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Regulation, Red Tape and Location Choices of Top R&D Investors

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Abstract

This paper investigates how product and labour market regulations and red tape affect the way in which top corporate research and development (R&D) investors worldwide organise their cross-border operations. The decision about where a company locates its international subsidiaries is modelled using location-specific framework conditions, socio-economic factors and other controls commonly used in the economic geography literature. The location decision drivers are estimated using a multilevel mixed-effects logistic regression, controlling for both fixed and random effects. Our results confirm that both product market regulation (PMR) and employment protection legislation (EPL) significantly affect the location decisions of top R&D investors, as well as red tape and profit tax. The marginal effect of PMR is by far the largest, followed by EPL; the cost of starting a business and profit tax show lower marginal effects. Moreover, we found that (i) PMR and EPL exert a mutually reinforcing negative effect on the location decision of top R&D investors and (ii) of the three components of the PMR indicator —barriers to trade and investment, state control and barriers to entrepreneurship—the latter is the one with the lowest marginal effect. Policy implications are drawn accordingly.

JEL Classification: F23; D22; L20.

Keywords: Multinational Corporations (MNCs); Internationalization; Product market regulation; Employment protection.

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1. INTRODUCTION

The policy debate on the European economic recovery is currently focusing on one key question: will the European economy be able to generate a self-sustained and balanced expansion once the three temporary tailwinds that have sustained its recent performance—the sharp fall in oil prices, a supportive macro-economic policy and the depreciation of the euro's exchange rate—have died down?

To answer this question, both the shortfall of investment over the past 6 years, which has reduced the EU economic growth potential, and the declining trend in EU productivity growth, which has not yet been reversed, must be carefully considered. Furthermore, an ageing population and constraints on natural resources mean that future economic growth in the EU will be increasingly dependent on productivity-raising innovation (OECD, 2012). This scenario calls for a reboot of growth drivers—such as productivity and innovation—to ensure a sustainable recovery and to prevent reverting to a situation of consistent weak growth.

The Investment Plan for Europe[1] recently launched by the European Commission represents a first step in this direction. In addition to providing a financial commitment, the Plan has a long-term relevance for innovation and productivity growth because of its 'third pillar', which aims to create an investment-friendly environment. The underlying rationale of this pillar is that providing greater regulatory predictability, removing barriers to investment across Europe and further reinforcing the Single Market (i.e. creating optimal framework conditions) will unlock the full potential of investment in Europe, including investment in research and development (R&D). Accordingly, more efficient labour and product markets—alongside institutions and policies that allow productive firms to thrive—are recognised as key policy priorities also in the recent EC 5-Presidents Report (EC, 2015a).[2]

Against this background, and being aware that fostering private R&D investment in Europe is essential to revitalise EU innovation performance, this paper analyses the impact that third-pillar-relevant variables have in shaping the location choices of the top R&D investors worldwide. Namely, we test whether changes in the level of regulation in product and labour markets – and their possible interplay – and in red tape have an impact in attracting foreign long-term investments (beyond the other factors considered in the literature, e.g. Moncada-Paternò-Castello *et al.*, 2011; Siedschlag *et al.*, 2013). In doing so, we investigate the role structural policies play in shaping firms' location decision, as Aghion *et al*. (2005; 2009) did for their effects on innovation and productivity.

To this end, we use the 2014 EU Industrial and R&D Investment Scoreboard (JRC–IPTS) dataset, collecting information on the top 2,500 R&D investors worldwide.[3] In the empirical application, we model the probability of a company international subsidiary to be located in a particular country upon location-specific regulatory framework conditions, socio-economic factors, and other controls commonly used in the economic geography literature. The location decision drivers are estimated using a multilevel mixed-effects logistic regression, controlling for both fixed and random effects. The synthetic indicators EPL (employment protection legislation) and PMR (product market regulation), provided by the Organisation for Economic Co-operation and Development (OECD), are used to characterise rigidities in the labour and product markets, respectively. The cost of starting a business and the level of tax on profits provided by the World Bank's *Doing Business 2016* report are used to proxy cross-country differences in administrative costs and profit tax.

[1] http://ec.europa.eu/priorities/jobs-growth-investment/plan/index_en.htm

[2] http://ec.europa.eu/priorities/economic-monetary-union/docs/5-presidents-report_en.pdf

[3] We had information on subsidiaries for 2,288 of these companies, and included in the analysis only the subsidiaries for which complete geographical and industrial information was available (140,382).

From an economic point of view, more efficient labour[4] and product markets (intended as markets promoting a high level of employment, and able to absorb shocks and allocate resources in favour of the most productive and innovative firms) and lower administrative costs should help foster innovation and attract (and/or increase) investment in knowledge-based capital (OECD, 2013a) through the creation of a friendlier business environment. In fact, the effectiveness of the wider innovation system often hinges on the quality of framework conditions and the capacity to ensure an innovation-friendly climate in both more and less R&D-intensive parts of the economy (EC, 2015b).

The multinational corporations (MNCs) analysed in this study are among the most technologically advanced firms in the world, accounting for a substantial proportion of global business R&D investment (about 90 %; Hernandez *et al.*, 2015). Their foreign direct investments are considered very important for the diffusion of advanced technologies (Blomström and Sjöholm, 1999) and for channelling embodied knowledge spillovers (Blomström and Kokko, 1998; Branstetter, 2006). The presence of MNCs has essential productivity-enhancing effects, as it increases competition in the host country (Barrios *et al.*, 2005[5]), leading to improved market efficiency and higher productivity (Javorcik, 2004). Furthermore, the opening up of trade and FDI triggers a selection process that results in the most productive firms replacing the least productive ones within sectors (Mayer and Ottaviano, 2007). Therefore, attracting investment by MNCs has important demand effects in the short run and significant effects on potential growth in the medium to long-run.

The remainder of this paper is organised as follows. Section 2 briefly reviews the literature describing the importance of well-designed framework policies in promoting innovation through the creation of a business-friendly and attractive environment and in influencing the location decisions of R&D-intensive multinationals. Section 3 discusses the dataset and methodology employed for the empirical analysis. Section 4 presents a short descriptive analysis of the geographical location of the companies in the sample and comments on the results of the econometric analysis. Finally, section 5 summarises the main results and presents the major policy implications.

[4] 'Efficient labour markets' are commonly defined as labour markets combining security and flexibility (e.g. flexible and reliable labour contracts that avoid a two-tier labour market, comprehensive lifelong learning strategies, effective policies to help the unemployed re-enter the labour market, modern social security systems and enabling labour taxation). In this paper we focus only on the degree of employment protection legislation.

[5] The authors found that, although competition effect may have initially deterred local firms from entering the market, this initial effect was later offset by positive externalities, making the overall impact of FDI largely positive for the domestic industry.

2. WHY DO WELL-DESIGNED FRAMEWORK POLICIES FACILITATE CREATIVE DESTRUCTION AND CREATE A BUSINESS-FRIENDLY ENVIRONMENT?

European countries are currently in lively competition with the rest of the industrialised world and with emerging economies to attract internationally mobile investments and to enhance aggregate demand and potential growth in both the short and long-run.

Concurrently, in advanced knowledge-based economies, frontier innovation has become the main source of growth (Aghion and Griffith, 2005); therefore, the capacity to attract high-value FDI from knowledge-intensive multinationals in high-technology industries and in innovation is a key element for sustained growth.

In this context, MNCs are central economic actors because of their large international investments and numerous foreign subsidiaries, which enable them to shift activities within their multinational network according to changing demand, costs and general framework conditions. In line with this, Berbedos *et al.* (2008) show that a competitive product market can be a pool factor attracting technological leaders.

The literature on the attractiveness of a country in terms of international investment and location factors is broad and diverse and has not yet resulted in many clear-cut policy implications. A single theory explaining the location decisions of MNCs is still lacking, and a variety of models attempting to explain such decisions emphasise different drivers. As a comprehensive review of it is beyond the scope of this paper, in what follows we focus on the reasons why product and labour market regulations and red tape would affect the location decisions of top R&D multinationals. Accordingly, we briefly summarise the most relevant findings that have emerged from the empirical literature. In doing so, our theoretical reference will be the Schumpeterian innovation paradigm.

In a Schumpeterian framework, growth is driven by innovative entrepreneurs and the innovations introduced within the economic environment tend to displace previous innovations. In this context, growth involves a conflict between old and new technologies and old and new skills. Structural policies—such as product market liberalisation and/or labour market flexibility—may have a role in facilitating this process of creative destruction (Aghion *et al*., 2005, 2009) by favouring a business-friendly environment.[6]

Moreover, the typically long-term character and high volume of investment involved in setting up a subsidiary abroad makes the stability of the regulatory framework a crucial factor. *Ceteris paribus*, we expect that environments characterised by lower levels of product and labour market regulation and lower costs to start a business will be more attractive to R&D-intensive multinationals that are looking for dynamic ecosystems of innovation and market conditions that favour returns to innovative investments.

[6] Clearly, the incentive to locate in a particular country rather than another will be also affected by other institutional framework conditions, such as the relative efficiency of its judicial system and of its bankruptcy regime. In fact, a well-functioning civil justice system that guarantees legal certainty and proper contract enforcement is mostly relevant for innovative firms. Reforms such as rationalising the organisation of courts, fostering investment in in-court ICT and introducing incentives to reduce excessive litigation rates (for instance by enhancing the use of alternative disputes resolution methods) are all found to positively affect the efficiency of civil justice and, as a result, to enhance entry rates and favour the exit of less successful firms (EC, 2014b; Lorenzani and Lucidi, 2014), the resources of which can be then be reallocated among surviving firms. Accordingly, Carpus Carcea *et al*. (2016) found that efficient preventive restructuring frameworks tend to favour the survival of firms and are positively associated with the level of entrepreneurship. Although we do not directly and separately test the role of these factors, they are all aspects considered in and captured by the OECD PMR composite indicator. Unfortunately, owing to the significant number of missing values for the indicators on contract enforcement and efficiency of insolvency in the World Bank's Doing Business database, it has not been possible to verify these hypotheses for our sample of companies.

Stated simply, the Schumpeterian creative destruction process needs a dynamic business environment to function smoothly.[7] This means framework conditions that, for instance, allow young innovative firms to easily enter a market and grow, without facing excessive and costly regulation barriers, and allow inefficient firms to exit the market, freeing resources for those that stay in business. In the presence of high administrative entry costs, stringent product market regulation (in the following PMR) and excessive employment protection legislation (EPL), this reallocation of resources may be less efficient, damaging the most innovative and productive firms and sectors (EC, 2015b).

More specifically, reforms reducing excessive PMR, especially those reducing entry barriers, may spur innovation via three channels. Firstly, they generate higher firm entry rates, which may in turn exert pressure on incumbents to innovate. Secondly, they promote greater market discipline, which improves management performance and scope for technology adoption. Thirdly, they stimulate easier and cheaper access to inputs, which raises the returns to investment in R&D, innovation and technology development and other intangible assets.[8]

For economies to thrive on innovation, labour also needs to be reallocated within and across firms and sectors. In a constantly changing economic context and/or with the introduction of labour-saving technologies, labour market frictions may generate inefficient labour allocation and unemployment in specific sectors. In these cases, a stringent EPL may hinder the redirection of resources towards the most productive uses and delay the match of labour supply and demand. In line with this expectation, a high EPL may reduce R&D investment, hampering the growth of innovative firms that are in need of skilled personnel and complementary resources to implement and commercialise their innovations (Andrews and Criscuolo, 2013, Amoroso *et al.*, 2015).

Aghion *et al.* (2005) empirically tested the Schumpeterian theory on the relationship between product market competition and innovation rate. They showed the existence of an inverted U-shaped relationship between product market competition and innovation. This implies the presence of an 'escape competition effect' at lower levels of product market competition, while the aforementioned 'Schumpeterian effect'—pointed out in earlier endogenous growth models and before that in the industrial organisation theoretical literature[9]—dominates at high initial levels of product market competition.[10] Therefore, although competition may increase the incremental profit from innovating, it could also reduce innovation incentives for laggards.[11]

[7] In such a paradigm, faster growth generally implies a high rate of firm turnover (Aghion and Akcigit, 2015), with a positive effect on competition and an increase in the number of firms entering the market. This finding is particularly marked in highly innovating sectors (see Aghion and Griffith, 2005, for a survey).

[8] Intangible assets such as: training and education of workers, internal organisation structures, customer and institutional networks, marketing, and software and information technology.

[9] The standard industrial organisation literature predicts that innovation should decline with increasing levels of competition, as more competition decreases the monopoly rents that reward the entry of new and successful innovators. However, a number of empirical works, such as those by Geroski (1995), Nickell (1996) and Blundell *et al.* (1995) have instead pointed to a positive correlation between product market competition and innovation. Since their publication, there have been several theoretical attempts to reconcile the Schumpeterian paradigm with the evidence provided in these studies. These have generated various predictions regarding the relationship between product market competition and innovation. As a survey of these attempts goes beyond the scope of this article, we suggest referring to Aghion and Howitt (1997, Chapter 7).

[10] Their results also indicate a similar inverted U-shaped relationship at the industry level, and that it tends to be steeper for firms in the so-called neck-and-neck industries (see footnote 11) and/or that are closer to the leading edge in their industry. Their findings are also in line with earlier analysis using UK company data. Blundell *et al*. (1995, 2002) established that market share is a significant positive determinant of innovation intensity at the firm level (even after controlling for fixed effects, for endogeneity of market share and for firm size) and that industry competition measures, including industry concentration and import penetration, show positive and significant competition effects, which, at industry level, tend to dominate.

[11] Competition may increase the incremental profits from innovating (thereby encouraging R&D investments aimed at 'escaping competition') and it will do so to a greater extent in industries in which oligopolistic firms face similar production costs (the so-called 'neck-and-neck' industries).

The empirical literature supporting the hypothesis that the removal[12] of regulatory barriers and a reduction of red tape can favour business dynamics is quite broad. According to it, a decrease in regulatory barriers particularly favours the entry of new young firms in protected sectors, and that these firms are generally among the most innovative in those sectors.[13] Firm-level evidence suggests that the EU's business R&D deficit may reflect regulatory constraints on the rapid growth of new, technology-based entrants in the EU compared with the US (Aghion *et al.*, 2008). In addition, cumbersome regulations and administrative procedures for starting a business are found to be associated with a smaller number of legally registered firms, greater informality, a smaller tax base and more opportunities for corruption (Audretsch *et al*., 2006) and higher entry rates (Ciriaci, 2014). Klapper *et al*. (2009) have also found that barriers to start a business and entry costs are significantly and negatively correlated with business density, calculated as the total number of businesses registered as a percentage of the economically active population (aged 15–64). According to the authors, for every 10 percentage points decrease in entry costs, business density increases by 1 percentage point.

The increasing body of literature and empirical research analysing the effect that changes in the level of PMR have on economic performance through the process of entry and exit also focuses on the final effect that this has on productivity (Conway *et al*., 2006). Scarpetta *et al*. (2002) found that the overall PMR level (and, in particular, administrative barriers to start-ups) has a significant negative impact on firm entry (see also Brandt, 2004). More recently, Andrews and Cingano (2012) relate allocative efficiency to framework policies, such as the level of administrative burdens on start-ups and the cost of closing a business, and to the level of employment protection legislation. In line with this empirical evidence, Canton *et al*. (2014) found that the less strict PMR that applies to professional services, which are increasingly and intensively used by knowledge-intensive manufacturing firms (Ciriaci and Palma, 2016), improves business dynamics and, as a result, firms' ability to allocate resources efficiently.

Besides favouring a more dynamic business environment, lower regulation levels also facilitate outsourcing from MNCs to domestic firms and co-operation between MNCs and domestic firms. Outsourcing enables enterprises to combine their internal knowledge with their partners' specific competencies and to specialise and enhance their competitive advantage further (Porter, 1990; Coffey and Bailly, 1991; Abramovsky *et al*., 2004). Indeed, MNCs locate their research facilities to foreign locations to tap into the knowledge and techniques created abroad to complement their in-house technological activities, or to develop new knowledge and competences (Cantwell *et al.*, 2004; Criscuolo *et al*., 2005). Stringent regulation could also decrease the quantity and quality of knowledge-intensive business services and damage the innovation ecosystem, thus decreasing its 'attractiveness' when it comes to the location decisions of R&D-intensive multinationals.[14] In fact, production-based R&D flows acquired from knowledge-intensive business services, often among the most regulated sectors (Canton *et al*., 2014), increase manufacturing innovativeness in terms of both patent applications and patent quality (Ciriaci *et al*., 2015).

Many other socio-economic factors significantly influence the strategic location decision of MNCs. Besides firm-specific characteristics, such as firm size and corporate performance, sector and technological intensity,[15] other important drivers in the host country have been identified as particularly relevant. These include (i) market features, such as size, growth potential and purchasing power; (ii) the presence of high-quality scientific infrastructure and human resources;[16] (iii) the existence of agglomeration forces, such as

[12] This entails the reduction of excessive rents and provides incumbents with incentives to make their production processes more efficient (see, among others, Nicoletti and Scarpetta, 2003; Christiansen *et al*., 2013; OECD, 2013b; Prati *et al*., 2013; Restuccia and Rogerson, 2013; Ciriaci, 2014).

[13] This is also in line with the evidence presented by Bartelsman *et al*. (2003), who found that in the EU and the US the dynamics of entry-exit and survival follow similar patterns, whereas the growth performance of surviving firms shows noticeable differences.

[14] As assessed and argued in a number of articles, the sectoral gains arising from more efficient production and increases in firm-level productivity due to liberalisation efforts will, in turn, spread throughout the economy as a result of the increasing sector vertical integration observed in the last decades (Canton *et al*., 2014; EC, 2014b; Ciriaci and Palma, 2016; Ciriaci *et al*., 2015; OECD, 2015).

[15] Internationalised firms are 'bigger, generate higher value added, pay higher wages, employ more capital per worker and more skilled workers and have higher productivity' (Mayer and Ottaviano, 2007).

[16] *Ceteris paribus*, firms favour countries that are well endowed with universities, research and technological centres of excellence, and with a higher proportion of scientists, engineers and higher education graduates.

clusters, scientific parks or outstanding innovative or creative cities; (iv) the presence of tax breaks and government support, and legal and intellectual property protection systems; (v) geographical and cultural distance between the source and the destination country; and (vi) technological proximity between the MNC and the host country.[17] However, the relative importance of these drivers also depends on the industries in which such corporations operate and the propensity of MNCs to resort to the international markets for their knowledge creation activities. Cost considerations, including labour costs, appear to be less relevant in high-technology industries than in other industries; instead, the quality of the location factors in the host country is much more important.

Using this setting, we will verify the extent to which differences in the strictness of regulation (in both product and labour markets) and the cost of starting a business, used as proxy for red tape, affect the location decision of R&D-intensive multinationals, controlling for the main key drivers of companies' location decisions identified by previous empirical literature.

[17] Firms may favour a certain location because they want to benefit from the knowledge activities developed by firms in the same industry (intra-industry and specialisation spillovers or proximity to other companies) or by firms operating in different industries (inter-industry and diversity externalities) (e.g. Cantwell and Piscitello, 2005; Alcácer and Chung, 2007). Geographical distance, in contrast to proximity, is expected to exert a negative effect on the probability that firms will locate in a country given the increased cost it entails. For a discussion and empirical evidence on the role of technological proximity see Dosso and Vezzani (2015).

3. DATA & METHODOLOGY

3.1 THE DATABASE

The analysis is based on the EU Industrial R&D Investment Scoreboard data (JRC–IPTS, http://iri.jrc.ec.europa.eu/scoreboard.html), which contains economic and financial information for the world's top 2,500 corporate R&D investors. It is based on company data taken directly from companies' annual reports.[18] Each of these top 2,500 R&D companies invested at least €15.5 million in R&D in 2013.

Information on the subsidiaries of these top R&D investors was obtained by matching the Scoreboard dataset with the ORBIS databank, using the corporate structure of the Scoreboard companies in place at the end of 2014. We were able to identify 218,343 industrial subsidiaries[19] belonging to 2,338 of the top corporate R&D investors worldwide. Unfortunately, ORBIS does not report location or main sector of activity for all these subsidiaries. Only those for which both location and main sector of activity were known were included in the analysis. The final number of subsidiary companies included in the analysis is 140,382, belonging to 2,288 out of the top 2,500 corporate R&D investors worldwide.[20]

The Scoreboard dataset has been merged with data on PMR and EPL from the OECD and with the World Bank's Doing Business and World Development Indicators databases. As is common in the relevant empirical literature, we also used a series of geographical and cultural distance measures provided by the GeoDist database, which was developed and described by Mayer and Zignago (2005, 2011).

The PMR composite indicator translates policy action into a quantitative indicator. Although comprehensive, rich and comparable across countries, it does not capture all regulatory barriers, but only a selection of them. Therefore, it provides a partial approximation of the regulatory framework in each country using, as a main source of information, the responses of national governments to the OECD Regulatory Indicator Questionnaires. As such, it may not fully reflect the opinion of the private sector. The components of PMR are three composite indicators: (1) state control; (2) barriers to trade and investment; and (3) barriers to entrepreneurship (see Koske *et al*., 2015, for a full description of the methodology used to construct the PMR).

The EPL composite indicator measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures needed to hire workers on fixed-term or temporary work agency contracts. The EPL is constructed by aggregating 21 items covering different aspects of employment protection regulations as they were in force on 1 January of each year. Thus, the indicator tries to condense the complex set of factors characterising EPL regulating the labour market.

The main advantage of the World Bank's Doing Business dataset, from which data on the administrative cost of starting a business and on the level of taxation on profits have been taken, is that it allows cross-country comparison in a field where available (and comparable across time and countries) data are very limited. This includes quantitative indicators on the regulations that apply to firms at different stages of their life (regulations for starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing

[18] The Scoreboard has been published annually since 2004, to provide a reliable, up-to-date benchmarking tool for comparisons between companies, sectors and geographical areas, as well as to monitor and analyse emerging investment trends and patterns.

[19] Following Castellani *et al*. (2015), we did not include in the analysis subsidiaries classified as branches.

[20] It is worth noting that the international investment considered in the following (i.e. the presence of a subsidiary in a country) is not necessarily linked to R&D, but includes all types of investment. For instance, between 2003 and 2012, 1,150 of these top R&D spenders have invested in 33,572 FDI projects (Montresor and Vezzani, 2015). The largest number has been in manufacturing (37.6%), followed by sales and marketing (14.6%) and R&D (11.7%), confirming a well-documented pattern of internationalisation of economic activities (e.g. Karabag *et al*., 2011).

contracts and resolving insolvency). Therefore, it records all procedures officially required, or commonly carried out in practice, for an entrepreneur to start up and formally operate an industrial or commercial business, as well as the time and cost to complete them and the paid-in minimum capital requirements. The World Development Indicators, from which we extract data on gross domestic product (GDP), trade and unemployment, is one of the main World Bank datasets. Data are collected from officially recognised international sources.[21]

3.2 THE ECONOMETRIC STRATEGY

To model the location decisions of our company, we use a multilevel mixed-effects logistic regression framework, controlling for both fixed and random effects. Indeed, each company can locate subsidiaries in one (or more) foreign country(-ies); the dependent variable takes value 1 if a company locates at least one subsidiary in a given country, 0 otherwise. There are 39 observations for each company, corresponding to the number of 'possible' host countries in the sample (a company does not locate international subsidiaries in its home country). The probability that a firm *i* will locate in a given country *c* could be written as:

$$P\ (y_{ci} = 1|x_{ci}, \mu_i) = F(\beta x_{ci} + \mu_i)$$

where x_{ci} identifies the drivers of the company decision to locate in a given foreign country, μ_i are company-specific random intercepts and $F(\cdot)$ is the cumulative logistic distribution, which maps the linear predictor of the probability of success $(y_{ci} = 1)$ with $F(\vartheta) = \exp(\vartheta)\ /\{1 + \exp(\vartheta)\}$. The random parameters define the stochastic portion (unobserved) of the choice function, which can be correlated over alternatives. This property relaxes the assumption of a lack of correlation among alternatives characterising conditional logit models that gives rise to the independence of irrelevant alternatives (IIA) property and its restrictive substitution patterns (Train, 2003).

This setting allows a more appropriate modelling of a firm decision to locate in a given country by directly dealing with the clustered structure of the data, where each cluster has its own choice behaviour. Indeed, in the present setting, instead of considering all observations at once, these are organised as a series of *N* independent clusters (our companies) nested into *I* different clusters (industries). Although the mixed logit model is very flexible, simulation techniques involved for computational reasons have so far limited its application. Nonetheless, a similar setting has been used by Basile *et al*. (2008) to analyse the subsidiary location of multinational firms in 50 European regions, and by Griffith *et al*. (2014) to ascertain the importance of corporate income taxes in determining where firms choose to legally own their intellectual property rights. Dosso and Vezzani (2015) use it to analyse the determinants of the international knowledge-seeking strategies of Scoreboard companies worldwide.

Among the drivers of a company location decision, x_{ci}, we included (i) the third-pillar relevant variables discussed above (PMR, EPL and the cost of starting a business); (ii) country controls (GDP level, differences in per capita GDP between source and destination country, trade as a share of GDP, unemployment rate, tax rate on profits); and (iii) geographical controls (distance in kilometres between the capital of the hosting country and original country location of the Scoreboard company, existence of shared borders—which has a value of 1 if the two countries share a border—and of a common language—which has a value of 1 if the two countries have the same language). It is worth noting that, as PMR emerged as the main determinant of such a probability, we decided to analyse the impact of its three components, i.e. State Control, Barriers to trade and investment, and Barriers to Entrepreneurship. Among the country controls, we had initially also included the number of tertiary-educated people but, as results were

[21] For more detailed information about the OECD indicators and its components see: http://www.oecd.org/eco/reform/indicatorsofproductmarketregulationhomepage.htm and http://www.oecd.org/els/emp/oecdindicatorsofemploymentprotection.htm. For the World Bank Doing Business and World Development Indicators, see: http://www.doingbusiness.org/methodology and http://data.worldbank.org/about/data-overview/methodologies. For the GeoDist database, see http://www.cepii.fr/cepii/en/bdd_modele/presentation.asp?id=6

confirmed and its insertion caused a large drop in the number of observations (especially because of missing data for China), we excluded it from the final estimations (results are available upon request). There is a plethora of other different factors that may influence international location decisions. We think that those selected are the most relevant for the specific issue at stake and we assume that the effects of other omitted factors cancel-out each other.

PMR values are available every 5 years (the last available year is 2013). In our analysis we used the average value between 2008 and 2013. The same holds for the high-level indicators (state control, barriers to entrepreneurship and barriers to trade and investment), whereby the simple average constitutes the value of PMR. However, EPL values are available yearly, and we used the average for the period 2008–2012. For the cost of starting a business (expressed as share of income per capita) we used the average from 2008 to 2012. The countries for which all the three indicators are available are Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, the UK, the US (PMR data available for only 2008), Brazil, China, India, Indonesia (PMR data available for only 2008), the Russian Federation, South Africa and Latvia (ELP data available only for 2012; PMR data available only for 2013).

Apart from EPL, PMR (and its three components), common border and common language, all the variables are expressed in logs. Table A1 (in the Appendix) shows the descriptive statistics for the explanatory variables.

4. RESULTS

4.1 WHERE DO TOP R&D INTENSIVE MULTINATIONALS LOCATE?

Out of the 2,500 companies present in the R&D Scoreboard, we managed to find information on subsidiaries for 2,288 of them. For these companies we considered only those subsidiaries that are not branches (as Castellani *et al*., 2015) and for which we could retrieve information on the sector of activity. Therefore, the final number of subsidiary companies included in the econometric analysis is 140,382, of which 89,940 (64.1%) are 'international', that is subsidiaries located in a country different from the one where the Scoreboard parent company headquarter is located (see Table 1).

Table 1: **Sample description**

Number of top R&D investors in the sample*	2,288
R&D 2013 avg	229 ml
Net Sales 2013 avg**	7,090 ml
Employees 2013 avg***	23,282
Number of subsidiaries****	140,382
- of which "national"	50,442
- of which "international"	89,940

Source: The EU Industrial R&D Investment Scoreboard.

Notes: **out of the top 2,500 top R&D investors; **compute on 2,271 companies for which data are available out of the top 2,500 top R&D investors; **compute on 2,007 companies for which data are available out of the top 2,500 top R&D investors; **** we did not take into account branches and subsidiaries companies for which the information on activity sector was not available*

International subsidiaries located in the EU represent 58.3 % of all subsidiaries; of the rest, 10.3 % are in the US, 1.5 % in Japan and 2.7 % in China (the remaining 27.2% are located in the rest of the world). Looking at the top countries where the Scoreboard companies locate their international subsidiaries, 56.7 % are found in only 10 countries (see Table 2), a level of concentration that is lower than that for Scoreboard headquarters.

Some interesting facts emerge if we compare the number of Scoreboard headquarters in a country and the number of international subsidiaries of other Scoreboard companies located in the same country. If we take the first 10 countries by number of international subsidiaries, only 7 of them are also among the first 10 countries by number of Scoreboard headquarters. Spain, Canada and Mexico account for very few headquarters but many subsidiaries. For Canada, and especially for Mexico, this can depend on how close ties are to the US, as these three countries are part of a free trade agreement. As regards Spain, this observation can be explained by the general high level of attractiveness of this country for FDI during the 1990s and the 2000s—at least until the financial crisis (see, for example, Barrios *et al*., 2004; Rodriguez and Pallas, 2008; Guimón, 2009).

Table 2: **Distribution of international subsidiaries by country of destination (top 20 countries) and number of SB companies presented via HQ or subsidiaries, by country**

Country	n. of international subsidiaries by country of destination	n. of SB companies present in the country through their subsidiaries	n. of SB companies with HQ located in the country
United Kingdom	10,543	1,398	132
United States	9,242	1,133	735
Germany	8,331	1,241	136
Netherlands	5,932	1,081	39
France	4,480	978	86
Spain	3,122	912	16
China	2,407	702	163
Italy	2,380	843	35
Canada	2,344	911	24
Mexico	2,211	704	1
Poland	2,156	678	1
Switzerland	2,067	737	60
Ireland	2,022	523	14
Belgium	1,973	679	13
Brazil	1,912	791	9
India	1,780	811	23
Sweden	1,711	622	47
Australia	1,642	588	14
Austria	1,463	539	17
Japan	1,310	745	380
Others	*20,912*	/	*343*

In contrast to the above, Switzerland, Sweden and Japan are in the top 10 for number of Scoreboard headquarters but are in a lower position on the chart for Scoreboard subsidiaries. The position of Sweden does not come as a surprise, given the size of its internal market. In the case of Switzerland—host to many pharmaceutical and financial multinationals—the explanation may reside in the way we count subsidiaries—considering only industrial ones and not branches (which is the kind of subsidiary that is typical of financial MNCs). Finally, the reason why Japan is at the bottom of the top 20 destination countries chart may be the historical closed nature of the Japanese market and its onerous institutional rules (see Nakamura and Oyama, 1998). So it comes as no surprise that Japan is the country with by far the highest number of national subsidiaries (11,525), accounting for 22.8 % of all national subsidiaries of the Scoreboard companies included in the analysis. This is in line with the so-called 'home bias' of major Japanese R&D intensive firms (Belderbos *et al.*, 2013).

A similar picture emerges when the number of Scoreboard companies headquartered in a particular country is compared with the number of Scoreboard companies present in the same country through one or more of

their subsidiaries. Some countries, such as Spain and Canada, register a much higher presence of Scoreboard companies than might be expected if only the number of headquarters is considered.

Table 3 reports, for the same top 20 destination countries, the average values of the OECD's PMR and EPL indicators, and of the cost of starting a business, over the period 2008–2013 for the PMR and 2008–2012 for the other two variables (the length of the period determined by data availability for the countries in the sample).

Table 3: **EPL, PMR and cost of starting a business in the top 20 destination countries**

Country	EPL (mean 08-12)	PMR (mean 08-13)	Cost of starting a business as share of income per capita (mean 08-12)
United Kingdom	1.7	1.1	0.6
United States	1.2	1.1	1.2
Germany	3.0	1.4	4.9
Netherlands	2.9	0.9	5.5
France	2.8	1.5	0.9
Spain	2.6	1.5	9.8
China	3.2	3.0	4.2
Italy	3.0	1.4	17.3
Canada	1.5	1.5	0.4
Mexico	2.7	2.0	20.0
Poland	2.4	1.8	16.7
Switzerland	2.1	1.5	2.1
Ireland	2.0	1.4	0.3
Belgium	3.0	1.5	5.2
Brazil	1.5	2.5	6.2
India	2.6	3.2	56.1
Sweden	2.5	1.6	0.6
Australia	1.8	1.4	0.7
Austria	2.4	1.3	5.0
Japan	2.1	1.4	7.5
Average	*2.4*	*1.7*	*7.2*

In the UK, the country that accounts for the highest proportion of international subsidiaries (11.7 % of the total), values for EMP, PMR and cost of starting a business are well below average. This is true also for the US. This is consistent with the relationship we are expecting to find between framework conditions indicators and subsidiary location. However, the co-occurrence of low levels of our framework variables and high number of international subsidiaries becomes more blurred towards the bottom of the table.

To investigate if there is more descriptive evidence in support of our hypothesis, we looked at pairwise correlation coefficients between the number of international subsidiaries located in country *i*, and the three aforementioned regulatory and red tape indicators (reported in Table 4).

Table 4: **Correlations**

	N. of international subsidiaries	Employment Protection (EPL)	Product Market Regulation (PMR)	Cost of starting a business
N. of international subsidiaries	1			
Employment Protection (EPL)	-0.0397*	1		
Product Market Regulation (PMR)	-0.0756*	0.1656*	1	
Cost of starting a business	-0.0455*	0.2902*	0.5799*	1

Notes: ** significant at 5%.*

Even these simple descriptive statistics shows that there is a statistically significant negative correlation between the general level of labour and product market regulation and red tape and the presence of international subsidiaries of R&D-intensive Scoreboard companies.

4.2 ECONOMETRIC ANALYSIS

In the empirical application we modelled the probability that a company located an international subsidiary in a particular country on third-pillar relevant variables (employment protection legislation, product market regulation and red tape barriers), country variables and other geographical controls.

More in particular, the model first estimated the impact that EPL, PMR, and the cost of starting a business and have on the probability that a company located a subsidiary in a country, considering also the interaction between EPL and PMR, and controlling for other framework conditions including profit taxation (Table 5). We then used the same model to identify which component of the PMR indicator —the variable emerged as the one with the highest impact on such probability—is the most influential (Table 6).

From a policy point of view, this analysis would help not only to detect which of the three aforementioned third pillar relevant variables affects the most the kind of investment considered here (the presence of a subsidiary in the country), but also to rank the different possible reforms in terms of their potential impact on it.

The estimation results for the three different specifications used are reported in Table 5 (columns 1 to 3). The specification reported in column 3 is our reference model. Below, we first comment on the effects of the third-pillar variables and the different impacts of the three components of PMR (section 4.2.1). We then discuss the estimates obtained for the country and geographical determinants (section 4.2.2). Finally, we focus on the implications of the complementarity between PMR and EPL for the EU-28 Member States (section 4.2.3).

Before discussing the general estimation results, a caveat must be emphasised. As no information was available on the year when the subsidiary was opened, a lack of data common to many studies in the field,

identifying causal relations is not straightforward. However, our econometric analysis aims not to explain the decision to open a subsidiary in a particular year, but to analyse the correlation between a multinational's decision on how to organise its worldwide activities and a series of country characteristics and geographical variables. These variables are those likely to be considered when such a decision is taken and/or when the mother company decides whether or not to stay in a particular host country. The majority of these characteristics are structural and display a low degree of variation over time. Nonetheless, we use average values over a 5- or 6-year period for our main variables of interest, and a 1-year lag for the controls.

Finally, it should be recalled that, as we use a particular class of logistic estimator, the coefficients attached to our regressors could not be interpreted as elasticities. In order to quantify the effects of our main variable of interest (PMR and EPL) on the location conditional probabilities we will compute and comment their marginal effects.

4.2.1 The marginal effect on location probability of top R&D multinational for third-pillar relevant variables

Taken together, the results confirm our theoretical expectations: product and labour market regulations, as well as the cost of starting a business, significantly affect the location probability of top R&D multinationals (Table 5).

Table 5: **Probability of locating subsidiaries in a given country: regression results**

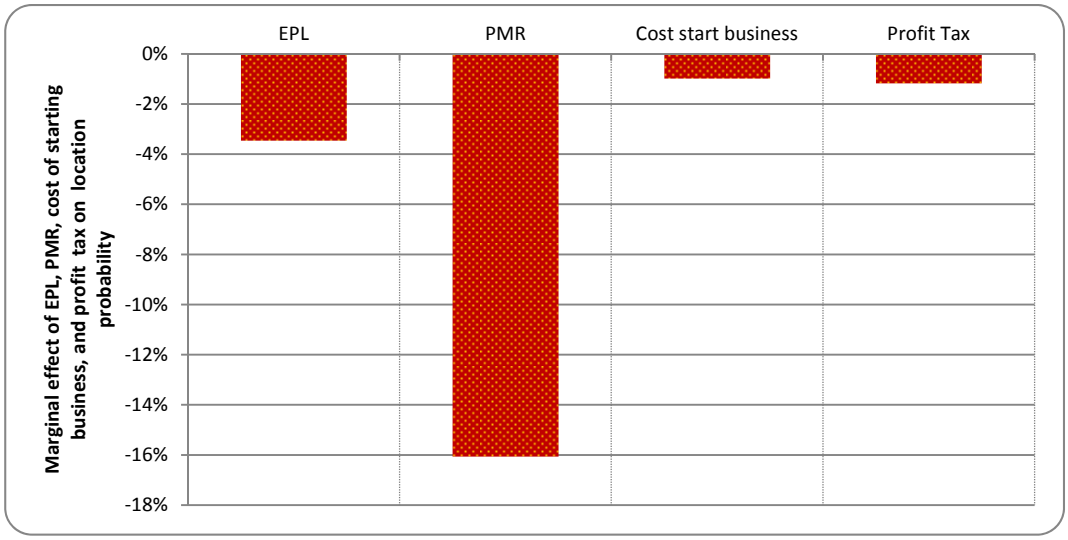
	(1)	(2)	(3)
Employment Protection (EPL)	-0.035	0.900***	1.471***
	(0.023)	(0.066)	(0.078)
Product Market Regulation (PMR)	-0.705***	0.722***	1.043***
	(0.021)	(0.096)	(0.108)
EPL * PMR		-0.569***	-1.046***
		(0.037)	(0.044)
Cost of starting a business			-0.089***
			(0.010)
Profit Tax			-0.106***
			(0.020)
GDP	0.944***	0.977***	1.216***
	(0.010)	(0.010)	(0.015)
Trade as a share of GDP			0.602***
			(0.039)
Unemployment share			-0.085***
			(0.030)
Difference in gdp per capita (sub_country-HQ_country)			-0.713***

			(0.025)
Common borders	-0.143***	-0.178***	-0.253***
	(0.053)	(0.054)	(0.055)
Common official language	0.723***	0.809***	0.841***
	(0.036)	(0.037)	(0.038)
Distance	-0.523***	-0.523***	-0.520***
	(0.016)	(0.016)	(0.017)
Constant	-21.666***	-24.890***	-33.624***
	(0.284)	(0.360)	(0.654)
Random effects			
Company (headquarter)	4.544***	4.551***	4.239***
	(0.169)	(0.169)	(0.161)
Observations	89,349	89,349	84,549
Number of groups	2,287	2,287	2,167
Chi-square	11019	11067	11143
Log-likelihood	-31656	-31541	-30002
Intraclass Correlation	0.580	0.580	0.563
LR test vs logistic	0.000	0.000	0.000

Standard errors in parentheses - *** p<0.01, ** p<0.05

It is important to note that, given the insertion of the interaction term between the PMR and EPL indicators, the signs of the individual coefficients on their own are not really telling. What counts are their overall marginal effects, which considers also the interaction term. Therefore we have computed the overall marginal effects at the mean values of the key explanatory variables, as reported in Figure 1.

Figure 1: **Marginal effects of third-pillar variables and tax rate on location probability**



In the baseline specification (see column 1 of Table 5), the PMR indicator is negative and significant, and it remains significant in the rest of the specifications, also when the interaction effect is included. In contrast, the EPL index in the baseline specification is not significant, but becomes so in the presence of the interaction term between the two composite indicators. In particular, the coefficient capturing the interaction effect between PMR and EPL is negative and significant, and does not vary when additional controls are included.

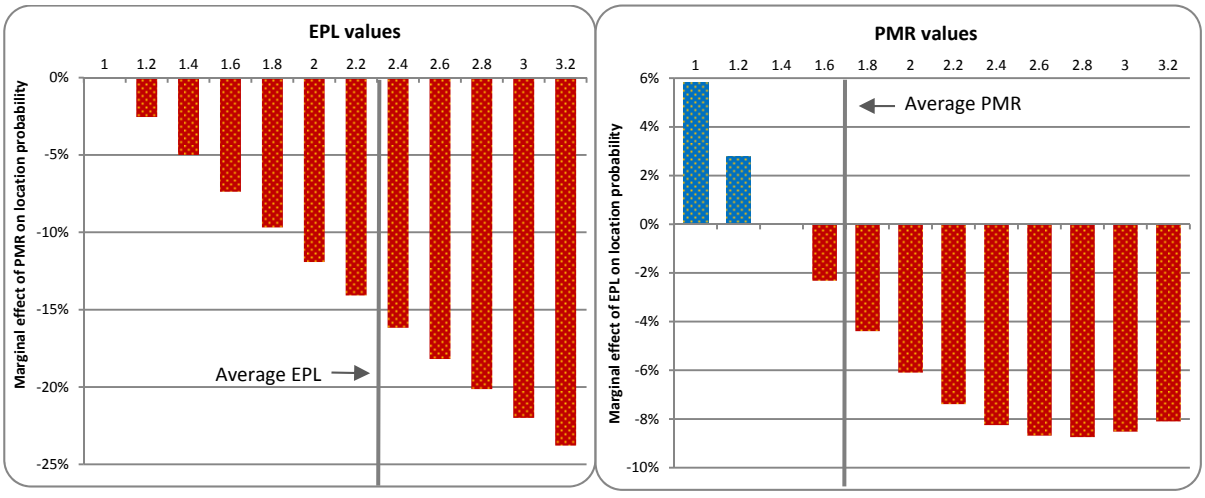
This means that PMR and EPL are indeed complementary, as in Aghion *et al*. (2009). Exploiting macro-panel data for OECD countries, they found that the interaction between PMR and labour market rigidity explained a major part of the total factor productivity growth of countries close to the technological frontier, the effect of EPL being significantly lower if considered on its own. Moreover, this result may imply that there is a certain value of the PMR above which the EPL becomes a significant negative explanatory variable of the location probability, an aspect that will be dealt with in more detail in section 4.2.3.

The marginal effect of PMR is by far the largest, indicating that PMR is the factor with the most influence on the location decisions of R&D-intensive multinationals. EPL ranks second, followed by the tax rate on profits and the cost of starting a business (which, in our setting, proxies the level of red tape, but is also an important indicator of the business dynamism of a country).

More specifically, a 1-point increase/decrease in the PMR indicator decreases/increases the probability of choosing a particular location by 16.1 %. The same increase/decrease in the EPL indicator decreases/increases said probability by 3.5 %. If the two policy indicators are considered separately (i.e. not as complementary regulation tools) the marginal effect of a 1-point increase/decrease in PMR on the location probability is much lower, as it would decrease/increase by only 7.5 % (see Table A2, column 1), and the level of EPL is not even significant, as already stressed. An increase in the tax rate on profit decreases the location probability by 1.2 %, and an increase in the cost of start a business decreases it by 1 %.

Because of the non-linearity of the logit model, and to better exploit the interaction/complementarity between EPL and PMR, we also computed the marginal effects of each of these two variables for different values of the other one (Figure 2). As anticipated, the non-significance of EPL in the baseline specification (where EPL and of PMR are considered separately) allows the identification of a threshold value of PMR above which EPL becomes significant in determining the location probability.

Figure 2: **Marginal effects of PMR and EPL indicators for different values of each other**



Note: only marginal effects statistically significant are reported.

Interestingly, Figure 2 shows that the negative impact of PMR on the location probability increases as the level of EPL rises (Figure 2, left). This means that the higher the level of employment protection legislation in a given country, the greater the negative marginal effect of PMR on location probability.[22] More interestingly, for low levels of PMR, the effect of EPL on the same probability is null (and eventually positive; Figure 2, right), which is in line with the results obtained for the baseline specification 1. Stated simply, the higher the level of product market regulation, the higher the negative effect of employment protection and *viceversa*.

Given the prominent role of the level of product market regulation emerged in the analysis, being the PMR index used a composite indicator (see Section 3.1), we can explore which one of its three main components – State Control, Barriers to trade and investment, and Barriers to Entrepreneurship – has the greater influence on the location probability.

Table 6 reports the estimations using the full specification used in Table 5 (column 3), including separately the three components of PMR as explanatory variables and their interactions with the EPL composite indicator.

Table 6: **Probability of locating subsidiaries in a given country: regression results. Comparison among the three components of PMR**

	State Control	Barriers to trade and investment	Barriers to entrepreneurship
Employment Protection (EPL)	1.460***	0.527***	0.821***
	(0.102)	(0.041)	(0.078)
State Control 2008/13	0.748***		
	(0.109)		
EPL*State Control 2008/13	-0.672***		
	(0.043)		
Barriers to trade and investment 2008/13		1.514***	
		(0.083)	
EPL*Barriers to trade and investment 2008/13		-1.183***	
		(0.038)	
Barriers to entrepreneurship 2008/13			1.240***
			(0.101)
EPL*Barriers to entrepreneurship 2008/13			-0.653***
			(0.041)
Cost of starting a business	-0.068***	-0.140***	-0.023**
	(0.009)	(0.010)	(0.009)

[22] As the average value of the PMR indicator for the whole sample of companies is 2.4, the marginal effect of the PMR indicator is 16 %, as previously mentioned.

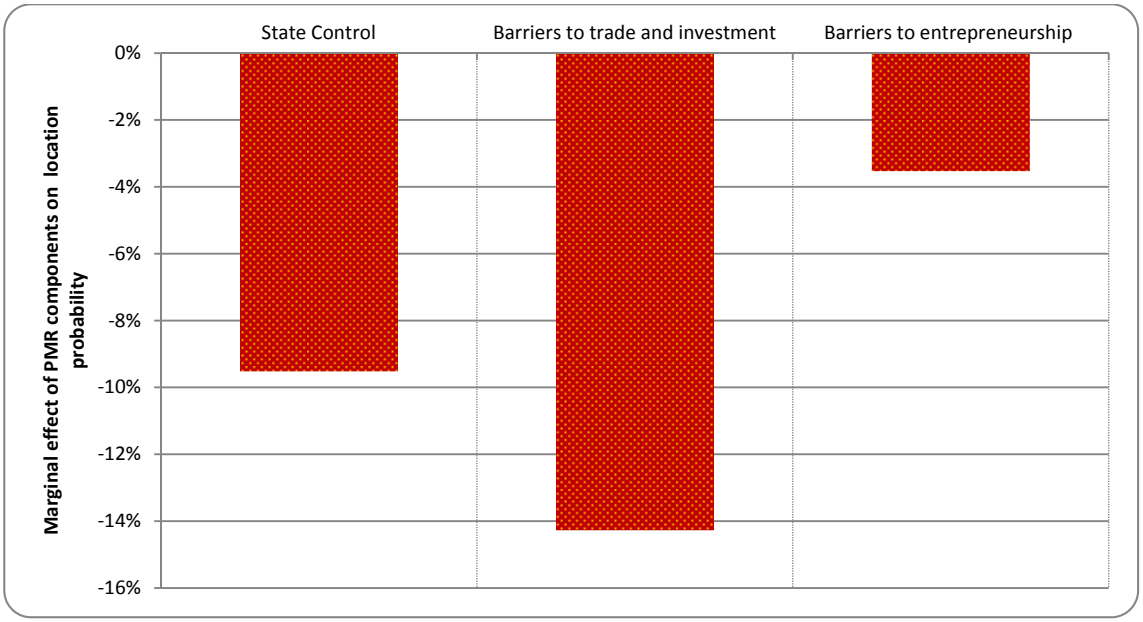
Profit Tax	0.005	-0.058***	0.012
	(0.020)	(0.020)	(0.020)
GDP	1.143***	1.249***	1.201***
	(0.015)	(0.015)	(0.015)
Trade as a share of GDP	0.539***	0.625***	0.889***
	(0.039)	(0.040)	(0.038)
Unemployment share	0.167***	-0.266***	0.187***
	(0.028)	(0.032)	(0.028)
Difference in gdp per capita (sub_country-HQ_country)	-0.410***	-0.703***	-0.144***
	(0.019)	(0.024)	(0.019)
Common borders	-0.336***	0.039	-0.120**
	(0.055)	(0.056)	(0.054)
Common official language	0.776***	0.646***	0.684***
	(0.038)	(0.038)	(0.038)
Distance	-0.558***	-0.467***	-0.508***
	(0.017)	(0.017)	(0.017)
Constant	-32.081***	-34.027***	-35.486***
	(0.669)	(0.619)	(0.651)
Random effects			
Company (headquarter)	4.307***	4.246***	4.325***
	(0.164)	(0.161)	(0.166)
Observations	84,549	84,549	84,549
Number of groups	2,167	2,167	2,167
Chi-square	11151	11035	10454
Log-likelihood	-30109	-29991	-30641
LR test vs logistic	0.000	0.000	0.000

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

The three columns of Table 6 report the coefficients of the independent variables, each including a different component of PMR in the set of explanatory variables.

As for the results in Table 5, the presence of the interaction term between EPL and one of the PMR components (a different one for every specification) makes the simple reading of the individual coefficients' signs and magnitude misleading. Therefore, Figure 3 reports the overall marginal effects at the mean values of the three PMR components.

Figure 3: **Marginal effects of the three PMR components**



Barriers to trade and investment is the component with the greatest negative impact on location probability (–14.3 %), followed by state control (–9.5 %) and barriers to entrepreneurship (–3.5 %). Therefore, explicit barriers to trade (such as differential treatment of foreign suppliers) and excessive state control (which often means unfair competition from state-owned enterprises) have a greater effect on the probability of an MNC's subsidiary to be located in a particular country than barriers to entrepreneurship, which is probably more relevant for smaller companies.

4.2.2 The effects of country and geographical control variables

As shown in Tables 5 and 6, country controls included are significant and enter the equation with the expected sign,[23] both when the PMR indicator is considered as a whole and when its three components are treated separately.

In addition, as expected, and in line with previous empirical evidence (Barrios *et al*., 2012; Alstadsæter *et al*., 2015), the tax rate on profits shows a significant negative correlation with the probability of locating in a particular host country.[24]

Our proxies for a country's market potential (GDP), innovation capacity (its R&D intensity) and its openness to trade (trade as a proportion of GDP) are positive and significant in all the specifications. Our companies tend to locate where market potential and head-start opportunities are higher. This finding is in line with many studies stressing the importance of these factors as motivation for investments in general—and R&D investment in particular. Our companies also tend to favour countries with levels of GDP per capita lower than the source country, hinting that they may also target skilled labour at a lower cost.

As far as the included geographical controls are concerned, we found that distance from headquarters negatively affects the probability of locating subsidiary activities in a given foreign country. In fact, the

[23] A relevant exception is represented by the unemployment rate. For this variable, the sign changes across the different specifications. However, these signs are in line with simple correlation coefficients between PMR (and its components) with unemployment rate. Because correlations are in general low (less than 0.12 in absolute terms) we keep unemployment rate in the estimation, but we retain ourselves from giving an interpretation of this result.

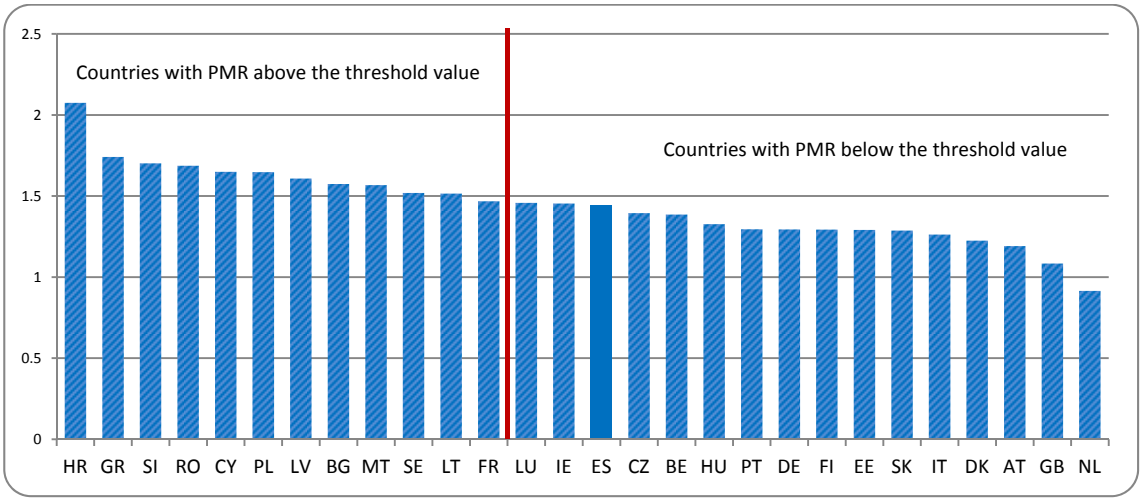
[24] The literature on the impact of taxation on FDI is considerable as reviewed by De Mooij and Everdeen (2006) and Devereux and Maffini (2007).

relative estimated coefficients are negative and strongly significant for all the specifications. In addition, sharing a border shows a significant negative correlation with the probability of location in the host country, whilst the dummy for commonality of spoken language affects it positively. These three findings suggest that distance does indeed have an effect on the location decision of the companies analysed. They tend to locate their subsidiaries neither too close to nor too far from their headquarters, and also choose on the basis of a common language. Sharing a language increases the efficiency in transferring and aggregating knowledge (Grant, 1996). The importance of this factor makes particular sense in the case of knowledge-intensive companies, such those in this analysis.

4.2.3 The threshold value of the PMR index to benefit from PMR/EPL complementarity

As previously anticipated, there is a threshold value of the PMR index (1.46) below which the level of employment protection legislation has no effect on the location decision of top R&D Multinationals. Figure 4 ranks the EU-28 countries according to their average PMR level in 2013, from the highest to the lowest, and also shows the aforementioned threshold value. Hence, the sample of countries is divided into two groups, above and below the threshold.

Figure 4: **PMR in 2013 and threshold value for the EU-28 countries**



To benefit from the complementarity between PMR and EPL, and to significantly increase[25] the probability of attracting R&D-intensive multinationals, countries above the threshold (from France to Croatia) should reduce their PMR value below 1.46. Clearly, this does not imply that those countries below the threshold would not benefit from a reduction of PMR, as the coefficient attached to the PMR indicator is always negative and significant (Table 5). However, in the case of countries below the threshold, the combined effect of both indicators and the effect of PMR alone are the same, as the marginal effect of the EPL indicator is zero (or even, at very low PMR values, positive).

[25] As seen in section 4.2.1, the combined marginal effect of a reduction of PMR and EPL is larger than the effect of a reduction of the same magnitude of the PMR indicator alone.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper aimed at investigating the extent to which product and labour market regulations and red tape affect, among other socio-economic factors, the probability that top corporate research and development (R&D) investors locate in a particular country.

In general our results confirm previous empirical evidence showing that R&D-intensive MNCs tend to locate their international activities in countries with greater market potential, head-start opportunities and openness to trade. Companies prefer to move into countries close rather than far away from their headquarters. They also choose the location for their international activities on the basis of cultural factors, such as a common language. This could make the task of sharing and integrating technical knowledge (often tacit) easier, which would lead to lower costs.

The empirical evidence confirms our key theoretical hypotheses: product and labour market regulations, as well as the cost of starting a business, significantly affect the location decision of top R&D investors' subsidiaries. When taken separately, the level of PMR has the greatest negative effect on companies' location decisions, while EPL does not appear to play a significant role in such choices. When considering the interaction between PMR and EPL, results show that these two regulations exert a mutually reinforcing negative effect on the decision of top R&D investors about where to locate their subsidiaries. More specifically, the negative effect of a one-point increase of the PMR indicator on the probability of locate subsidiaries in a given country increases when its interaction with EPL is considered (from –7.5% to –16%). The effect of EPL is negative and significant (–3.5%) only when coupled with high levels of PMR. In other words, the higher the level of product market regulation, the higher the negative effect of employment protection and *viceversa*. Translated into policy terms, these results suggest the importance of bearing in mind both markets when considering possible reforms of one of the two. The interplay between PMR and EPL calls for integrated/coordinated policies in the two realms.

Among the different components of the PMR index, barriers to trade and investment have the greatest impact on location decisions, followed by state control and barriers to entrepreneurship. In particular, a one-point decrease of the barriers to trade and investment indicator leads to a 14.3 % increase of the probability of locate subsidiaries in a given country, *versus* a 9.5 % and a 3.5 % increase in the case of a similar reduction of the state control and barriers to entrepreneurship indicators, respectively. By lowering barriers to trade and investment, EU policy-makers may facilitate the market uptake of new products and have the greatest impact in attracting foreign investments.

Interestingly, the study identifies a threshold of the PMR index above which EPL becomes significant in deterring location decisions. In addition, the analysis shows that, given their current level of PMR, there are some EU countries (France, Lithuania, Sweden, Malta, Bulgaria, Latvia, Poland, Cyprus, Romania, Slovenia, Greece, Croatia) that could particularly benefit from the PMR/EPL complementarity emerged. In fact, by reducing the level of the PMR indicator below the threshold identified in the analysis (1.46), these countries would trigger the complementarity effect and become a more attractive location for MNCs' subsidiaries.

The cost of starting a business and the corporate income tax rate also play a negative role on companies' location decisions. However, their effect is much lower than that of the other two framework conditions discussed above. The decisions of the companies considered in our study seem to be driven more by a desire to improve efficiency than by cost reduction considerations.

Finally, a caveat should be kept in mind when reading our results. In our analysis we focus on a particular set of firms (the top R&D investors worldwide) and on their current subsidiaries, for which we don't have the year of establishment. This limits our analysis to the observation of conditional ex-post probabilities.

Second, the aforementioned PMR/EPL complementarity does not automatically imply that markets should be deregulated as such because, as shown in Aghion *et al.* (2005) for innovation, an excessive reduction of market regulation could even negatively influence country attractiveness. Therefore, further research on this area may provide additional insights on the necessity to carefully consider how product market regulation and employment protection interact in different socio-economic environments taking into account the multiple effects they have on the society.

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APPENDIX

Table A1: **Descriptive statistics for the regression model explanatory variables**

Variable	Obs	Mean	Std. Dev.	Min	Max
Employment Protection (EPL)	91,677	2.40	0.51	1.08	3.31
Product Market Regulation (PMR)	100,829	1.70	0.49	0.94	3.25
Cost of starting a business	141,918	1.44	1.52	-3.91	4.06
Profit Tax	139,630	2.53	0.64	0.18	3.35
GDP	141,981	26.13	1.51	22.32	30.25
Trade as a share of GDP	141,981	4.42	0.57	3.19	6.05
Unemployment share	139,709	1.93	0.52	0.02	3.18
Difference in gdp per capita (sub_country-HQ_country)	134,421	-0.93	1.43	-4.86	4.38
Distance	146,372	8.65	0.89	4.09	9.89

Table A2: **Marginal effects of the key variables (from table 5)**

	(1)	(2)	(3)
EPL	-0.4%	-0.8%	-3.5%
PMR	-7.5%	-6.8%	-16.1%
Cost of starting a business			-1.0%
Profit Tax			-1.2%

Note: *EPL is not significant at 5% in (1)*

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