)/\mu \right] \). Hence, it holds that:

\[
\frac{d\sigma_1}{da_1} = \exp \left[ \left( \tau_2^* - \tau_1^* + \theta (a_1 - a_2) \right)/\mu \right] \frac{1}{\mu} \frac{d\left( \tau_2^* - \tau_1^* + \theta (a_1 - a_2) \right)}{da_1} = \left( \frac{\sigma_1}{a_1 + \sigma_1^2} \right).
\]  
(8)

where the third line uses the differentials derived in 6 and 7. Again, a sufficient and necessary condition for \( \frac{d\sigma_1}{da_1} > 0 \) 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\(^{12} \).

**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.

Finally, using the FOC in equation 5, it is possible to compare the implicit equilibrium taxes in all the alternative cases corresponding to different levels of institutional quality.

\(^{12}\)Clearly, the opposite is true when \( \beta > \theta \). In this case, it holds that \( \frac{d\tau_2}{da_1} > 0 \). However, due to higher variable costs associated with better institutions, taxes increase more in country 1, or \( \frac{\tau_2}{\tau_1} > \frac{\tau_2}{\tau_1} \). Thus, it is \( \frac{d\sigma_1}{da_1} < 0 \).
Hence, one gets the following inequality:

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

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

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 (hence, in our case, it is $\sigma_1 > 1/2$). Finally, as shown in the full game in Appendix A, in the asymmetric equilibrium net revenues from corporate taxation are larger in the high quality country.

### 4 Empirical evidence

The stripped-down two-country model outlined 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’ revenues. 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 activity 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, I 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 $N_i$ being the number of investors in country $i$. Let $J$ be the number of host countries. Given the enlarged choice set, the probability for a firm from country $i$ to invest in country $j$ is given by the multinomial logit formula:\(^{13}\)

$$s_{ij} = \frac{\exp(A_{ij})}{\sum_l \exp(A_{il})}$$  \hspace{1cm} (9)

where $A_{ij}$ 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 $ij$. Consistently with the findings of the empirical literature on FDI, I include in $A_{ij}$ 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$$^{14}$; moreover, let $n_i \equiv N_i/N$ be the fraction of firms in country $i$. The expected bilateral stock of assets in country $j$ owned by investors from $i$ is then:

$$E[F_{ij}] = n_i s_{ij} K_j.$$  \hspace{1cm} (10)

Substituting 9 into 10, expected bilateral stocks can be expressed as$^{15}$:

$$E[F_{ij}] = n_i \frac{\exp(A_{ij})}{\sum_l \exp(A_{il})} K_j$$  \hspace{1cm} (11)

In order to move from the expected values $E[F_{ij}]$ to the bilateral stocks actually observed, define $\eta_{ij} \equiv F_{ij}/E[F_{ij}]$ as the ratio of actual to observed bilateral FDI stocks. It holds that

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\(^{13}\)In this specification the variance of the stochastic component in the profit function has been normalized with respect to the parameter $\mu$. Such normalization is equivalent to normalizing the scale of the profits that generate the logit choice probabilities. On this point, see Train (2003, ch. 3).

\(^{14}\)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 existing assets. It can be reconciled with de-novo entry by assuming divestitures or depreciation of assets.

\(^{15}\)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.
\[ E[\eta_{ij}] = 1. \] Equation 11 becomes then:

\[
F_{ij} = E[F_{ij}] \eta_{ij} = n_i \frac{\exp(A_{ij})}{\sum_l \exp(A_{il})} K_j \eta_{ij}
\] (12)

After imposing \( B_{il} \equiv \sum_l \exp(A_{il}) \), equation 12 becomes:

\[
F_{ij} = n_i \exp(A_{ij}) B_{il}^{-1} K_j \eta_{ij}
\] (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 \( i \) 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 \( n_i \)) and the size of the receiving country (measured by the value of its assets, \( K_j \)). \( B_{il} \) is a measure of the potential competition faced by country \( j \) in attracting the investment of country \( i \). 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 partners. Similarly, in our case, the term \( B_{il} \) 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, 2007; 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 an approach (Head, 2003)\(^{16} \). This problem can be tackled in a different way. Consider country \( i \)'s investment in country \( m \), which can be derived from equation 13, *mutatis mutandis*:

\[
F_{im} = n_i \exp(A_{im}) B_{im}^{-1} K_m \eta_{im}
\] (14)

\(^{16}\)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.
Taking the ratio of 13 to 14, and noting that $B_{ij} = B_{im}$, one gets:

$$\frac{F_{ij}}{F_{im}} = \frac{\exp(A_{ij})K_j}{\exp(A_{im})K_m} \eta_{ijm}. \quad (15)$$

where $\eta_{ijm} \equiv \eta_{ij}/\eta_{im}$. Hence, considering relative FDI stocks originating from the same investor eliminates the multilateral term, as they depend only on the relevant bilateral variables. This pattern of substitution among alternatives in logit models shows the so-called Independence from Irrelevant Alternatives (IIA); that is, the relative odds of choosing $j$ over $m$ are the same no matter what the other alternatives, or their attributes, are (Train, 2003).

Taking logs of both sides of 15 yields an equation that can be estimated using linear regression techniques\textsuperscript{17}. Similar approaches using difference gravity equations have been recently used in several papers in international trade. Djankov, Freund and Pham (2009) adopt this framework to quantify the effect of time delays on trade flows from exporting country pairs. Hanson and Xiang (2004) focus on how the home-market effect vary with industry characteristics. Anderson and Marcoullier (2002) employ a difference gravity equation with respect to a base country to analyze the effect of insecurity on the patterns of trade flows.

### 4.1 Specification and variables

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

$$\ln \left( \frac{\text{FDI}_{ij}}{\text{FDI}_{im}} \right) = \alpha + \alpha_0 \ln \left( \frac{\text{GDP}_j}{\text{GDP}_m} \right) + \alpha_1 \ln \left( \frac{\text{dist}_{ij}}{\text{dist}_{im}} \right) + (D_{ij} - D_{im}) \beta + \gamma_1 (\text{tax}_j - \text{tax}_m) + \gamma_2 (I_j - I_m) + \varepsilon_{ijm} \quad (16)$$

The dependent variable is given by the value of FDI stocks from country $i$ 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 investment. Hence, $\ln \left( \text{dist}_{ij} / \text{dist}_{im} \right)$ is the log-ratio of the geographical distance between the investor and the recipients; $(D_{ij} - D_{im})$ is the vector

\textsuperscript{17}As pointed out by Santos Silva and Tenreyro (2006), however, log-linearization of equations like 13 is only valid if $\eta_{ij}$, and therefore $\ln(\eta_{ij})$, are statistically independent of the regressors. If this is the case, the condition for consistency of OLS is not violated. To check the correct specification of the conditional mean I perform a heteroskedasticity robust RESET test.
difference of three dummies, whose components take the value of 1 if the investor and the relevant destination country share a common language, common legal origin, and have been linked by colonial ties in the past\textsuperscript{18}.

The main interest lies in the coefficients $\gamma_1$ and $\gamma_2$. The effect of the fiscal cost is captured by the differential $(\text{tax}_j - \text{tax}_m)$. 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 $\gamma_1 < 0$. $(I_j - I_m)$ measures the difference in institutional quality in the two host countries. \textit{Ceteris paribus}, economies with better institutions attract more foreign investment; hence, it should be $\gamma_2 > 0$.

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, I differentiate countries with respect to the quality of their institutions. Specifically, I 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\textsuperscript{19}.

Consequently, based on the institutional level associated with the host country pairs, I 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, I 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 $m$\textsuperscript{20}. Moreover, to capture how institutional quality affects the relationship between FDI and corporate taxation I include in the estimating equation a (demeaned) interaction term.

\textsuperscript{18}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.

\textsuperscript{19}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.

\textsuperscript{20}Clearly, each country pair enters only once.
as follows:

$$\ln \left( \frac{\text{FDI}_{ij}}{\text{FDI}_{im}} \right) = \alpha + \alpha_0 \ln \left( \frac{\text{GDP}_j}{\text{GDP}_m} \right) + \alpha_1 \ln \left( \frac{\text{dist}_{ij}}{\text{dist}_{im}} \right) + (D_{ij} - D_{im}) \beta +$$

$$+ \gamma_1 (\text{tax}_j - \text{tax}_m) + \gamma_2 (I_j - I_m) +$$

$$+ \gamma_3 \left[ (\text{tax}_j - \text{tax}_m) - (\text{tax}_j - \text{tax}_m) \right] \left[ (I_j - I_m) - (I_j - I_m) \right] + \epsilon_{ijm}$$

Thus, I estimate equation ?? 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 $\gamma_1$ 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.

In order to narrow down the dyads of receiving countries, more structure needs to be introduced. Specifically, the estimating strategy depends on choosing dyads of recipient 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 area, recognizing that geographical proximity makes different locations more comparable as to the relative fiscal cost to foreign investors. In other words, I 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). Secondly, by a similar reasoning, there is a 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).

### 4.2 Data

This section discusses briefly the main data used in the analysis. A detailed description of all the data and sources is found in Table C-2 in Appendix C. FDI is measured as the average stock of FDI in a sample of 59 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 my institutional quality variable I consider only those indicators that are more consistent with the suggested interpretation of institutions as a public good. Specifically, they are:

- 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.

Thus, I take the simple average of the two indices, using the three-period average over the years 1996-2000. I employ lagged values of the institutional variable to reduce possible problems of simultaneity with FDI\(^{21}\). I rescale the indicator - originally ranging from -2.5 to +2.5 - as to vary between 0 and 1; in all cases a higher score indicates better institutions.

Tax rates

Two different measures of the tax burden on corporations are employed in the analysis. First, I use the statutory tax rates. This is indeed the most immediate and readily available measure of the fiscal burden\(^{22}\). However, a possible shortcoming of statutory tax rates when analyzing

\(^{21}\) 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.

\(^{22}\) As Benassy-Quéré 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
A cross-section of countries is that 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, I 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 ones23.

Ex-ante measures of effective tax rates have been developed based on the provisions of the national tax codes. Effective, average or marginal tax 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.

23 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.
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 interestingly, 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.

![Average corporate tax rates.](image)

### 4.3 Results

I start by estimating the basic specification of the difference gravity equation in 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. At the bottom of the table the \( p \)-values obtained from a heteroskedasticity-robust RESET test are reported (Ramsey, 1969). The test shows that the hypothesis that the conditional expectation of the log-linear model be correctly specified cannot be rejected\(^{24}\).

\[\text{Table 1 around here}\]

\(^{24}\)The test is performed by checking the significance of an additional regressor constructed as a power function of the fitted values of the dependent variable.
All standard gravity estimates are reasonably similar to what is usually found in the literature. Turning to the variables of interest, 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 40% on average, all else equal. 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. 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, I check the explanatory power of GDP per capita and human capital. 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. 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. Overall, I take those findings as supporting the baseline specification.

In the next step, equation 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 estimated semi-elasticity with respect to differences in corporate taxation ranges from about -3.4, when the effective rate after 5 years is used, to -2.5. The coefficient on the institutional quality variable is estimated,  

\[ \exp \left( \frac{\gamma_2 \Delta (I_j - I_m)}{1} \right) - 1 \]

\[ = \exp \left( \frac{0.20}{1} \right) - 1 \]

\[ = \exp (0.20) - 1 \]

\[ = 2.21 - 1 \]

\[ = 1.21 \]

From equation 16 one can derive the percentage change in FDI as \( \exp (\gamma_2 \Delta (I_j - I_m)) - 1 \), where \( \Delta \) 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.

The point estimate increases substantially in magnitude as a consequence of multicollinearity.
always very precisely, around 2.4 on average. 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 taxation. 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 $F(2, 69) = 6.05$, with an associated p-value of 0.0038. Hence, the marginal effect of the statutory tax rate depends on the differences in institutional quality. The coefficient on institutional quality, which in the presence of the interaction term measures the 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.

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 level of (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 (0.254) a one percent higher tax differential decreases FDI stocks by 3.8 percentage points. Once the cross-term is taken into
account, the total effect of the tax rate becomes null as the institutional quality difference reaches 0.413, around 1.5 standard deviations above the sub-sample average. Similarly, at the average difference in institutional quality, the semi-elasticity of the effective tax rate after 5 years is -7.2. The cross effect, however, implies that the semi-elasticity (in absolute value) is reduced by roughly 5 percentage points when the difference in institutional quality reaches its maximum (0.485).

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, I 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 recipient country pairs.

[Table 5 around here]
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 larger investment compared to the low-quality/low-tax location, provided firms’ profits are sufficiently responsive to the institutional 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 depends on the differences in the quality of institutions.
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Appendix A

Taxation and the quality of institutions: a three-stage game

This section describes and solves the full two-country game where both the tax rate and the level of institutional quality are choice variables. Subsequently, I provide an extension of the game dealing with the particular arrangement of subsidized institutional quality.

As anticipated in Section 3, competition among jurisdictions is modelled as a non-cooperative three-stage game in which governments sequentially choose institutional quality; at the last stage of the game they set their tax rates. The choice on institutional quality is a long term policy object, whereas tax rates can be readily adjusted in the short run. I capture these features by hypothesizing commitment on the quality of institutions. Moreover, modelling the choice on quality as Stackelberg game reflects important differences among countries, which in turn affect their capabilities to compete for mobile capital on the international stage. One could naturally think of a general framework of a developed country competing with a developing economy, or, alternatively, of an old EU member state facing competition from new member states in Central and Eastern Europe. Hence, the full game is as follows:

*Stage I*. Country 1 chooses the level of institutional quality.

*Stage II*. Country 2 chooses the level of institutional quality.

*Stage III*. Countries simultaneously set their tax rates.

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 3 in the text that government revenues to be maximized are:

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

where $\beta a_j X_j + C(a_j)$ is the total cost associated with institutional quality provision. I assume throughout that $\beta < \theta$, where $\theta$ is a parameter measuring the sensitivity of firms’ profits to institutional quality. Recalling the comparative statics results in Section 3, it is indeed easy
to see that without this restriction there would be no incentives for governments to invest in high institutional quality.

The game is solved by backward induction. Thus, the analysis in Section 3 describes the unique third-stage equilibrium in taxes in the case of prior commitment in the quality of institutions. Here, the optimal decisions in the Stackelberg game in quality are examined.

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 $R_2(a^H, a^L)$ 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 $\sigma$ 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 $\sigma > 1$. Thus, the payoff functions to country 2 are as follows:

$$
R_2(a^H, a^H) = \mu N - C(a^H)
$$
$$
R_2(a^H, a^L) = \mu \frac{1}{\sigma} N - C(a^L)
$$
$$
R_2(a^L, a^H) = \mu \sigma N - C(a^H)
$$
$$
R_2(a^L, a^L) = \mu N - C(a^L)
$$

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

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

and

$$
r^*(a^L) = \begin{cases} a^H & \text{if } \Delta C(a) < \mu (\sigma - 1) N \\ a^L & \text{if } \Delta C(a) > \mu (\sigma - 1) N \end{cases}.
$$
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, ΔC(a), so does the strategy of the leading country. In particular, one can distinguish three different scenarios depending on the magnitude of ΔC(a). Since (σ − 1) > (1 − 1/α), these are:

Case i). Low incremental cost of quality: ΔC(a) < μ(1 − 1/α)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 R1(aH, aH) > R1(aL, aH). Hence, it will also choose a high quality.

Case ii). Intermediate incremental cost of quality: μ(1 − 1/α)N < ΔC(a) < μ(σ − 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 R1(aH, aL) with R1(aL, aH). It can be verified that R1(aH, aL) > (ΔC(a) > (>) μ(σ − 1/α)N. Since (σ − 1/α) > (σ − 1), country 1 will always set a high quality.

Case iii). High incremental cost of quality: ΔC(a) > μ(σ − 1)N.

In this cost range the lagging country will always set a low quality. It is easy to see that R1(aH, aL) > R1(aL, aL).

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, ΔC(a) < μ(1 − 1/α)N, both countries provide high institutional quality ("race to the top"). Equilibrium taxes are τ1|1|H,H = τ2|1|H,H = 2μ + βaH.
• For intermediate incremental cost, \( \mu \left( 1 - \frac{1}{\Delta C(a)} \right) N < \Delta C(a) < \mu \left( \sigma - 1 \right) N \), 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 \( \tau^*_2|_{(H,L)} = \mu (1 + \sigma^{-1}) + \beta a^L \).

• 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 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, \( R_1 (a^H, a^L) > R_2 (a^H, a^L) \).

**Extension: subsidizing institutional quality**

The previous analysis 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:

\[
R_1 = (\tau_1 - \beta a_1) X_1 - C (a_1) - \lambda C (a_2)
\]
\[
R_2 = (\tau_2 - \beta a_2) X_2 - (1 - \lambda) C (a_2)
\]  

where \( \lambda \) 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 \( \Delta C (a) < \mu (1 - \frac{1}{\sigma}) N \), both countries provide high quality ("race to the top");
- for \( \mu (1 - \frac{1}{\sigma}) N < \Delta C (a) < \mu (1 - \frac{1}{\sigma}) N(1 - \lambda)^{-1} \), there is quality differentiation with the lagging country setting a high quality ("second mover advantage");
- for \( \mu (1 - \frac{1}{\sigma}) N(1 - \lambda)^{-1} < \Delta C (a) < \mu (\sigma - 1) N(1 - \lambda)^{-1} \), 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, the scope for sustaining such equilibria is higher. 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 additional cost for high quality, which is not sustainable. 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.
Appendix B.

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: \( \frac{\partial X_i}{\partial s_i} = -\frac{1}{\mu} X_i (1 - s_i) < 0 \), \( \frac{\partial X_i}{\partial s_j} = \frac{1}{\mu} X_i s_j > 0 \), \( \frac{\partial X_i}{\partial a_i} = \frac{1}{\mu} X_i s_j \theta > 0 \). 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 \( G^1_1 d\tau_1 + G^1_2 d\tau_2 + G^1_{a_1} da_1 = 0 \). Recalling the definition \( \sigma_1 \equiv X_1/X_2 \), it is easy to show that

\[
G^1_{\tau_1} = 1 - \frac{\mu}{(1 - s_1)^2} \frac{\partial X_i}{\partial \tau_i} = 1 + \sigma_1
\]

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

\[
(1 + \sigma_1) d\tau_1 - \sigma_1 d\tau_2 - (\sigma_1 + \beta) da_1 = 0 \quad (19)
\]

Mutatis mutandis, the total differential of the implicit equilibrium tax rate for country 2 is \( G^2_1 d\tau_1 + G^2_2 d\tau_2 + G^2_{a_1} da_1 = 0 \). 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:

\[
-\frac{1}{\sigma_1} d\tau_1 + \left(1 + \frac{1}{\sigma_1}\right) d\tau_2 + \frac{1}{\sigma_1} \theta da_1 = 0 \quad (20)
\]

Finally, combining 19 and 20 gives the expressions 6 and 7 in the text.
## Table C-1: Countries Coverage

<table>
<thead>
<tr>
<th>European Union and Associated Countries</th>
<th>Andean Community</th>
<th>ASEAN (plus Three)</th>
<th>MERCOSUR</th>
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</thead>
<tbody>
<tr>
<td>Austria (i)</td>
<td>Bolivia</td>
<td>Indonesia</td>
<td>Argentina</td>
</tr>
<tr>
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<td>Ecuador</td>
<td>Singapore</td>
<td>Brazil</td>
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<td>Bulgaria</td>
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<td>Venezuela</td>
<td>Malaysia</td>
<td>Uruguay</td>
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<td>Cyprus</td>
<td>Argentina</td>
<td>Philippines</td>
<td>India</td>
</tr>
<tr>
<td>Denmark (i)</td>
<td>CER</td>
<td>EFTA</td>
<td>NAFTA</td>
</tr>
<tr>
<td>Finland (i)</td>
<td>Australia (i)</td>
<td>Singapore</td>
<td>Canada (i)</td>
</tr>
<tr>
<td>France (i)</td>
<td>New Zealand</td>
<td>Japan (i)</td>
<td>Mexico</td>
</tr>
<tr>
<td>Germany (i)</td>
<td>CIS</td>
<td>Israel</td>
<td>United States (i)</td>
</tr>
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<td>Armenia</td>
<td>Egypt</td>
<td>Morocco</td>
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<td>Georgia</td>
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<td>Portugal (i)</td>
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<td>Slovakia</td>
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<td>Malta</td>
<td>United Kingdom (i)</td>
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<td>Romania</td>
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<td>Spain (i)</td>
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<tr>
<td>Sweden</td>
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<td></td>
</tr>
</tbody>
</table>

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 C-2: Variables and data sources

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<thead>
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<th>Description</th>
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<tbody>
<tr>
<td>Distance</td>
<td>Greater circle distance between economic centers in investor-recipient country pairs. Source: CEPII (<a href="http://www.cepii.fr">www.cepii.fr</a>).</td>
</tr>
<tr>
<td>Colony</td>
<td>Dummy equal to one for investor-recipient country pairs linked by colonial ties. Source: CEPII (<a href="http://www.cepii.fr">www.cepii.fr</a>).</td>
</tr>
<tr>
<td>Language</td>
<td>Dummy equal to one for investor-recipient country pairs sharing a common language. Source: CEPII (<a href="http://www.cepii.fr">www.cepii.fr</a>).</td>
</tr>
<tr>
<td>Legal origin</td>
<td>Dummy equal to one for investor-recipient country pairs sharing the same legal origin. Source: La Porta et al. (1999).</td>
</tr>
<tr>
<td>School</td>
<td>Average years of schooling for population aged 25 and over. Source: Barro and Lee (2000).</td>
</tr>
</tbody>
</table>

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 .ve years divided by the present-discounted value of the pretax earnings of a standardized enterprise. Source: Djankov et al. 2008. |
### Table 1: Difference Gravity

<table>
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<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ratio_GDP</td>
<td>0.993***</td>
<td>0.916***</td>
<td>0.934***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.039)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>ratio_Distance</td>
<td>-1.315***</td>
<td>-1.305***</td>
<td>-1.314***</td>
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<tr>
<td></td>
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<td>(0.050)</td>
<td>(0.049)</td>
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<td>0.300***</td>
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<tr>
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<td>(0.103)</td>
<td>(0.107)</td>
<td>(0.104)</td>
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<tr>
<td>Colonial ties</td>
<td>0.893***</td>
<td>0.906***</td>
<td>0.902***</td>
</tr>
<tr>
<td></td>
<td>(0.101)</td>
<td>(0.112)</td>
<td>(0.112)</td>
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<tr>
<td>Common legal origin</td>
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<td>0.615***</td>
<td>0.623***</td>
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<tr>
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<td>(0.0864)</td>
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<td>(0.064)</td>
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<td>4,389</td>
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<td>R-squared</td>
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<td>0.1707</td>
<td>0.4672</td>
<td>0.6477</td>
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</table>

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>
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<th>(3)</th>
<th>(1)</th>
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<th>(3)</th>
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<td>ratio_GDP</td>
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<td>(0.039)</td>
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<td>-1.279***</td>
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<td>0.353***</td>
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<td>(0.101)</td>
<td>(0.099)</td>
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<td>(0.118)</td>
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<td>(0.115)</td>
<td>(0.100)</td>
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<td>(0.111)</td>
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<td>0.099</td>
<td>0.131*</td>
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<td>0.131</td>
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<td>0.099***</td>
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<td>(0.069)</td>
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<td>(0.066)</td>
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<td>5,184</td>
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<td>4,297</td>
<td>5,092</td>
<td>4,297</td>
<td>4,297</td>
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<tr>
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<td>0.564</td>
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<td>0.592</td>
<td>0.597</td>
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<td>0.566</td>
<td>0.629</td>
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<td>0.586</td>
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</table>

Table 2: Difference Gravity - Robustness

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.
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<th>Country pairs</th>
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<th>Asymmetric</th>
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<td>(3)</td>
</tr>
<tr>
<td>ratio_GDP</td>
<td>1.027***</td>
<td>1.011***</td>
<td>1.000***</td>
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<tr>
<td></td>
<td>(0.038)</td>
<td>(0.055)</td>
<td>(0.055)</td>
</tr>
<tr>
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<tr>
<td></td>
<td>(0.090)</td>
<td>(0.131)</td>
<td>(0.129)</td>
</tr>
<tr>
<td>Common language</td>
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<td>0.285</td>
</tr>
<tr>
<td></td>
<td>(0.231)</td>
<td>(0.237)</td>
<td>(0.247)</td>
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<td>0.854***</td>
<td>0.878***</td>
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<tr>
<td></td>
<td>(0.145)</td>
<td>(0.161)</td>
<td>(0.160)</td>
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<td>Common legal origin</td>
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<td>0.524***</td>
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<td>(0.129)</td>
<td>(0.139)</td>
<td>(0.140)</td>
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<td>(0.640)</td>
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<td>1,415</td>
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<td>0.592</td>
<td>0.579</td>
<td>0.598</td>
</tr>
<tr>
<td>F-statistics</td>
<td>6.62</td>
<td>2.58</td>
<td>2.66</td>
</tr>
<tr>
<td>(prob &gt; F)</td>
<td>(0.0017)</td>
<td>(0.0797)</td>
<td>(0.0739)</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ratio_GDP</td>
<td>0.928***</td>
<td>0.968***</td>
<td>0.956***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.035)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>diff_Tax</td>
<td>-1.818***</td>
<td>-4.645***</td>
<td>-5.544***</td>
</tr>
<tr>
<td></td>
<td>(0.695)</td>
<td>(0.794)</td>
<td>(0.950)</td>
</tr>
<tr>
<td>diff_Institutions</td>
<td>2.958***</td>
<td>3.186***</td>
<td>3.398***</td>
</tr>
<tr>
<td></td>
<td>(0.343)</td>
<td>(0.349)</td>
<td>(0.354)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.005</td>
<td>0.058</td>
<td>0.073</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.066)</td>
<td>(0.067)</td>
</tr>
<tr>
<td>Observations</td>
<td>452</td>
<td>374</td>
<td>374</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.799</td>
<td>0.786</td>
<td>0.787</td>
</tr>
<tr>
<td>RESET test p-value</td>
<td>0.2296</td>
<td>0.5406</td>
<td>0.5486</td>
</tr>
</tbody>
</table>

Notes: Dependent variable is log-difference of aggregate 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 in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.
Table 5: Aggregate Difference Gravity

<table>
<thead>
<tr>
<th>Country pairs</th>
<th>Low quality</th>
<th></th>
<th>High quality</th>
<th></th>
<th>Asymmetric</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>ratio_GDP</td>
<td>0.880***</td>
<td>0.995***</td>
<td>0.962***</td>
<td>0.954***</td>
<td>0.771***</td>
<td>0.816***</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.051)</td>
<td>(0.052)</td>
<td>(0.115)</td>
<td>(0.109)</td>
<td>(0.111)</td>
</tr>
<tr>
<td>diff_Tax</td>
<td>0.736</td>
<td>-4.173***</td>
<td>-3.547***</td>
<td>-5.261***</td>
<td>-0.890</td>
<td>-3.010</td>
</tr>
<tr>
<td></td>
<td>(0.932)</td>
<td>(0.996)</td>
<td>(1.301)</td>
<td>(1.793)</td>
<td>(3.402)</td>
<td>(3.378)</td>
</tr>
<tr>
<td>diff_Institutions</td>
<td>1.778***</td>
<td>2.618***</td>
<td>2.629***</td>
<td>-1.593</td>
<td>-2.604</td>
<td>-0.683</td>
</tr>
<tr>
<td></td>
<td>(0.587)</td>
<td>(0.584)</td>
<td>(0.645)</td>
<td>(2.771)</td>
<td>(3.798)</td>
<td>(4.157)</td>
</tr>
<tr>
<td>diff_Tax*diff_Institutions</td>
<td>-2.109</td>
<td>3.427</td>
<td>1.029</td>
<td>6.404</td>
<td>17.84</td>
<td>3.735</td>
</tr>
<tr>
<td></td>
<td>(6.582)</td>
<td>(5.086)</td>
<td>(7.261)</td>
<td>(36.12)</td>
<td>(68.47)</td>
<td>(57.97)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.049</td>
<td>0.096</td>
<td>0.117</td>
<td>-0.153</td>
<td>-0.319</td>
<td>-0.254</td>
</tr>
<tr>
<td></td>
<td>(0.082)</td>
<td>(0.082)</td>
<td>(0.087)</td>
<td>(0.158)</td>
<td>(0.232)</td>
<td>(0.214)</td>
</tr>
<tr>
<td>Observations</td>
<td>176</td>
<td>134</td>
<td>134</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.786</td>
<td>0.817</td>
<td>0.806</td>
<td>0.528</td>
<td>0.485</td>
<td>0.491</td>
</tr>
<tr>
<td>F-statistics</td>
<td>0.32</td>
<td>10.65</td>
<td>4.37</td>
<td>4.43</td>
<td>0.10</td>
<td>0.41</td>
</tr>
<tr>
<td>(prob &gt; F)</td>
<td>(0.7285)</td>
<td>(0.0001)</td>
<td>(0.0145)</td>
<td>(0.0154)</td>
<td>(0.9062)</td>
<td>(0.6680)</td>
</tr>
</tbody>
</table>

Notes: Dependent variable is log-difference of aggregate 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 in parentheses. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.