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Factors influencing the FDI Location choice for knowledge intensive services and headquarters within the EU and Austria

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Abstract

This study investigates the determinants of bilateral Greenfield FDI projects and flows in knowledge intensive business services from OECD/BRIC countries to the EU countries for the period 2003-2010. Greenfield FDI projects are distinguished by type of activity: (i) business services, (ii) design, development and testing activities, (iii) headquarters activities and (iv) R&D services. Another aim of this study is to provide new empirical evidence on the patterns of Greenfield investments in knowledge intensive business services over time, source country and destination country. For Austria, the number of Greenfield investments in headquarter functions remains stable over time whereas Greenfield investments in R&D and related activities declined during the sample period. The same holds true for the number of jobs generated through greenfield investments. The results using panel count data models show that wage costs, tertiary education, corporate taxes, having a common border and sharing a common language all play a significant role in determining bilateral Greenfield FDI projects in knowledge intensive services. However, the impact of corporate taxation and labour costs differs widely across the functions and does not play a role in Greenfield investments in R&D and development, design and testing services.

Keywords: Greenfield foreign direct investment, knowledge intensive business services, headquarter functions, R&D activities, gravity equation, panel data, FDI determinants

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 **ÖSTERREICHISCHES INSTITUT FÜR
WIRTSCHAFTSFORSCHUNG**

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Intensive Business Services**

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This study investigates the determinants of bilateral Greenfield FDI projects and flows in knowledge intensive business services from OECD/BRIC countries to the EU countries for the period 2003-2010. Greenfield FDI projects are distinguished by type of activity: (i) business services, (ii) design, development and testing activities, (iii) headquarters activities and (iv) R&D services. Another aim of this study is to provide new empirical evidence on the patterns of Greenfield investments in knowledge intensive business services over time, source country and destination country. For Austria, the number of Greenfield investments in headquarter functions remains stable over time whereas Greenfield investments in R&D and related activities declined during the sample period. The same holds true for the number of jobs generated through greenfield investments. The results using panel count data models show that wage costs, tertiary education, corporate taxes, having a common border and sharing a common language all play a significant role in determining bilateral Greenfield FDI projects in knowledge intensive services. However, the impact of corporate taxation and labour costs differs widely across the functions and does not play a role in Greenfield investments in R&D and development, design and testing services.

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1 Introduction

Traditionally, Europe has a relatively strong position in FDI inflows in knowledge intensive business services. This also holds true for Austria. However, in recent years, the locational attractiveness of the EU countries for Greenfield investment in knowledge intensive business services decreased. In Austria, the number of Greenfield investments in R&D activities and development, design and testing activities have decreased significantly since 2008. At the same time, multinational corporations in industrialized countries are increasingly engaged in the offshoring of higher value added knowledge intensive activities - often to low wage countries (Lewin, Massini and Peeters, 2009; Dossani, and Kenney 2007). In particular, offshoring of R&D facilities and business services has increased significantly in recent years (Hall, 2010; Doh et al., 2009). The number of relocations of corporate and regional headquarters has also increased in the past years (Baaij et al, 2012). Advances in information and communication technologies are seen as the main factors for the rise of FDI in knowledge intensive services.

The simultaneous occurrence of an increase in offshoring of knowledge intensive activities to emerging economies and the decrease in the FDI inflows in knowledge intensive activities in Europe raised widespread concerns about declining EU competitiveness for new cross border investments in higher value added activities. Business services and R&D and headquarter services all belong to the group of knowledge intensive business services. These activities belong to most targeted industries in EU countries. One reason for targeting knowledge intensive services is the potential indirect spillover effects for local companies and local universities. Direct effects include an increase in demand for high skilled workers. Relocation of headquarters may result in higher tax revenues. Knowledge intensive business services are typically more complex, involve symbolic–analytical work and often require higher skilled workers than other types of services, such as payroll processing and call centers (Manning et al. 2010).

Historically, in Austria, foreign controlled enterprises have played an important role not only in manufacturing, but also in services, which accounts for 20 per cent of total output in business services. The dominance of foreign controlled enterprises is even greater for R&D activities with a share of almost 50 per cent (based on FATS statistics

published by Statistics Austria). In Austria, special incentives and programs are available for foreign affiliates and local headquarters that also conduct R&D activities. Given that governments actively seek to attract FDI in knowledge intensive services and the recent decline in FDI inflows in knowledge intensive services in Europe and Austria, it is worth investigating the main host country factors influencing the decision to invest abroad.

In this study, a FDI gravity model based on Greenfield investment data is estimated. The data, with about 5,500 observations, consists of bilateral Greenfield investment flows' project data for four types of knowledge intensive business services from 26 OECD/BRIC countries to the EU member states (EU-27) for the period 2003-2010. The basic gravity model is augmented by a large number of policy and non policy factors (e.g. corporate taxes and labour costs, FDI regulation, costs of starting a business and labour market flexibility indicators) and factor endowments (e.g. skills, R&D and broadband penetration).

The main contribution of the study is to estimate the determinants of Greenfield FDI flows for different business services using panel data methods that allow for the controlling of fixed host and home country common time effects. Knowledge intensive business services are distinguished in three types: (i) business services, (ii) design, development and testing activities (iii) headquarter services and (iv) R&D services. The FDI gravity model is estimated using the Poisson Pseudo-Maximum Likelihood (PPML) estimator, which was developed by Santos Silva and Tenreyro (2011a, 2011b). The PPML estimator makes it possible to account for zero flows and also allows for the inclusion of host and home country factors as well as time dummies. Greenfield FDI data is drawn from the FDI market's database, which contains flows for about 110,000 investment projects worldwide for the period 2003-2010. Another contribution is to provide stylized facts on the trends and patterns in the change in Greenfield investment in Europe and in Austria.

Despite the growing interest in the determinants of knowledge intensive business services, few studies have investigated the location factors for knowledge intensive business services. Available previous studies tend to agree that skills, corporate taxes, cultural proximity and, to a lesser extent, labour costs and ICT infrastructure matter for

attracting FDI in business services (Liu, Feils and Scholnick, 2011; Bunyaratavej, Hahn, and Doh, 2007, 2008; Doh, Bunyaratavej and Hahn, 2009). Similar findings are obtained for FDI in headquarter functions. Some studies find that institutional quality and GDP per capita of the host country are significant factors for FDI in business services (Kolstad and Villanger, 2008). For FDI in R&D activities and innovation, the literature agrees that the knowledge base is more important than cost based factors (OECD 2011).

The literature on the determinants of FDI using gravity equations is extensive (Zwinkels and Beugelsdijk, 2010 and Fratianni, Marchionne and Oh, 2011). However, few studies have investigated the determinants of Greenfield FDI flows in knowledge intensive business services. Knowledge of the determinants of Greenfield FDI in knowledge intensive business services is particularly important to policy makers because Greenfield investment often leads to an increase in productivity and employment and into technology spillovers in the host country whereas the effects of FDI through mergers and acquisitions are less straightforward. In fact, Wang and Wong (2009) find that Greenfield FDI is significantly positively related to economic growth whereas FDI through M&As is insignificant.

The structure of the report is as follows. Section 2 presents the empirical model and the hypotheses. In section 3, trends in Greenfield investment in Europe and Austria over time and by source, destinations countries and correlations with possible FDI determinants are discussed. In section 4, a range of empirical results are presented and, lastly, section 5 contains concluding remarks.

2 Empirical model and hypotheses

2.1 Previous literature and hypotheses

In general, the determinants of FDI are likely to differ across different functions. Where cost based considerations may play an important role for FDI in manufacturing, FDI knowledge intensive activities are unlikely to be driven by low labour costs, but rather depend on the availability of a knowledge base, such as skilled workers and qualified universities (Narula and Bellak, 2009). Historically, higher value added service activities, such as R&D and design, have been less likely to be offshored than

production facilities' goods (Venables, 1999). However, advances in ICT increase the probability of relocation of such activities. An increasing number of studies have investigated the location factors for specific corporate functions (e.g. business services, headquarter services and R&D services) (see OECD 2009 for a summary of the literature). The literature on the determinants of bilateral FDI flows and stocks using gravity models is extensive (see Chakrabarti, 2001 for a survey). For FDI in services based on official FDI data, few studies are available (Kolstad and Villanger, 2008; Ramasamy and Yeung, 2010; Riedl, 2010). This strand of the literature investigates the determinants of FDI in business services using aggregate or bilateral cross-country data. Using data for 38 countries, Kolstad and Villanger (2008) find that institutional quality (measured as socio-economic conditions, government stability, corruption, law and order and bureaucratic quality) and high level GDP/capita in the host country are the main factors influencing FDI flows in business services. Using data for the OECD countries for the period 1980-2003, Ramasamy and Yeung (2010) find that education, openness with respect to service trade and market size are the main factors for FDI in services. More fundamentally, the authors find that FDI in services is highly persistent over time indicating that the effect of various factors on FDI are much lower in the short term than when compared to long term effects. In addition, quality of labour is relatively more important than mere cheap labour costs in attracting FDI. However, services are not distinguished between business services and remaining services.

Most studies use commercial FDI data to investigate the determinants of FDI in knowledge intensive services. The literature tends to agree that skills, corporate taxes and cultural factors are the main factors for attracting FDI in business services (Liu, Feils and Scholnick, 2011; Doh, Bunyaratavej and Hahn, 2009). In addition, cost saving considerations due to taxes, wage and energy prices may play a role. Among the cost factors, corporate taxes and labour costs are regarded as main factors for attracting FDI in business services (Doh et al., 2009; Bunyaratavej et al., 2008; Farrell, 2005). The result for the impact of ICT infrastructure is mixed.

In particular, Doh et al. (2009) investigated the determinants of service offshoring for three types of services, namely, call centres, ICT services and shared service centre based a global database of over 36,000 FDI projects since 2002. The authors find that

the relative level of education, relative wage costs, English language and distance are important and significant drivers of service offshoring for call centres, ICT services and shared service centres. However, ICT infrastructure and host country GDP are not significantly different from zero.

Liu, Feils and Scholnick (2011) investigated the determinants of US service offshore outsourcing between the period 1992–2005. The data consist of a broad range of service activities, including financial, telecommunication, computer and information services and business services. The authors find that host country GDP, tertiary education, international Internet bandwidth, institutional quality (contract enforcement and property rights, the police, and the courts) and cultural proximity all have a significant impact on service offshoring. Wage costs and geographical distance are negatively associated with service offshoring. More importantly, the authors find that services that are more routine, less complex or less interactive (such as technical services) are outsourced more to foreign countries. In contrast, non-routine, complex and interactive services, such as financial services and research and development and testing services, are offshored more frequently.

Home country conditions may also play an important role for outward FDI. Witt and Levin (2007) suggest that the increase in outward FDI is a strategic escape response caused by the home country institutional environment.

Another strand of the literature is based on surveys among multinational firms on their judgment about the main location factors for business services. Based on the survey data of 485 U.S. firms and 880 European firms, Manning (2012) investigated the importance of location factors for knowledge intensive business services. The author find that the availability of domain-level expertise and talent pools and low labor costs are of major importance, while infrastructure, cultural and geographical proximity are of low importance. Sass and Fifekova (2011) investigated the location factor in the business service sector in Eastern Europe. Based on 30 interviews conducted with senior managers in the business service sector, the authors find that the availability and cost of educated and skilled labour is regarded as one of the most influential factors in their decision to invest in Central and Eastern Europe (Sass and Fifekova, 2011). Quality of infrastructure (especially information and communication infrastructure) and the

political and business environment are of some importance while investment incentives and cultural proximity play no role.

According to UNCTAD's World Investment Prospect Survey (2009), among foreign investors, demand side pull factors are the most important determinants for a location's attractiveness for business services. In particular, size, growth of local markets and access to international/regional markets are regarded as the main location factors (see Table 1). The availability of skilled labour and talent is ranked as the fourth most important location factor with 12 per cent. In contrast, for total FDI, availability of skilled labour and talents is ranked as the sixth most important location factor indicating that location factors differ between FDI in business services and other types of FDI activities. It is interesting to note that availability of skilled labour is a more important location factor than cheap labour costs. The most striking result from the survey is the very minor importance of incentive schemes and access to finance as determinants in attracting FDI in business services.

Table 1: Location factors by order of importance 2009-2011

	Business services	Total
Presence of suppliers and partners	10.3	9.9
Follow your competitors	2.6	4.5
Availability of skilled labour and talents	12.1	8.3
Cheap labour	10.3	5.6
Size of local market	15.5	17.1
Access to international/regional markets	12.9	9.6
Growth of market	16.4	15.9
Access to natural resources	-	4.0
Access to capital market (finance)	2.6	3.0
Government effectiveness	4.3	4.7
Incentives	3.4	2.5
Quality of infrastructure	4.3	6.3
Stable and business friendly environment	5.2	8.6
total	100	100

Source: World investment Prospects survey 2009-2011. UNCTAD (2009).

R&D activities differ from business services in many aspects. Business services are more tradable whereas R&D activities of multinational enterprises are geographically concentrated in the home country. Lewin et al. (2009) suggest that innovation activities should be kept under the tight control of the parent company. Conventional wisdom suggests that the home country should remain the most important single location for R&D (Patel, and Pavitt, 1991). An exception is the foreign R&D activities of some

large multinational companies in small countries (e.g. Switzerland, Sweden) (Cantwell, 1999). More recently, Criscuolo et al., (2010) determined that innovative activity within multinational firms is largely concentrated on the parent company.

A major motivation for FDI in R&D and related knowledge activities is the need to augment a firm's knowledge base. This is often referred to as asset-augmenting R&D. The previous empirical literature on the determinants of FDI in R&D activities agree that the available knowledge base, such as the scientific infrastructure and educational qualifications of the work force, are the main factors for attracting FDI in R&D and related activities (Rilla and Squicciarini, 2011). Hall (2010) suggests that the quality and specialisation of local universities and research institutions and the availability of scientists and engineers are the most important location factors for R&D. Another important determinant of the international location of R&D is the potential for knowledge spillovers from competitors, universities and research institutes (Lewin et al. 2009). In addition, firms may also be sensitive to the tax treatment of their R&D spending. Lewin et al. (2009) suggest that the shortage of skilled labour in the multinational corporation's home country will lead to higher offshoring of innovation activities.

Firms' rankings of the importance of location factors for R&D find similar results. Based on a survey of 246 multinationals in the US and EU countries, Thursby and Thursby (2006) find that access to scientists and engineers, both as employees and at universities, intellectual property rights protection and ownership are the main factors for locating corporate R&D in developed countries whereas tax breaks and subsidies are ranked as least important. Innovation activities are typically highly agglomerated. The reason for the geographical concentration is the possibility of knowledge spillovers from competitors and universities. Therefore, Greenfield investment in R&D activities may exhibit a high degree of path dependence. It is often stated that there are tendencies to follow the location decision of other multinational firms. These strategies are commonly referred to as herd behavior or "follow the leader" strategies (Rilla and Squicciarini, 2011). Another important location factor is the level of value added of foreign affiliates in medium and high technology industries, as these types of activities often require substantial R&D expenditures (Kuemmerle, 1999). Size of the market is

historically regarded as another location factor (Doh et al., 2005). However, Baldwin (2009) suggests that the importance of market size decreased due to further globalisation and growing integration of countries whereas the importance of supply side factors increased. Cost based factors are generally regarded as less important than other factors (Erken and Kleijn, 2010). Based on the FDI market's database, Catellani, Jimenez-Palmero and Zanfei (2011) suggest that distance is less important in determining bilateral FDI activity in R&D while cultural factors and regional trade agreements are significant and positive. Based on 1,722 offshored R&D projects between 2002 and 2005, Demirbag and Glaister (2010) find that the knowledge infrastructure (R&D, level of education) in the host country is a major determinant of R&D offshoring.

Traditionally, multinational companies keep their corporate headquarters in the country of origin. In recent years, relocation of headquarters has increased. Relocations of regional headquarters are more common than those of corporate locations. Location factors for corporate and regional headquarters include attractive corporate tax rates, attractive personal tax rates, availability of highly skilled workers, cultural proximity, ICT infrastructure, availability of frequent international air flights, central geographic location and other factors (availability of quality residential housing, quality medical services, cultural amenities) (Deschryvere, 2009, Py and Hattem, 2010). Based on 14,000 investment projects, Py and Hatem (2010) find that sharing the same language, skill level and market potential are additional important factors for FDI in headquarter services. Agglomeration forces are also important for the location decision of headquarter services. For instance, Strauss-Kahn and Vives (2009) find that headquarter location is significantly positively influenced by the presence of headquarters in the same region. Possible explanations are knowledge spillovers through employee mobility. Home country factors may also have an influence on headquarter relocations. In particular, high levels of corporate taxation will lead to higher probability of headquarter relocations (Baaij et al., 2012). Based on the Zephyr database for industrialized countries, Voget (2011) finds that headquarter relocation is highly sensitive to corporate taxes (including the treatment of repatriation of foreign profits) in the host country. In particular, the author finds that a one-percentage point decrease in foreign effective tax rates increases the likelihood of relocation by 0.22 percentage

points. Laaman, Sumular and Torstila (2012) find that cross-border headquarter relocations in Europe are also sensitive to taxation in regard to home country taxes.

Based on a survey of multinational firms operating in Austria, Sieber (2008) finds that the availability of skilled workers and educational attainment are the main location factors for headquarter services. Furthermore, the modification of the group taxation regime in 2004, which now includes foreign subsidiaries, is seen as a major location factor for FDI in headquarter services. Knoll (2004) finds that institutional factors (legal structure and security of property rights), educational attainment of workers, availability of skilled workers and corporate taxation are the main location factors with little differences between Greenfield investment in services, in general, and headquarter services, in particular.

FDI barriers in the host country are likely to discourage inward FDI into knowledge intensive services since they lead to higher investment costs. In addition, product-market regulations in the host country may also lead to additional costs on businesses and create barriers to entry for FDI (Azémar and Desbordes, 2010). Activities of investment promotion agencies can also influence FDI inflows in knowledge intensive services activities. Investment promotion agencies offer a variety of supporting services and often concentrate activities on a few priority sectors or target activities. In Austria, R&D activities, headquarter services, automotive, biotechnology, ICT and green technologies belong to the targeted priority sectors (see Austrian business agency). These activities all require a high skill level of the local workforce. To analyze the quality of the services provided by investment promotion agencies, the World Bank has developed Global Investment Promotion Benchmarking (World Bank, 2009). Investment promotion agencies for Austria and for EU countries are ranked quite high with an unweighted average of "Good" for the EU-15 countries and "Best Practice" for Austria.

To sum up, Greenfield FDI inflows in knowledge intensive services may depend on a large number of factors. However, little is known about the major factors influencing Greenfield FDI flows into knowledge intensive services.

2.2 Empirical model

The empirical specification takes into consideration a wide range of potentially relevant determinants of FDI. Recent studies by Carr, Markusen and Maskus (2001) and Bergstrand and Egger (2007) emphasized the role of differences in skill endowments and capital intensity between the host and home country in determining bilateral FDI flows. In addition, a wide range of characteristics of the host and home markets play an important role for Greenfield investment in business services. As outlined above, these variables include market size, cost based factors - such as labour costs - corporate and labour taxes, skills, ICT infrastructure and FDI restrictions.

The dependent variables are the log number of Greenfield FDI projects (plus one project) in four types of knowledge intensive services. The types of services most likely associated with service offshoring tend to be those that are capable of being performed from a wider distance and whose products can be delivered through relatively new forms of advanced telecommunications (Internet). Software programming, accounting or telephone call centre services are among the service categories that are most easily outsourced to low-wage locations, such as India or Central Eastern Europe. Blinder (2006) characterizes the kind of services that are the most susceptible to international outsourcing as services that require no face-to-face interaction and can be impersonally delivered.

The empirical specification is based on a standard FDI gravity equation augmented by several host and home country factors:

$$\begin{aligned} \ln(FDISVCS_{ijt} + 1) = & \beta_0 \ln GDPHOME_{it-1} + \beta_1 \ln GDPHOST_{jt-1} + \beta_2 \ln DIST_{ij} + \beta_3 CORPTAXHOME_{it-1} + \\ & + \beta_4 CORPTAXHOST_{jt-1} + \beta_5 ULCHOME_{it-1} + \beta_6 ULCHOST_{jt-1} + \beta_7 \ln TERTIARYHOME_{it-1} + \\ & \beta_8 TERTIARYHOST_{jt-1} + \beta_9 \ln RELGDPCAP_{ijt-1} + \beta_{10} EURO_{ijt} \cdot NEWEURO_{ijt} \\ & + \beta_{11} EU_{ijt} \cdot EUNEW_{ijt} + \phi X_{ijt-1} + \theta Z_{ij} + \alpha_{ij} + \lambda_t + \varepsilon_{ijt} \end{aligned} ,$$

where i is the home country, j is the host country and \log is the natural logarithm. The variables are defined as follows:

$FDISVCS_{ijt}$ is the number of Greenfield FDI projects in one of the four service categories from the parent i to the source country j . In addition, the logarithm of estimated Greenfield FDI flows (plus one EUR) from parent country i to host country j are used;

$GDPHOME_{it-1}$, $GDPHOST_{jt-1}$ are home and host country GDP in current EUR;

$DIST_{ij}$ is the distance between capital cities of the investing and host country;

$CORPTAXHOME_{it-1}$, $CORPTAXHOST_{jt-1}$ are the effective average tax rate for the nonfinancial sector of the home and host country respectively;

$WHOME_{it-1}$, $WHOST_{jt-1}$ are wage costs of the home and host country respectively;

$TERTIARYHOME_{it-1}$, $TERTIARYHOST_{jt-1}$, are the share of labour force, between ages 15 and 74, with tertiary education (levels 5 and 6) of the home and host country respectively;

X_{ijt-1} represents a set of time varying host and parent country factor variables (i.e. R&D/GDP ratio, FDI regulatory restrictiveness index, strength of legal rights index for getting credits, strength of investor protection index, cost of starting a business as a percentage of income per capita, employment protection legislation, top marginal tax rate, protection of intellectual property, hiring and firing practices, labor force share with wages set by centralized collective bargaining, fixed broadband Internet subscribers, Internet users per 100 people, total tax rate of businesses in per cent of commercial profits and quality of investment promotion agencies);

Z_{ij} represents time invariant control variables (i.e. contiguity, sharing the same language and when they share a (former) colonial link) and ε_{ijt} is the error term.

The gravity equation contains bilateral country-pair fixed effects, α_{ij} , in order to control for unobserved time-invariant heterogeneity and includes common time effects, λ_t .

The main hypotheses are that corporate taxation and wage costs in the host country have a negative impact on Greenfield investment in knowledge intensive services, but the effect is likely to be higher for business and headquarter services than for the remaining knowledge intensive services. Note that corporate taxes are only a crude measure of the tax burden of headquarter functions and R&D activities since they are often less strongly taxed than other types of investment (Bellingwout et al. 2012). However, data on the exact tax burden for these functions are limited.

In addition, a skilled labour force in the host country is expected to increase Greenfield investment in knowledge intensive services. Endowment of ICT measured as broadband penetration Internet penetration is also expected to have a positive and significant impact on Greenfield investment for all types of knowledge intensive services. Furthermore, Greenfield FDI outflows in business services may be higher for countries characterized by a high level of skilled labour force and/or R&D GDP ratio.

Host and home country regulation of product markets and labour market flexibility can also affect Greenfield investment. Among the regulation indicators, FDI restrictions are considered to be the most important. Although the FDI restrictions in EU countries have significantly declined in the last decade, FDI in some business services is still hampered by restrictions. Tight employment protection legislation in the host countries is expected to have a negative effect on Greenfield investment.

One estimation problem is the presence of zero values of Greenfield FDI in the different types of business services. It is well known that in the presence of zero investment flows, pooled OLS or fixed-effects estimates are biased due to heteroscedasticity. Here, Santos-Silva and Tenreyro (2006, 2011b) introduced the Poisson pseudo-maximum likelihood (PPML) estimator, which can handle zero values for the dependent variable and is consistent even in the presence of heteroscedasticity. The PPML estimator belongs to the count data regression models, but can be applied if the dependent variable is positive and continuous and the conditional mean function is exponential (Wooldridge 2002). Since the dependent variable meets these requirements, we use the fixed-effects PPML and cluster robust standard errors (clustered by host countries). In principle, the gravity equation can be directly estimated without taking the natural logarithm of the dependent variable. Another possibility is to add one unit to the dependent variable and then apply the natural logarithm. This makes it possible to interpret the regression coefficients as elasticities or semi-elasticities. The PPML estimator enables us to control for target and source country factors as well as time dummies. Since multinational enterprises will not react immediately to changes in the FDI determinants, all explanatory variables are lagged one year ($t-1$).

3 Data and descriptive statistics

Greenfield investment in knowledge intensive business services is drawn from the FDI markets database, which contains a register of about 110,000 Greenfield investment projects worldwide for the period 2003-2011. The FDI project information is derived from media sources and can be interpreted as investment commitments. The FDI markets database contains information on the type of FDI project by function, name and country origin of the parent company, destination country and number of jobs generated by Greenfield investment and the amount of capital flows. The FDI market's database is used by the UNCTAD in its World investment report and is also widely used in the academic literature (Hahn, Bunyaratavej and Doh, 2011; Davies and Desbordes, 2012; Di Minin and Zhang; 2010).

The database is particularly appropriate for Greenfield FDI projects in services that are often characterized by low capital intensity and those which are also likely to be underrepresented in the balance of payments-statistics. Note that the investment flows and the corresponding number of jobs generated by these FDI flows are based on estimated data, which may not be completely accurate. The advantage of Greenfield investment data is that they are also less affected by round-tripping activities via various EU countries. It is well known that FDI activity in some EU countries is exaggerated by the phenomenon of round-tripping FDI.

The data consists of Greenfield FDI projects and flows in three types of services for 26 major home countries (i.e. Australia, Austria, Belgium, Brazil, Canada, China, Denmark, Finland, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Russia, South Korea, Spain, Sweden, Switzerland, United Kingdom and United States), 27 host countries, namely the EU-27 member states for the period 2000-2010 (total bilateral FDI stock), and for the period of 2003-2010 for Greenfield FDI. For the purpose of the project, four out of the fourteen different activities are chosen: (i) business services, (ii) design, development and testing activities, (iii) headquarters activities and (iv) R&D services. Headquarter services may include regional and corporate headquarter services. The FDI projects are aggregated across source and destination country and by types of business services. For the

analysis, about 10,000 FDI projects are extracted. The data is taken from various sources (see Table 1).

Table 1: Definition of the explanatory variables

variable	measure	source
level of GDP	EURO current prices	New Cronos, OECD, national statistics
geographical distance	distance between the principal cities weighted by population size in kilometers	Mayer and Zignago (2006)
sharing the same language	dummy variable	Mayer and Zignago (2006)
(former) colonial link	dummy variable	Mayer and Zignago (2006)
shared border	dummy variable	Mayer and Zignago (2006)
educational attainment of the people aged between 15-64	share in total population aged 15-64 in per cent	New Cronos, OECD, national statistics
ratio of R&D expenditures to GDP	per cent	New Cronos OECD and EUROSTAT, World Bank
hourly labour costs in the business sector	EURO in current prices	New Cronos, U.S. Bureau of labor office for some non EU countries.
effective average tax rate	per cent	European Commission, "Taxation trends in the European Union" based on ZEW, based on Devereux and Griffith (1999, 2003)
strength of investor protection	index (0-10) (10=highest protection)	World Bank
protection of intellectual property	index (0-10) (10=highest protection)	World Bank
getting credit - strength of legal rights	index (0-10) (10=best)	World Bank
ratio of costs of starting a business to income per capita	per cent	World Bank
Fixed broadband Internet subscribers	per 100 people	World Bank
Internet users	per 100 people	World Bank
ratio total tax rate to commercial profit	per cent	World Bank
top marginal tax rate	per cent	Economic Freedom
hiring and firing practices	index 1-10, 1=least,10=most regulated	Economic Freedom
labor force share with wages set by centralized collective bargaining	index 1-10, 1= highly centralized, 10=least centralized, i.e. best	Economic Freedom
Employment protection	index 0-4, 0=best,	OECD
FDI regulatory restrictiveness	index 0 and 1, 0=open and 1=closed	OECD, Kalinova, Palerm and Thomsen (2010)

For the FDI gravity equation using Greenfield FDI, the total number of possible combinations is 5,616 (i.e. 8 years x 26 parent countries x 27 host countries). However, for some parent and home countries, there are no bilateral FDI activities. These cases have to be excluded.

Table 2 provides the evolution of the number of Greenfield FDI projects in Austria distinguished by the four different types of knowledge intensive services. In addition, the number of jobs generated by Greenfield investment are provided. One can see that the number of Greenfield FDI projects is very small, ranging between 14 for business services and between four and five for the remaining knowledge intensive services per year on average for the period 2003-2011. As expected, the number of FDI projects decreased after the financial and economic crisis in 2009. An exception is the number of FDI projects in headquarter services, which has remained relatively stable over time.

The number of jobs generated through Greenfield investments is highest for headquarter services with about 680 new jobs per year on average and lowest for business services. The number of jobs generated by Greenfield investment in R&D services, design, development and testing and business services are 418, 98 and 246 per year on average respectively. This indicates that FDI in headquarter functions lead to larger employment creation than other types of investments. Overall, the employment generation by Greenfield investment in business services is small given the number of domestic employment in the corresponding sector, namely professional, scientific and technical activities with about 418,000 employees. Greenfield investments in R&D are relatively more important when comparing the number of 95,000 R&D employees with the number of new jobs generated by Greenfield FDI.

Table 2: Number of Greenfield FDI projects and number of jobs in Austria, 2003-2010

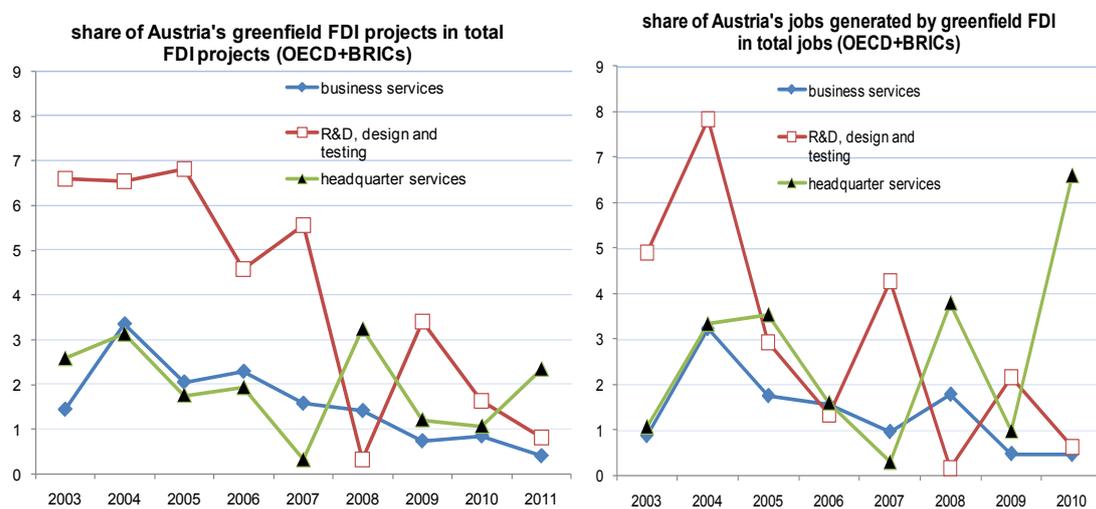
	business services	Design, Development, testing	Headquarters	R&D services
	number of Greenfield FDI projects			
2003	8	2	4	4
2004	17	5	6	2
2005	15	3	4	6
2006	22	2	4	6
2007	19	8	1	8
2008	20	1	11	0
2009	10	4	5	6
2010	11	5	4	0
2011	7	2	7	0
mean 2003-'11	14	4	5	4
	number of jobs generated by Greenfield investment			
2003	87	500	212	278
2004	290	960	480	540
2005	233	350	737	527
2006	289	150	296	327
2007	346	670	100	1176
2008	547	70	1318	0
2009	145	248	348	915
2010	122	276	2169	0
2011	153	355	459	0
mean 2003-'11	246	398	680	418
	number of jobs per FDI project			
2003	11	250	53	70
2004	17	192	80	270
2005	16	117	184	88
2006	13	75	74	55
2007	18	84	100	147
2008	27	70	120	
2009	15	62	70	153
2010	11	55	542	
2011	22	178	66	
mean 2003-'11	17	120	143	130

Source: FDImarkets database.

Looking at the number of jobs generated per FDI project, one can see that headquarter function, development, testing and R&D services and design generate much more jobs than those generated by business services.

Figure 1 shows the evolution of the share of Greenfield FDI projects in total FDI projects in the OECD and BRIC countries over time. In addition, the corresponding share in number of jobs generated by Greenfield FDI is provided. One can see that Austria's share in world FDI projects (defined by FDI projects in the OECD and BRICs) for business services and R&D design and testing steadily decreased over time. This indicates that Austria's attractiveness to investors in the area of knowledge intensive services decreased significantly after the financial crisis. In contrast, the share of Greenfield investments in headquarter services remains stable over time, but is highly volatile at the same time. Note that the increase in the number of jobs generated by Greenfield FDI in 2009 is caused by a large headquarter relocation in the electronics equipment sector.

Figure 1: Number of Greenfield FDI projects and number of jobs created by service activity in Austria, 2003-2010



Source: FDImarkets database.

Table 3 shows the distribution of the number of FDI projects by source country. One can see that German multinationals are the largest investors in knowledge intensive business services by far dominating other investors. This already indicates that cultural proximity, namely, sharing a common language and geographical proximity, such as

sharing a border, are major factors driving Greenfield FDI activities between the two countries. The United States is the second largest investor with the exception of FDI in development, design and testing and Canada is the second largest investor. The strong position of German investors is also confirmed by firm level data of German multinationals. Based on firm level data for German multinational enterprises, Austria is the second most important foreign location for R&D after the US (Belitz, 2012).

Table 3: Number of Greenfield FDI projects by activity and destination country (means 2003-2010)

business services		Design, Development, testing		Headquarters		R&D services	
source	# FDI-P	source	# FDI-P	source	# FDI-P	source	# FDI-P
Germany	40	Germany	17	Germany	16	Germany	15
United States	15	Canada	6	United States	5	United States	3
United Kingdom	12	United States	4	France	5	UAE	3
Italy	9	Netherlands	2	United Kingdom	3	United Kingdom	2
Denmark	7	Japan	2	Italy	3	Italy	2
other	43	other	1	other	13	other	7

Source: FDImarkets database.

Table 4 shows a cross-country comparison of the number of FDI projects and corresponding jobs generated. The results are restricted to European locations (excluding Russia and Ukraine). Among the EU countries, the United Kingdom, Germany, Spain, France, Ireland and Switzerland are the primary destinations for the four types of knowledge intensive business services accounting for both 63 per cent of total Greenfield investment projects in the EU-27, plus Norway and Switzerland, and 64 per cent of jobs generated by these investments. Given the country's size, Austria has attracted a significant number of Greenfield FDI in knowledge intensive activities, such as R&D and headquarters services. Between 2003 and 2010, the cumulated number of jobs created by foreign multinationals in headquarter services and through Greenfield FDI was about 5,960. The United Kingdom, followed by Spain, Germany, Netherlands, Switzerland and France, is the most attractive location for headquarter services in the EU/EFTA countries in terms of new jobs generated by Greenfield FDI. The United Kingdom is particularly successful in attracting headquarter function, accounting for 29 per cent of all Greenfield headquarter projects in the EU countries (plus Norway and Switzerland) and 20 per cent of the number of jobs generated by these investment. The reason for this is the cultural historical proximity to the US. For FDI in headquarter functions, Austria is in the 10th and clearly ahead of other comparable countries, such

as Sweden, Denmark and the Czech Republic. Furthermore, the Netherlands and Switzerland both exhibit a relatively large share of FDI in headquarter functions given their size in terms of population. This may indicate that locations in core regions in Western Europe are preferred over more peripheral locations, but may also reflect favourable tax regimes for holding conditions.

Table 4: Number Greenfield FDI projects and their jobs generated by activity and destination country cumulated between 2003-2010

	business scvs	dev, design, testing	head- quarters number of projects	R&D	business scvs	dev, design, testing	head- quarters number of jobs	R&D
Austria	126	32	45	32	2127	3526	5949	3763
Belgium	167	49	70	32	4824	4975	6176	2480
Bulgaria	115	20	1	6	2093	1263	84	360
Cyprus	22	0	0	0	286	0	0	0
Czech Republic	149	60	20	17	2281	5868	1887	1999
Denmark	124	30	76	20	1906	2187	4872	1262
Estonia	47	9	5	1	660	325	426	92
Finland	61	12	7	10	959	976	436	508
France	576	124	145	107	18561	7276	9606	5474
Germany	733	166	247	70	11588	11064	16918	6642
Greece	101	3	7	0	1953	197	741	0
Hungary	175	37	22	39	2956	4085	1972	3365
Ireland	238	87	129	81	7155	5627	11479	5316
Italy	281	38	17	38	4264	2959	2865	3897
Latvia	28	1	4	2	1381	67	390	32
Lithuania	39	3	1	4	762	185	104	309
Luxembourg	57	3	9	1	1412	138	424	5
Malta	23	0	2	1	313	0	146	173
The Netherlands	171	32	125	17	3620	2587	16282	882
Norway	30	7	3	4	436	673	308	427
Poland	230	69	22	30	8342	5217	2952	3241
Portugal	96	14	5	9	1370	1341	324	663
Romania	331	69	33	15	6157	9126	6609	1223
Slovakia	61	12	12	4	950	1485	941	1570
Slovenia	26	3	4	0	352	114	368	0
Spain	387	91	142	96	6425	11239	19286	7263
Sweden	157	45	45	26	3151	3589	4137	2606
Switzerland	304	29	148	16	5774	2686	15828	1286
United Kingdom	1159	248	539	159	28399	20595	32523	17174
coefficient of variation	1.20	1.26	1.70	1.33	1.35	1.22	1.38	1.20

Source: FDI markets database.

The corresponding cumulated number of jobs in R&D activities created by FDI is about 3,760 for the similar time period. Here, Austria is in the seventh position, but clearly ahead of other countries with similar country size, level of GDP per capita and level of absorptive capacity (e.g. R&D/GDP ratio), such as Finland, the Netherlands, Denmark, Switzerland, Belgium and Sweden. However, as mentioned above, the number of Greenfield FDI projects in R&D activities significantly decreased after 2008. As expected, the most advanced countries in Europe account for the largest proportions of FDI in R&D activities. However, the Czech Republic, Hungary, Poland and Slovakia

received a significant amount of FDI in R&D activities as can be seen in the number of jobs generated by this type of FDI when compared to their country size and absorptive capacity.

Another striking feature of Greenfield investment in knowledge intensive services is that the concentration of the investments differ for the different activities. From Table 4, we see that the coefficient of variation is highest for headquarter and R&D services indicating a larger dispersion of these activities.

Table 5 gives an indication of FDI specialisation patterns at the country level both measured in terms of number of FDI projects and the corresponding number of jobs generated.

Table 5: Share of Greenfield FDI projects in total Greenfield FDI projects and jobs by activity and destination country mean 2003-2010

	share of Greenfield FDI by activity in per cent				share of employment created by Greenfield FDI by activity in per cent			
	business services	Design, Development, testing	Head-quarters	R&D services	business services	Design, Development, testing	Head-quarters	R&D services
Austria	15.2	3.7	4.9	4.0	2.7	4.3	7.6	5.0
Belgium	12.0	3.5	5.4	2.4	4.7	4.8	5.7	2.4
Bulgaria	10.1	1.7	0.1	0.5	0.8	0.5	0.0	0.1
Cyprus	35.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0
Czech Republic	9.8	4.5	1.1	1.3	0.7	2.2	0.4	0.7
Denmark	19.5	4.7	12.9	3.1	5.4	6.1	14.6	3.1
Estonia	13.6	2.1	1.2	0.3	1.5	0.7	0.6	0.2
Finland	19.3	3.0	1.3	3.3	4.1	2.8	0.9	2.3
France	14.0	3.0	3.6	2.7	7.6	2.9	3.9	2.3
Germany	16.3	3.6	5.9	1.7	3.8	3.7	6.0	2.3
Greece	31.7	1.0	2.4	0.0	6.5	0.7	2.7	0.0
Hungary	10.2	2.1	1.3	2.4	0.9	1.1	0.6	1.1
Ireland	19.6	6.4	10.3	7.1	6.2	4.4	9.5	4.9
Italy	19.8	2.8	1.2	2.8	3.3	2.4	2.3	3.2
Latvia	9.7	0.4	1.5	0.7	3.5	0.2	1.0	0.1
Lithuania	11.7	1.0	0.3	1.0	1.7	0.6	0.3	0.5
Luxembourg	37.9	2.1	6.4	0.7	16.7	1.8	5.6	0.1
Malta	23.7	0.0	2.6	1.3	1.7	0.0	1.0	1.2
Netherlands	13.2	2.5	9.7	1.5	4.3	3.1	19.4	1.1
Norway	11.1	3.0	1.3	1.3	2.4	4.2	1.9	1.1
Poland	8.8	2.7	0.8	1.2	1.3	0.8	0.4	0.5
Portugal	17.1	2.4	0.9	1.7	1.5	1.4	0.4	0.7
Romania	16.8	3.2	1.7	0.8	0.9	1.3	1.0	0.2
Slovakia	7.2	1.5	1.3	0.5	0.4	0.7	0.4	0.8
Slovenia	16.7	1.3	2.7	0.0	1.7	0.2	1.8	0.0
Spain	13.9	3.1	5.1	3.6	1.8	3.2	5.7	2.2
Sweden	17.6	5.1	5.0	3.0	5.9	4.9	7.6	5.0
Switzerland	29.0	2.9	14.4	1.7	10.5	4.9	29.0	2.7
United Kingdom	18.3	3.8	8.5	2.7	5.6	4.0	6.6	3.1
EU-27	15.3	3.2	4.8	2.2	2.7	2.2	3.4	1.5

Source: FDImarkets database.

In the EU countries, based on unweighted country averages, the share of Greenfield FDI projects in the four main knowledge intensive business services (business services,

design development and testing, Headquarter and R&D services) amounted to 25 per cent during the period 2003-2010. The corresponding share for the number of jobs generated by Greenfield investment is 9.8 per cent. It is interesting to note that Austria received a disproportionate share of Greenfield investment in headquarter and R&D services during the sample period with a share of 28 per cent in terms of number of projects and 20 per cent in terms of number of jobs generated. In particular, Austria received higher than average inflows of R&D services and headquarter services with shares of five and 7.6 per cent of total jobs generated by Greenfield investments over the period 2003-2010 respectively. Switzerland is the country showing the highest specialization in headquarter functions with a share of 29 per cent of all Greenfield jobs during the period 2003-2010.

Table 6 shows the regional distribution of the Greenfield investments in knowledge intensive services. As expected, there is a large urban concentration of FDI inflows in knowledge intensive services. For headquarter functions, London is number one in Europe, followed by Dublin, Copenhagen and Amsterdam. Vienna is in the eighth position. When measured in terms of jobs generated by these investments, Vienna is in the fifth position. For FDI in R&D services, Barcelona is the most attractive location with about 35 FDI projects in FDI activities. Vienna is in the seventh position.

Table 6: Share of Greenfield FDI projects in total Greenfield FDI projects and jobs by activity and destination country mean 2003-2010

headquarter				develop- ment design, testing				R&D services			
rank	city	co.	# proj.	rank	city	co.	# proj.	rank	city	co.	# proj.
1	London	UK	206	1	Dublin	IE	34	1	Barcelona	ES	35
2	Dublin	IE	72	2	Belfast	UK	32	2	Budapest	HU	23
3	Copenhagen	DK	57	3	Bucharest	RO	22	3	Dublin	IE	21
4	Amsterdam	NL	56	4	London	UK	21	4	Cambridge	UK	17
5	Barcelona	ES	45	5	Budapest	Hu	20	5	Belfast	UK	13
6	Paris	FR	42	6	Paris	FR	19	5	Cork	IE	13
7	Madrid	ES	33	6	Prague	CZ	19	5	Paris	FR	13
8	Vienna	AT	31	7	Warsaw	PL	18	6	Galway	IE	11
9	Geneva	CH	30	8	Madrid	ES	16	6	Montpellier	FR	11
10	Berlin	DE	28	8	Munich	DE	16	7	Edinburgh	UK	10
				9	Copenhagen	DK	14	7	Vienna/Orth Donau	AT	10
12	Villach	AT	12	9	Edinburgh	UK	14	8	Copenhagen	DK	8
				10	Barcelona	ES	13	8	Madrid	ES	8
				10	Brno	CZ	13	8	Milan	IT	8
								8	Prague	CZ	8
									Sophia-Antipolis		
				11	Graz	AT	12	8	Nice	FR	8
				15	Vienna	AT	8	8	Stockholm	SE	8
								8	Wroclaw	PL	8
								9	Aalborg	DK	7
								9	Munich	DE	7
								10	Dijon	FR	6
								10	Larne	UK	6
								10	London	UK	6

headquarter				develop- ment design, testing				R&D services			
rank	city	co.	# jobs	rank	city	co.	# jobs	rank	city	co.	# jobs
1	London	UK	11473	1	Bucharest	RO	4692	1	London	UK	3249
2	Barcelona	RD	7470	2	Belfast	UK	2354	2	Budapest	HU	1840
3	Dublin	IR	6531	3	Dublin	IE	2230	3	Madrid/etafe	ES	1600
4	Amsterdam	NL	5967	4	Budapest	HU	2035	4	Barcelona	ES	1532
5	Vienna	AT	4885	5	Brno	CZ	1812	5	Dublin	IE	1451
6	Seville	ES	4341	6	London	UK	1730	6	Turin	IT	1250
7	Copenhagen	DK	3601	7	Prague	CZ	1543	7	Stockholm/Södertälje	SE	1212
8	Bucharest	RO	3382	8	Madrid	ES	1377	8	Cambridge	UK	1207
									Karlsruhe		
9	Geneva	CH	3067	9	Warsaw	PL	1293	9	Hagenbach	DE	1100
10	Utrecht	NL	3000	10	Kraków	PL	1236	10	Prague	CZ	1082
				12	Graz		1205	11	Villach	AT	1040
				26	Vienna		873	12	Vienna Orth/Donau	AT	976

Source: FDImarkets database.

In order to give a first indication of the determinants of Greenfield FDI activity, scatter plots for selected FDI determinants are provided where FDI activity is aggregated across source countries. Note that FDI activity is adjusted by country size. This is done by dividing the number of jobs by domestic employment in the corresponding sector. Figure 2 shows a negative and significant relationship between Greenfield FDI flows in business services and two different measures of taxation, namely effective average corporate taxes and the total tax rate. There is also a negative and significant correlation between FDI in development, design and testing activities and corporate taxes (Figure 3).

Figure 2: Correlation between Greenfield FDI activity in business services and taxes

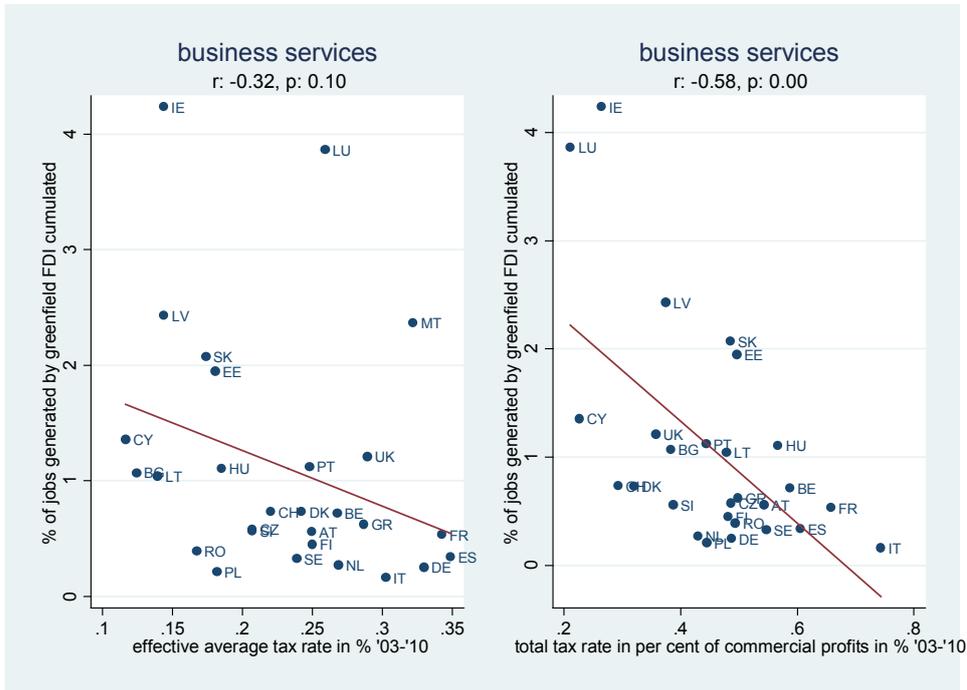
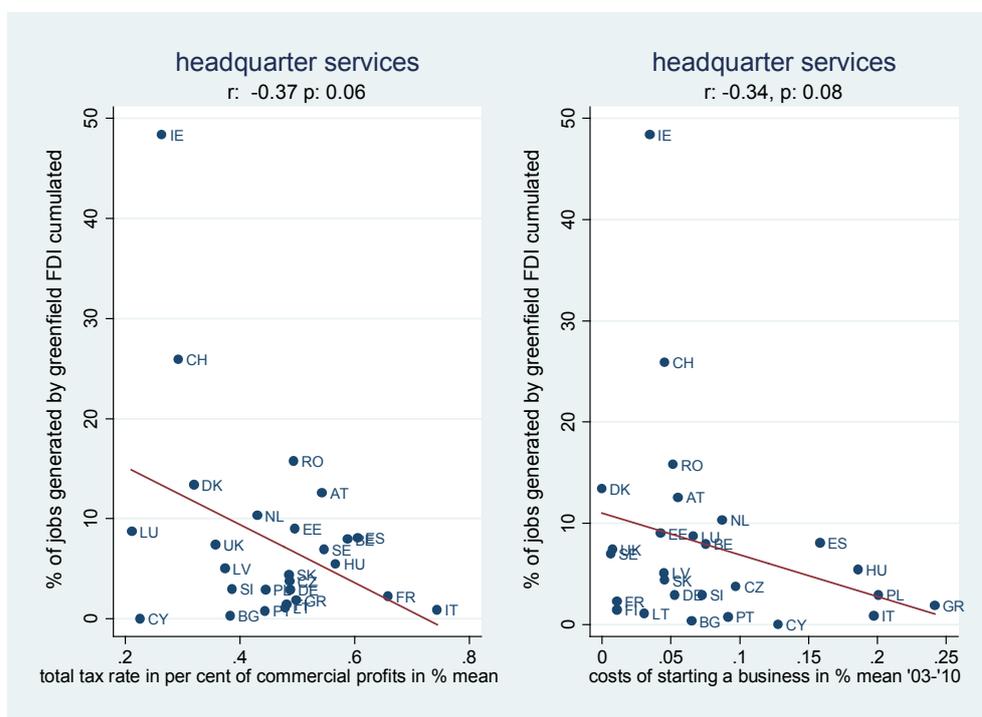


Figure 3: Correlation between Greenfield FDI activity in development, design and testing and both taxes and costs of starting a business



Figure 4: Correlation between Greenfield FDI activity in headquarter services and both taxes and costs of starting a business



However, the correlation between the costs of starting a business and FDI inflows in development, design and testing activities is not significantly different from zero (Figure 3). Furthermore, on one hand, there is a negative correlation between taxes and FDI inflows in headquarter functions and, on the other hand, between FDI inflows and the costs associated with starting a business (Figure 4). This already indicates that cost based factors are significant determinants of Greenfield FDI inflows in headquarter functions.

Table 7 reports the correlation coefficients between Greenfield investments in the different knowledge intensive services from source country j to host country i (normalized by host country size) and a number of possible FDI determinants. Correlation coefficients are provided for the four different service activities. There is a significant relationship between Greenfield investment (as a percentage of host country GDP) in the knowledge intensive business services and corporate taxes of the host country. This also holds true for the adjusted top statutory tax rate on corporate income and can be observed for all four different types of activities.

Table 7: Correlations coefficients between the number of Greenfield FDI flows by activity and host country characteristics

		business services	Design, Development, testing	Head- quarters	R&D services
adjusted top statutory tax rate on corporate income in %	correlation	-0.08	-0.09	-0.05	-0.06
	p-value	0.00	0.00	0.01	0.00
	# of obs	3193	3193	3193	3193
effective average corporate tax rate in %	correlation	-0.09	-0.09	-0.04	-0.06
	p-value	0.00	0.00	0.02	0.00
	# of obs	3193	3193	3193	3193
total tax rate (% of commercial profits)	correlation	-0.08	-0.03	-0.08	-0.05
	p-value	0.00	0.24	0.00	0.02
	# of obs	1993	1993	1993	1993
unit labour costs	correlation	-0.07	-0.03	-0.01	-0.08
	p-value	0.00	0.13	0.48	0.00
	# of obs	3047	3047	3047	3047
hourly wage compensation in EUR	correlation	-0.08	-0.06	0.00	-0.03
	p-value	0.00	0.00	0.97	0.08
	# of obs	3184	3184	3184	3184
tertiary graduates share in %	correlation	-0.02	-0.03	0.02	-0.01
	p-value	0.35	0.07	0.35	0.62
	# of obs	3193	3193	3193	3193
R&D/GDP ratio in %	correlation	-0.08	-0.05	-0.02	-0.03
	p-value	0.00	0.01	0.23	0.07
	# of obs	3156	3156	3156	3156
fixed broadband internet subscribers (per 100 people)	correlation	-0.04	-0.04	0.01	-0.04
	p-value	0.01	0.02	0.75	0.02
	# of obs	3179	3179	3179	3179
internet users per 100 people	correlation	-0.04	-0.05	0.01	-0.04
	p-value	0.02	0.00	0.74	0.04
	# of obs	3179	3179	3179	3179
labor force share with wages set by centralized collective bargaining (1-10) (=1 highly centralized, 10=least centralized, i.e. best)	correlation	0.08	0.04	0.01	0.01
	p-value	0.00	0.04	0.79	0.55
	# of obs	2802	2802	2802	2802
strength of investor protection index (0-10) (10=highest investor protection)	correlation	0.02	0.04	0.06	0.07
	p-value	0.33	0.11	0.01	0.00
	# of obs	1993	1993	1993	1993
hiring and firing practices (1-10) (1=least regulated, 10=most regulated)	correlation	0.04	0.04	0.03	0.03
	p-value	0.02	0.05	0.17	0.07
	# of obs	2802	2802	2802	2802
protection of intellectual property (0-10) (10=highest protection)	correlation	-0.05	-0.05	0.02	-0.01
	p-value	0.01	0.02	0.23	0.73
	# of obs	2802	2802	2802	2802
top marginal tax rate in %	correlation	-0.06	0.01	-0.02	0.01
	p-value	0.00	0.63	0.22	0.77
	# of obs	2802	2802	2802	2802
cost of starting a business (% of income per capita)	correlation	0.00	-0.03	-0.04	-0.01
	p-value	0.91	0.06	0.03	0.74
	# of obs	3128	3128	3128	3128
getting credit - strength of legal rights index (0-10) (10=best)	correlation	0.05	0.04	0.05	0.05
	p-value	0.01	0.03	0.01	0.02
	# of obs	2782	2782	2782	2782
FDI regulatory restrictiveness index (0-1) (0=open; 1=closed)	correlation	-0.01	-0.02	-0.02	0.03
	p-value	0.77	0.34	0.27	0.08
	# of obs	3001	3001	3001	3001
distance in kilometers	correlation	-0.08	0.03	0.01	0.05
	p-value	0.00	0.11	0.66	0.00
	# of obs	3193	3193	3193	3193
shared border	correlation	0.03	0.00	0.01	-0.01
	p-value	0.14	0.97	0.65	0.59
	# of obs	3193	3193	3193	3193
common language	correlation	0.04	0.04	0.11	0.08
	p-value	0.04	0.03	0.00	0.00
	# of obs	3193	3193	3193	3193
former colony	correlation	0.09	0.01	0.09	0.01
	p-value	0.00	0.61	0.00	0.48
	# of obs	3193	3193	3193	3193

Unit labour costs and wages are partly significant. Sharing a common language is significantly related with Greenfield investment independent of the type of activity. Surprisingly, the level of broadband penetration and tertiary education are not significantly related to Greenfield investment in knowledge intensive services. The indicators of protection of intellectual property are partly significant depending on the measure and type of activity. The correlation coefficient already provides first evidence that the drivers of FDI in knowledge intensive services differ across the different types.

4 Empirical results

Table 9 in the Appendix shows the marginal effects obtained from the Poisson Pseudo maximum likelihood (PPML) estimator of the determinants of bilateral Greenfield FDI projects in the four different types of knowledge intensive business services in the EU-27 countries. The dependent variable is the logarithm number of bilateral Greenfield FDI projects plus one FDI project in order to keep observations with zero projects. Table 10 in the Appendix shows the corresponding marginal effects where the dependent variable is the logarithm of the amount of Greenfield investment.

Host country and parent country dummies are jointly significant, but not reported. The majority of policy and non policy factors are not included in the final specification because they are not significant at conventional significance levels. In particular, labour market flexibility, indicators of intellectual property rights protection, quality of investment promotion agencies and indicators of investor protection are insignificant when source and host country fixed effects, common time effects and other control factors are taken in account. The FDI regulatory index has the expected negative sign, but is statistically insignificant even when based on one-sided-tests (p-value of 0.10). One reason for the insignificance of these variables is that the annual time variation is very small and a longer time series based on a five-year interval data is needed to explore the effects of these variables.

Furthermore, we do not find significant evidence that Greenfield investments in knowledge intensive services are influenced by past investments measured either by the past cumulated number of FDI projects in one the four functions or by Greenfield investment flows and, therefore, not included in the final specification.

The findings for the gravity factors, namely the logarithm of host country and home country GDP and distance, are mixed. For Greenfield investments in business services, we find that host and home country GDP are positive and significant, indicating that Greenfield FDI projects in business services increase with the market size of the host country and with the level of GDP of the parent country. The coefficients are also robust with respect to the measurement of Greenfield investment, which is either based on the number of projects or the amount of investment flows. The elasticities are quite large with values exceeding one when Greenfield investment is measured as capital flows. For Greenfield investment in R&D services and the related group, namely development, design and testing activities, the results show that market size is insignificant. The insignificance of host country GDP indicates that market seeking considerations are not relevant for FDI in R&D, design and testing activities. This is consistent with Nachum and Zaheer (2005) who find that FDI in information intensive industries is unlikely to be driven by market seeking considerations. For FDI in headquarter functions, size of the host market clearly matters, but the elasticities are somewhat smaller than that for business services.

Surprisingly, the results show that geographical distance is significantly positively related with FDI in knowledge intensive business services in three out of four cases. This means the higher the distance, the higher the bilateral Greenfield FDI activity in knowledge intensive service between two countries. For FDI in headquarter services, Py and Hatem (2010) also find distance to be a positive coefficient. Overall, this indicates that multinational companies increasingly choose offshore locations independent of the geographical distance from the home country. However, Greenfield investment activity is still higher between neighbouring countries.

However, for FDI in business services, the results show a negative, but insignificant sign for distance. Although geographical distance is not significant, geographical proximity plays some role as can be seen in the significance of the coefficient of a common border. Host countries with a common border to the parent country receive more than 100 per cent Greenfield investments than compared to those not sharing a common border. The common border effect is larger for FDI in business services than for the remaining knowledge intensive services.

Cultural factors are also relevant in influencing bilateral Greenfield FDI in knowledge intensive business services. For Greenfield FDI in R&D services, development, design and testing activities the results show that a common language significantly increased the number of bilateral activity between two countries whereas for business and headquarter services, sharing a common language is irrelevant.

The impact of the effective average corporate tax rate also differs widely across the different types of knowledge intensive services. In particular, there is a negative and significant effect of corporate taxes on the number of Greenfield FDI projects in business and headquarter services. The marginal effects are -0.32 and -0.17 indicating that a decrease in the effective average corporate tax rate by one percentage point increases the number of Greenfield FDI projects by 0.3 and 0.17 per cent. When Greenfield investment is measured as the investment flows, one can see that the impact of corporate taxation is quite large in absolute terms with semi-elasticities of -4.1 and -3.7. This indicates that a one percentage point increase in the effective average tax rate leads to decrease in Greenfield investment by 4.1 and 3.7 per cent respectively. The results are consistent with Voget (2011) who finds the relocation of headquarters to be highly sensitive to changes in corporate income tax rates. It is interesting to note that the impact of corporate taxes on Greenfield investment in business and headquarter services is quite large when compared to the findings of recent meta-analyses (Feld and Heckemeyer, 2011).

For FDI in R&D services, development, design and testing activities the results show that corporate taxation has a negative impact, but the coefficients are not significantly different from zero. The impact of the other main cost factor, namely wage cost, also differs across the different knowledge intensive business services. For FDI in business services and headquarter services, the results show a negative and significant impact of hourly wages in the host country. However, hourly wages are not relevant for FDI in R&D and development, design and testing. This indicates that cost based factors are of minor importance for Greenfield investment in high value added activities.

The coefficient of the share of tertiary education in the host country is positive in all cases, but not significantly different from zero in all cases. When measured as the amount of Greenfield investment, the tertiary graduates' share is positive and significant

in the case of Greenfield FDI in business and headquarter services. However, tertiary education in the host country seems to be irrelevant in cases of FDI in R&D activities. The insignificance of the tertiary education share for FDI in R&D activities is somewhat surprising and stands in contrast to the literature. One explanation is that education quantity is a poor measure of the skills of the workforce in EU countries. The literature suggests that in industrialized countries the equality of education is more important than the quantity of highly educated workers.

The absolute difference in GDP per capita between the host and home country is positive and significant in the case of FDI in business services and partly for FDI in development, design and testing activities. This means, the higher the absolute difference in GDP per capita between the host and parent country, the higher the FDI activity between these countries. Parent country characteristics also play a minor role in offshoring of knowledge intensive business services. Specifically, FDI projects in development, design and testing increase with the R&D/GDP ratio of the source country. Similarly, FDI in business services increase with the tertiary education share of the host country.

Furthermore, this study finds that the costs associated with starting a business are a significant factor influencing Greenfield FDI inflows in development, design and testing and R&D services. This is robust with respect to the measurement of Greenfield investments. For FDI in R&D services, the results show that broadband penetration is a significant and positive determinant. This clearly shows that a high level of broadband penetration is a prerequisite for knowledge interactions, such as transferring codified knowledge, between the parent company and its affiliates.

5 Conclusions and policy implications

In this study, the determinants of bilateral Greenfield investments in knowledge intensive services from OECD/BRIC countries to the EU countries have been investigated. In addition, trends and patterns of Greenfield investment in knowledge intensive services across time and by destination and source country are documented. The FDI gravity equation is estimated using panel count data models that account for host, home and common time effects as well as zero values of Greenfield FDI flows.

The findings using the Poisson Pseudo Maximum Likelihood estimator show that corporate taxes, wage costs, tertiary education, common border and a common language all play a significant role for bilateral FDI flows in knowledge intensive business services. However, the impact of these FDI determinants differs greatly across the different knowledge intensive services. In particular, the effect of corporate taxation and wage cost is only significant for Greenfield investments in business services and headquarter functions, but is not relevant for investments in R&D activities and development and design and testing activities. Variables measuring the regulatory burden of businesses are significant for R&D services and development, design and testing activities. ICT infrastructure measured as broadband penetration is a significant factor for FDI in R&D services. Most other determinants (e.g., past FDI activities, employment protection, intellectual property rights and labour market protection) fail to have a significant impact on FDI activity in knowledge intensive services when host, home and common time effects are controlled for. Some of these determinants are significant when based on partial correlation coefficients.

The findings have several important policy implications. First, wage costs and corporate taxation are not as important for the location of R&D services and related activities as the media and political organizations suggest. Second, access to skilled workers is a substantial driver of FDI in business and headquarter services. However, general tertiary education is not relevant for FDI in services. Cultural factors, such as sharing a common language, are more important. This indicates that FDI in R&D is partly a result of historical factors, which are exogenous and difficult to overcome.

Furthermore, Greenfield FDI activity in knowledge intensive activities is a relatively tiny proportion when compared to domestic employment in business services. Between 2003-2010, the number of jobs generated by Greenfield investment in R&D activities and development, design and testing activities amounted to eight per cent of the total domestic R&D personnel or one per cent when measured on an annual basis. This suggests that direct employment effects are small. However, the indirect effect of FDI in knowledge intensive services through competition effects, demonstration effects and spillover effects to local firms are probably much larger than the direct effects. The decrease in Greenfield investment in both R&D activities (including development,

design and testing activities) since 2009 is striking and deserves further attention. Measures to increase the attractiveness of FDI in R&D services should be a major concern of policymakers. One particular problem is the extremely strong concentration of German FDI in Austria. However, there is a widespread fear that German multinationals will further increase their offshoring activities in R&D activities in certain Central and East European countries as well as in China and South-East Asia (Belitz 2012). It seems to be that much of the investment in the emerging markets is likely to be at the expense of investment in the neighboring regions.

The empirical results of the sensitivity of Greenfield investments in headquarter services to corporate taxes also has important policy implications. In contrast to FDI in R&D and related activities, FDI in headquarter functions remains stable over time. The decline in corporate tax rates in 2004 clearly contributed to this development. In addition, the introduction of the cross border group taxation regime in 2004 also helped to attract new headquarter functions from abroad. Therefore, the cross-border group taxation regime should be maintained.

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Appendix

Table 8: Ratio of jobs generated by Greenfield FDI to domestic employment in the business sector and R&D employment cumulated 2003-2010

	ratio of jobs generated in business services (cumulated) to domestic employment in business services	ratio of jobs generated (cumulated) in Design, Development and testing to total domestic R&D personnel	ratio of jobs generated in Headquarters services (cumulated) to domestic employment in business services	ratio of jobs generated in R&D services (cumulated) to total domestic R&D personnel
Austria	0.6	4.1	1.6	4.4
Belgium	0.7	6.1	0.9	3.0
Bulgaria	1.1	6.4	0.0	1.8
Cyprus	1.4	0.0	0.0	0.0
Czech Republic	0.6	8.5	0.5	2.9
Denmark	0.7	3.0	1.9	1.7
Estonia	1.9	3.7	1.3	1.0
Finland	0.5	1.2	0.2	0.6
France	0.5	1.6	0.3	1.2
Germany	0.3	1.5	0.4	0.9
Greece	0.6	0.3	0.2	0.0
Hungary	1.1	8.1	0.7	6.7
Ireland	4.2	18.8	6.8	17.8
Italy	0.2	1.0	0.1	1.3
Latvia	2.4	0.7	0.7	0.3
Lithuania	1.0	1.1	0.1	1.8
Luxembourg	3.9	2.6	1.2	0.1
Malta	2.4	0.0	1.1	11.8
Netherlands	0.3	2.3	1.2	0.8
Norway	0.2	1.2	0.1	0.7
Poland	1.1	4.3	0.4	2.6
Portugal	0.4	2.0	0.1	1.0
Romania	2.1	21.9	2.2	2.9
Slovakia	0.6	6.3	0.6	6.6
Slovenia	0.3	0.8	0.4	0.0
Spain	0.3	3.6	1.0	2.3
Sweden	0.7	3.1	1.0	2.3
Switzerland	1.2	2.9	3.3	1.4
UK	0.9	4.2	1.0	3.5

Table 9: Poisson Pseudo maximum likelihood (PPML) estimates of the determinants of bilateral Greenfield FDI projects in the EU-27 countries (marginal effects)

	business services		Design, Development & testing		headquarters		R&D services	
	dy/dx	z	dy/dx	z	dy/dx	z	dy/dx	z
log GDP in EUR, host country, t-1	0.21 ***	3.03	-0.03	-1.18	0.02 ***	3.28	0.04	0.97
log GDP in EUR, parent country, t-1	0.18 **	2.28	0.09 **	2.03	0.03	0.75	0.05	1.65
log distance	-0.01	-0.84	0.01 **	2.27	0.02 ***	3.18	0.01 ***	3.48
shared border	0.12 ***	3.21	0.02 *	1.75	0.04 ***	4.47	0.02 ***	2.67
common language	0.03	1.23	0.03 ***	3.04	0.01	1.00	0.02 ***	2.99
former colony	0.06 **	2.08	-0.01 ***	-2.59	0.00	0.41	-0.01 ***	-4.20
host effective average corporate tax rate, t-1	-0.32 **	-2.23	-0.10	-1.32	-0.17 **	-1.98	-0.10 *	-1.74
log hourly wages costs, host country, t-1	-0.21 ***	-3.44	0.00	-0.05	-0.05 ***	-3.64	-0.04	-1.33
log hourly wages costs, parent country, t-1	-0.13	-1.61	-0.09 *	-1.72	0.00	-0.08	-0.03	-0.94
log share of tertiary education, host country, t-1	0.11	1.60	0.08 *	1.89	0.06	1.50	0.02	0.46
log sh. of tertiary education, parent country, t-1	0.10	1.40	0.07	1.61	0.02	1.10	0.01	0.24
absolute difference between log parent and log host GDP in ppp, t-1	0.10 ***	2.72	0.02 *	1.90				
log R&D/GDP ratio, parent country, t-1			0.07 **	2.46				
fixed broadband internet subs. per 100 people	0.21	1.56	0.06	1.23			0.18 ***	2.71
% cost of starting a business			-0.09 **	-2.03			-0.10 ***	-3.34
time dummy 2004	-0.01	-1.21			0.00	0.48		
time dummy 2005	-0.02	-1.19	0.00	-0.81	0.00	0.16	-0.01 *	-1.69
time dummy 2006	-0.02	-1.06	-0.01	-0.82	-0.01 **	-2.07	-0.01 **	-2.36
time dummy 2007	-0.04 *	-1.84	-0.01	-0.99	-0.01	-1.57	-0.03 ***	-4.74
time dummy 2008	-0.06 ***	-2.68	-0.01	-1.40	-0.01	-0.83	-0.03 ***	-5.21
time dummy 2009	-0.08 ***	-4.23	-0.02 **	-2.18	-0.01	-1.34	-0.03 ***	-5.49
time dummy 2010	-0.07 ***	-2.95	-0.02 **	-2.60	-0.01 *	-1.66	-0.03 ***	-5.57
host and home country effects	yes		yes		yes		yes	
R2	0.47		0.47		0.51		0.43	
of obs	5512		4054		4992		3672	

Notes: The dependent variable is the logarithm of the number Greenfield FDI projects (plus one EUR) by type of services from country i to country j. ***, ** and * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 10: Poisson Pseudo maximum likelihood (PPML) estimates of the determinants of bilateral Greenfield investment in knowledge intensive services in the EU-27 countries (marginal effects)

	business services		Design, Development & testing			headquarters		R&D services		
	dy/dx	z	dy/dx	z	dy/dx	z	dy/dx	z	dy/dx	z
log GDP in EUR, host country, t-1	3.45 ***	3.19	-0.72		-0.98	0.40 ***	3.33	1.11	1.25	
log GDP in EUR, parent country, t-1	2.57 **	2.14	1.98		1.61	0.38	0.51	0.98	1.59	
log distance	-0.17	-0.82	0.34	***	2.47	0.26 **	2.69	0.20 ***	3.59	
shared border	1.48 ***	2.89	0.71	**	2.18	0.84 ***	4.04	0.66 ***	3.13	
common language	0.44	1.23	0.63	***	2.45	0.12	0.90	0.12 *	1.81	
former colony	0.65 *	1.75	-0.23	*	-1.75	0.08	0.55	-0.19 ***	-7.03	
host effective average corporate tax rate, t-1	-4.05 *	-1.79	-3.46		-1.20	-3.70 ***	-2.81	-1.09	-0.91	
log hourly wages costs, host country, t-1	-2.58 ***	-2.56	-0.49		-0.44	-0.89 ***	-3.20	-1.16	-1.53	
log hourly wages costs, parent country, t-1	-1.51	-1.18	-2.08		-1.46	0.13	0.19	-0.58	-0.97	
log sh. of tertiary education, host country, t-1	1.42 **	2.03	1.84		1.32	1.23 **	2.09	0.23	0.31	
log sh. of tertiary education, parent country, t-1	2.75 **	2.55	1.12		1.04	0.70	1.48	0.41	0.77	
absolute difference between log parent and log host GDP in ppp, t-1	1.84 ***	3.22								
log R&D/GDP ratio, parent country, t-1			1.13	*	1.88					
fixed broadband internet subs. per 100 people								3.23 ***	2.74	
% cost of starting a business	2.15	1.16	-2.40	*	-1.74			-2.28 ***	-4.43	
time dummy 2004	-0.24	-1.33				0.01	0.13			
time dummy 2005	-0.34 *	-1.69	-0.07		-0.35	-0.05	-0.33	-0.20 **	-2.47	
time dummy 2006	-0.49 **	-1.98	0.00		0.02	-0.27	-3.68	-0.31 ***	-2.94	
time dummy 2007	-0.62 **	-2.04	0.13		0.46	-0.21 *	-1.66	-0.51 ***	-5.10	
time dummy 2008	-0.90 ***	-2.91	0.12		0.35	-0.13	-0.84	-0.57 ***	-5.10	
time dummy 2009	-1.17 ***	-4.38	-0.11		-0.35	-0.23 *	-1.95	-0.59 ***	-5.53	
time dummy 2010	-1.01 ***	-3.03	-0.20		-0.65	-0.27 *	-1.94	-0.62 ***	-5.50	
host and home country effects	yes		yes			yes		yes		
R2	0.32		0.31			0.32		0.31		
# of obs	5112		4078			4992		3672		

Notes: The dependent variable is the logarithm of Greenfield investments (plus one EURO) by type of services from country *i* to country *j*. ***, ** and * denote statistical significance at 1%, 5% and 10% levels, respectively.