13. Location, localisation, agglomeration: an examination of the geographical dimension of FDI spillovers

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13.1 INTRODUCTION

The presence and operations of foreign direct investment (FDI) are commonly linked to numerous direct positive effects in host economies, including capital investment, employment creation, multiplier effects and the generation of export revenues (Barba-Navaretti and Venables, 2004; Caves, 2007; McCann and Iammarino, 2013). Furthermore, there is a growing belief that FDI also creates important positive indirect effects in the form of productivity spillovers to domestic firms. Through a variety of possible channels, including demonstration effects, inter-firm labour turnover and input–output linkages between foreign-owned firms and their suppliers, domestic firms can obtain new technologies resulting in positive productivity effects (Blomström and Kokko, 1998; Görg and Greenaway, 2004).

In the belief that positive FDI spillovers are prevalent, many national and regional governments actively engage in attracting inward FDI, often offering generous benefits to new FDI firms. However, the body of empirical evidence on the common occurrence of these externalities is mixed and inconclusive (Hanousek et al., 2011; Irsova and Havranek, 2013; Havranek and Irsova, 2011). In response to this, recent studies have focused on examining a range of possible factors that may foster or hinder the occurrence of FDI spillovers. Their findings indicate that firm heterogeneity, of both FDI and domestic firms, is a significant factor influencing the sign and size of these spillovers. Regarding FDI firms, aspects of this include the degree of foreign ownership (Girma and Wakelin, 2007; Monastiriotis and Alegria, 2011), the time of entry (Merlevede and Purice, 2016) and the nationality of foreign investors

(Monastiriotis, 2014; Haskel et al., 2007; Javorcik and Spatareanu, 2011). As for domestic firms, factors found to influence FDI spillovers include firm size, productivity level, human capital and export status (Damijan et al., 2013; Blalock and Gertler, 2009; Abraham et al., 2010; Jordaan, 2008a). In related research, Crescenzi et al. (2015) find that the positive effect of industry FDI on the innovativeness of domestic firms in the UK is also subject to firm heterogeneity regarding market orientation and ownership structure.

Importantly, the geographical dimension of FDI spillovers receives limited attention in recent research. This is striking, as it is very likely that geography can play an important role in the materialisation of such externalities. It is well known from the literatures on innovation (Audretsch and Feldman, 2004) and agglomeration (Rosenthal and Strange, 2004) that geographical scale, proximity and density foster knowledge and productivity spillovers. Given the similarity of the underlying mechanisms of FDI spillovers (vertical linkages, labour pooling and demonstration effects; Blomström and Kokko, 1998; Smeets, 2008) and agglomeration economies (sharing, matching and learning; Puga, 2010), it is reasonable to expect that FDI spillovers are also more enhanced when FDI and domestic firms operate in the same regions (e.g. Blalock and Gertler, 2008; Jordaan, 2008b). In other words, one could argue that it is more likely that these externalities materialise at the sub-national rather than the national level in host economies (Jordaan, 2009). Furthermore, there may also be important *interrelations* between FDI spillovers and regional industry characteristics such as employment density, industrial concentration and regional specialisation (Menghinello et al., 2010; Jordaan, 2009). Importantly, as for example Crescenzi et al. (2014) find, regional agglomeration and institutional factors act as important location factors for FDI, further underlining the intricate relationship between regional industry agglomeration and FDI. Therefore, it is to be expected that FDI spillovers will be more prevalent in regions with other spillover-conducive characteristics, including high levels of industry and FDI concentration, productivity and urban agglomeration. However, a systematic examination of these issues is generally lacking from the literature.

The purpose of the present chapter is to expand upon recent empirical research on drivers of FDI spillovers by focusing explicitly on the geographical dimension of these externalities. Using data for Greek manufacturing firms for the period 2002–2006, we concentrate our analysis on the following three issues. First, we assess the importance of spatial proximity for FDI spillovers by estimating intra- and inter-industry spillovers at three different spatial scales: national, regional

(within NUTS 2 regions) and local (within NUTS 3 regions). Second, we present new evidence on the relation between agglomeration and (regional) FDI spillovers. In particular, we examine whether industry- and region-specific factors related to density and specialisation affect intra- and inter-industry FDI spillovers at the regional and local level. Third, we investigate whether effects from FDI are subject to spatial heterogeneity. To do so, we estimate FDI spillovers for regions that differ in terms of the overall scale of industrial concentration, urban agglomeration, level of inward FDI and aggregate productivity.

The chapter is structured as follows. In Section 13.2 we present a brief review of research on the geographical dimension of FDI spillovers and use this to motivate our empirical investigation. Section 13.3 discusses the data and model. Section 13.4 presents the main findings from our empirical analysis, which can be summarised as follows. First, both intra- and inter-industry FDI spillovers occur at the sub-national rather than the national level, confirming that spatial scale (localisation) matters. Intra-industry spillovers are most pronounced at the regional level, whereas inter-industry spillovers are strongest at the local level. Second, we obtain clear evidence on the interplay or synergies between regional industry agglomeration and FDI spillovers. Several interaction variables between regional FDI and inter-firm proximity and regional specialisation are significantly associated with firm-level productivity, typically fostering positive externalities. The inclusion of these interaction variables renders unconditional regional FDI spillovers insignificant, further indicating the importance of agglomeration for the materialisation of FDI externalities. Third, we find that the effects of FDI are subject to spatial heterogeneity. Distinguishing between regions according to their scale of manufacturing concentration, urban agglomeration, level of inward FDI and relative productivity level, we find that the effects of regional intra-industry FDI and local inter-industry FDI effects differ markedly, benefitting regions exhibiting favourable agglomeration characteristics. We discuss the implications of these findings in the concluding section.

13.2 LITERATURE REVIEW AND RESEARCH QUESTIONS

There is a close similarity between the mechanisms underlying FDI spillovers and those generating externalities from innovation (Audretsch and Feldman, 2004) and agglomeration (Rosenthal and Strange, 2004). For instance, demonstration effects, where domestic firms learn about new technologies incorporated into FDI firms, are facilitated when both

types of firms are located in the same region. This is in line with the notion of 'learning' found in the agglomeration economies literature. Furthermore, the FDI literature shows that domestic firms are more likely to experience knowledge spillovers by hiring local workers that were previously employed by FDI firms in the same region – this in turn relates to the notion of 'matching' in the agglomeration literature (Puga, 2010). Also, the agglomeration literature emphasises the importance of the mechanism of sharing, which refers to the exploitation of common distribution networks, resource-sourcing, supply linkages and local knowledge. In a similar way, studies in both the economic geography and international business literature have found that FDI firms create supportive linkages with local suppliers, generating important networks and knowledge spillovers at the regional level (Ivarsson and Alvstam, 2011; Domanski and Gwosdz, 2009; Jordaan, 2011, 2013).

Besides these notable similarities, the recognition that agglomeration creates productivity externalities suggests that there may also be interaction effects between agglomeration and FDI spillovers. If agglomeration generates positive externalities, FDI spillovers can be expected to be stronger in cases where agglomeration is more prevalent. This may occur in industries that are more heavily concentrated spatially and/or in regions which exhibit higher concentrations of firms. Furthermore, one could claim that the prevalence of FDI spillovers may be conditioned on spatial heterogeneity more broadly, depending on regional characteristics such as the scale of industrial concentration, the extent of urban agglomeration and regional productivity. Importantly, this may affect not only positive but also negative FDI spillovers. Negative effects arise when FDI firms force domestic firms to operate at smaller production scales resulting in efficiency losses (Aitken and Harrison, 1999) or when they put an upward pressure on prices of inputs, resulting in crowding-out effects among domestic firms (Menghinello et al., 2010; Jordaan, 2008b). Such effects can be expected to be more pronounced at the regional rather than the national level.

Despite the relative intelligibility of this line of thought, studies that examine the geographical dimension of FDI spillovers and the spatial factors that may condition their size and prevalence form a small minority in the relevant literature. Indeed, it can be argued that the main thrust of this literature pays little attention to the geographical dimension. This is in some ways rather curious, as the recent literature on FDI spillovers has experienced a marked shift in focus towards the examination of contextual factors that may condition the occurrence, level and nature of these spillovers. Findings from the limited number of studies

that do examine issues of geography with regard to FDI spillovers are often fragmentary and rather inconclusive.

Broadly speaking, evidence on the geographical dimension of FDI spillovers contains three sets of findings. The first set of findings relates to the general prevalence of regional FDI spillovers and their diffusion across space. The results in this literature are generally mixed. Aitken and Harrison (1999) present a firm-level analysis of manufacturing firms in Venezuela and find that, when controlling for both national- and regional-level FDI participation, regional FDI does not create a significant productivity effect. Similar findings of insignificant regional FDI effects are presented by Yudaeva et al. (2003) for Russia, while for Portugal Crespo et al. (2009) report a negative association between regional FDI and productivity of domestic firms. In contrast, evidence that regional FDI generates positive spillovers has been presented by Wei and Liu (2006) for China, Blalock and Gertler (2008) for Indonesia, Peri and Urban (2006) for Italy and Monastiriotis and Jordaan (2010) for Greece.

Similarly inconclusive are the results concerning the extent of spatial diffusion of FDI spillovers. Javorcik and Spatareanu (2008) estimate intra- and inter-industry spillovers in Romania, examining separately the effect of FDI participation inside each region and in all other regions. Their findings indicate that at the intra-industry level both intra- and inter-regional spillovers are negative whereas the productivity effect of intra- and inter-regional inter-industry FDI is positive. Jordaan (2008b) presents similar findings for Mexican regions, whereas Halpern and Muraközy (2007) present evidence for Hungary of negative intra-regional and positive inter-regional intra-industry spillovers. In contrast, for the UK Girma and Wakelin (2007), Driffield (2006) and Kneller and Pisu (2007) find that intra- and inter-industry FDI spillovers only materialise within UK regions, suggesting a high degree of localisation of spillovers and no spatial diffusion effects. In turn, significant spatial diffusion effects have been found in the studies by Mullen and Williams (2007) and Ke and Lai (2011).

A second set of findings concerns studies seeking to identify the presence of spatial heterogeneity. For Indonesia, Sjöholm (1999) looks at the effect of regional size and finds that this affects both the level and sign of FDI spillovers. Driffield (2004) and Girma and Wakelin (2007) examine the influence of state aid and regional incentives in the UK and find that positive FDI spillovers do not arise (or are at least smaller) in regions with assisted area status. For Italy, Menghinello et al. (2010) find that FDI spillovers differ between Northern and Southern regions and between regions with high or low FDI participation. Monastiriotis and Jordaan (2010) present similar findings of spatially heterogeneous effects

for intra-industry FDI spillovers among Greek manufacturing firms. Finally, for Romania, Altomonte and Colantone (2008) identify a clear difference in the FDI spillover impact between core regions and the rest of the country.

Last, in a third strand of this literature, a limited number of studies have examined interrelations between agglomeration and regional FDI spillovers. Barrios et al. (2006) estimate FDI spillovers for the Irish economy and find that positive spillovers only arise in industries where FDI and domestic firms are co-agglomerated. Evidence that positive spillovers are larger in agglomerated industries is presented by Driffield and Munday (2001) for the UK and Jordaan (2005) for Mexico. In turn, Jordaan (2008a) estimates FDI spillovers in several core regions in Mexico and finds that industry agglomeration can foster both positive and negative spillovers. Related to this, De Propris and Driffield (2006) find for the UK that intra-industry FDI spillovers are of a positive nature in clustered industries and negative in non-clustered industries. Finally, Menghinello et al. (2010), in what is perhaps the most detailed study of the inter-relation between agglomeration and regional FDI, find several significant positive and negative effects from the interaction of regional FDI with measures of regional and sectoral agglomeration in Italy.

The three strands of empirical research, as briefly reviewed here, show that there is considerable evidence that various elements of geography can play an important role for FDI spillovers. Having said this, it is also noteworthy that most of the studies focus on one or a limited number of these elements, thus providing only partial accounts of the geographical dimension of FDI spillovers. In the present chapter, we attempt to capture more fully the effects of geography and space on FDI spillovers. In particular, we address the following three research questions. First, what is the spatial scale at which FDI spillovers materialise? To answer this question, we estimate both intra- and inter-industry spillovers at three different geographical scales: national, regional (NUTS 2) and local (NUTS 3). Second, what are the relationships between agglomeration and FDI spillovers? To examine this, we account for regional industry agglomeration characteristics related to regional specialisation and employment density and assess whether these characteristics affect FDI spillovers – either by introducing interaction terms or by examining the impact of FDI across relevant sub-samples. Third, are FDI spillovers subject to spatial heterogeneity? Rather than referring to the direct relation between regional industry agglomeration characteristics and FDI spillovers, this question relates more to region-wide characteristics that may be linked to FDI spillovers. To identify the presence of spatial heterogeneity, we estimate FDI spillovers distinguishing between regions

according to their overall levels of agglomeration, inward FDI and productivity. Thus, our three research questions examine sequentially three central elements of the geographical dimension of FDI spillovers: their localisation, their relation to regional industry agglomeration characteristics and their spatial heterogeneity. To our knowledge, ours is the first study to examine these dimensions in an integrated and focused fashion.

13.3 DATA AND MODEL

The dataset that we use for the analysis consists of a large sample of manufacturing firms in Greece, comprising an unbalanced panel of 24,621 observations covering the period 2002–2006. The data was obtained from the Amadeus database of Bureau van Dijk, which is frequently used in empirical studies on FDI spillovers. The Amadeus database provides a range of firm-level information obtained from companies' balance sheets, including information on location, industry and type of ownership. More specifically, our dataset contains the following firm-level variables: turnover, number of employees, total fixed assets, ownership structure, location (NUTS 2 and NUTS 3) and NACE2 industry. With this information, we calculate a number of firm- and industry/area-level variables to use in our empirical analysis.[1]

The key variables of interest concern measures of intra- and inter-industry FDI participation. To measure the degree of intra-industry FDI, we follow common practice and take the ratio of the number of employees working for FDI firms over the total number of employees in the reference category. Given our focus on the question of scale (localisation), we measure intra-industry FDI participation at three different geographical scales: national, regional (NUTS 2) and local (NUTS 3). To capture the degree of inter-industry FDI participation there are two options. First, a weighted index which aggregates for each sector the shares of FDI employment across all other sectors using as weights the input (upstream) and output (downstream) shares of each sector, according to a national input–output table (see e.g. Javorcik, 2004; Blalock and Gertler, 2008). Second, an unweighted index which takes a simple arithmetic average of FDI participation in all other sectors, without applying any weights (see Girma and Wakelin, 2007; Menghinello et al., 2010). Intuitively, the first option is more appealing, as it captures

[1] Tables 13A.1, 13A.2 and 13A.3 in the Appendix show the full list of variables and summary statistics.

'actually expected' inter-industry linkages. In practice, however, these indicators of inter-industry FDI linkages are imperfect, as they are based on several assumptions that are unlikely to hold (Barrios et al., 2011). These include the assumptions that FDI firms have the same input sourcing and selling behaviour as domestic firms, that the FDI employment shares are reflective of their levels of sourcing and selling and that the coefficients of the national input–output table apply to all regions in a similar way. Given these shortcomings, we prefer to use the more broadly defined indicator of overall inter-industry FDI participation. For a given industry, we calculate inter-industry FDI as the share of FDI in total manufacturing employment, omitting the particular industry, at the three spatial scales.

The second set of variables that are of interest for our analysis concerns measures of regional industry agglomeration characteristics. The literature offers many indicators capturing various elements of agglomeration economies (Rosenthal and Strange, 2004; Melo et al., 2009). In our analysis we utilise two simple measures, each capturing a different dimension of agglomeration and each expected to exert a positive influence on FDI spillovers.[2] The first variable is a measure of relative specialisation, calculated as the share of a regional industry in total regional manufacturing employment, standardised by the corresponding sector's employment share nationally. Menghinello et al. (2010) present this measure as a direct indicator of localisation economies. The second indicator is calculated by dividing the total employment of a regional industry by the region's total area surface (in km^2). This variable measures the density of a particular sector in its region and tries to capture intra-industry firm proximity, reflecting the theoretical intensity of interactions across firms within each sector.

A third set of variables concerns some firm-specific characteristics and some broader regional/industry-level characteristics which may account for a firm's productivity via other regional externalities not directly linked to agglomeration. 'Small firms' captures the relative degree to which a regional industry consists of micro and small firms. We measure this variable as the ratio between the average firm size of a sector in a region and of the same sector nationally.[3] 'IndustryMix' is a variable representing the level of labour productivity that would be expected for

[2] We calculate all variables with an industrial and regional dimension at the NUTS 2 and NUTS 3 level.

[3] The effect of this variable may be positive or negative. Following the literature on industrial districts, a high share of small firms may generate positive productivity effects (Menghinello et al., 2010). In contrast, micro and small firms

any sector in a region, given the labour productivity of this sector's sub-divisions nationally and the employment composition of this sector (in terms of its sub-divisions) in the particular region.[4] Essentially, this variable captures the degree to which firm-level productivity is affected by productivity dynamics at the industry level nationally, that is, dynamics that occur at the general industry rather than the regional industry level (Rigby and Essletzbichler, 1997, 2000; Jordaan, 2008b). As for firm-specific variables, 'TechGap' captures the degree of technological differences between a given domestic firm and the most productive FDI firm in its regional industry. Although not of direct relevance to the issues of agglomeration and regional heterogeneity, this is an important variable within the context of the FDI literature, as numerous studies have shown that the materialisation of FDI spillovers may depend heavily on the technology distance between foreign and local firms (Peri and Urban, 2006; Girma, 2005; Blalock and Gertler, 2009). The other two firm-level variables are dummy variables controlling for firm size: one for firms with fewer than 10 employees ('Micro') and one for firms with more than 30 employees ('Medium and Large').

Our data also contain the three standard production-function variables (log of turnover, log of employment and log of fixed assets,[5] as a proxy for the firm's capital), which we use in order to derive our dependent variable, firm-level total factor productivity (TFP). Specifically, given that TFP is not directly observable, we estimate this econometrically through the following equation:

$$y_{i,s,r,t} - \overline{y}_{s,t} = \alpha_{s,t}\left(k_{i,s,r,t} - \overline{k}_{s,t}\right) + F_{i,s,r} + \varepsilon_{i,s,r,t} \qquad (13.1)$$

where $\boldsymbol{i}$ indicates firms; $\boldsymbol{s}$,$\boldsymbol{r}$,$\boldsymbol{t}$ represent the sector, regional and time dimensions of the data; $\boldsymbol{y}$ and $\boldsymbol{k}$ are firm-level turnover per worker and total fixed assets per worker; $\overline{y}$ and $\overline{k}$ are the industry-year averages of the

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are also known to use older and more standardised technologies, generating lower productivity effects (Jordaan, 2008b).

[4] We calculate this variable as follows. For the national industry level, we calculate average labour productivity (turnover over employees) for all NACE4 manufacturing industries. Subsequently, for a given regional NACE2 industry, we sum the productivity indicators of the national NACE4 industries that are classified under the NACE2 industry, using the shares of regional NACE4 industries in the regional NACE2 industry as weights.

[5] All nominal variables are deflated by the national consumer price index (CPI) and expressed in constant 2002 prices.

same variables; $\alpha_{s,t}$ captures the elasticity of output to physical capital; and ***F*** is a firm-level fixed effect which controls for unobserved time-invariant characteristics affecting productivity that are specific to the firm. Following Peri and Urban (2006), we take the residuals from this regression as our measure of firm-level TFP. Subsequently, we regress this TFP indicator on variables capturing intra- and inter-industry FDI participation to identify FDI spillovers. To do so, we specify the following baseline regression model:

$$TFP_{i,s,r,t} = \beta_0 + \beta_1 IntraindustryFDI_{s,r,t} + \beta_2 InterindustryFDI_{s,r,t} + \beta_3 Agglomeration_{s,r,t} + \beta_4 AISV_{s,r,t} + \beta_5 FSV_{i,s,r,t} + D_t + F_{i,s,r} + \varepsilon_{i,s,r,t} \quad (13.2)$$

This model makes TFP a function of intra- and inter-industry FDI; variables capturing elements of agglomeration economies; two vectors of area/industry-specific variables (AISV) and of firm-specific variables (FSV), and vectors of year dummies (***D***) and firm-level fixed effects (***F***). By having subtracted the industry-year averages from firm-level turnover and fixed assets in equation (13.1), industry-year effects are controlled for. By estimating equation (13.2) with firm-level fixed effects, time-invariant regional effects also drop out. To control for heteroscedasticity and autocorrelation, we estimate the model with clustered standard errors at the industry and regional levels. As noted earlier, our FDI variables are measured at three different scales. Thus, when we measure FDI at the national level, the index ***r*** for the FDI variables is dropped; while when we measure FDI at the regional (local) level, ***r*** indexes NUTS 2 (NUTS 3) regions. Additionally, given our interest in how agglomeration forces may influence intra- and inter-industry FDI spillovers (coefficients β_1 and β_2), in several regressions we add interactive terms between the agglomeration and FDI variables and/or estimate equation (13.2) for sub-samples of firms, split along a number of dimensions related to the prevalence of agglomeration forces. We explain this in more detail together with the presentation of our results, which follows in the next section.

13.4 EMPIRICAL FINDINGS

13.4.1 The Spatial Scale of Spillovers: Localisation versus Sector-Wide Effects

A key question for our analysis, relating to the importance of spatial scale and proximity, concerns the degree to which FDI spillovers are

localised. To examine this, we estimate equation (13.2), defining our intra- and inter-industry FDI participation variables alternatively at the national, regional (NUTS 2) and local (NUTS 3) levels. The findings are presented in Table 13.1.

Table 13.1 The spatial scale of FDI spillovers

	(1)	(2)	(3)	(4)
FDI variables				
National Intra-industry	0.29**	0.12	0.18	0.14
	(0.12)	(0.12)	(0.12)	(0.12)
National Inter-industry	0.66	0.69	0.34	0.35
	(0.68)	(0.68)	(0.69)	(0.67)
NUTS 2 Intra-industry		0.19**		0.22**
		(0.07)		(0.10)
NUTS 2 Inter-industry		0.11		0.02
		(0.15)		(0.14)
NUTS 3 Intra-industry			0.14**	–0.03
			(0.06)	(0.11)
NUTS 3 Inter-industry			0.85***	0.83***
			(0.21)	(0.20)
Firm controls				
Micro-firms	0.61***	0.61***	0.62***	0.62***
	(0.13)	(0.13)	(0.13)	(0.13)
Medium and large firms	–0.33*** (0.06)	–0.33*** (0.06)	–0.33*** (0.06)	–0.33*** (0.06)
TechGap	–0.018***	–0.0178***	–0.017***	–0.018***
	(0.004)	(0.004)	(0.004)	(0.004)
Regional controls				
IndustryMix	0.0007**	0.0008**	0.0009***	0.00091***
	(0.00038)	(0.00035)	(0.0003)	(0.00032)
Small firms ratio	–0.06	–0.06	–0.06	–0.06
	(0.04)	(0.04)	(0.04)	(0.04)

	(1)	(2)	(3)	(4)
Agglomeration variables				
Relative specialisation	–0.009	0.0025	–0.005	–0.002
	(0.02)	(0.02)	(0.024)	(0.02)
Employment density	0.035	0.03	0.03	0.03
	(0.036)	(0.03)	(0.03)	(0.03)
Constant	–0.126	–0.14	–0.184	–0.18
	(0.17)	(0.20)	(0.16)	(0.16)
Fixed effects	Firms & Years	Firms & Years	Firms & Years	Firms & Years
Clustered s.e.	Industry NUTS 2	Industry NUTS 2	Industry NUTS 2	Industry NUTS 2
Number of observations	24,588	24,588	24,588	24,588
R-squared (within)	0.024	0.025	0.025	0.026

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The agglomeration variables are measured at the NUTS 2 level.

The first column reports the results from the national-level measures of FDI. At this level, FDI participation is found to have a positive effect on the productivity of domestic firms located in the same sector, significant at the 5 per cent level. The effect across sectors is also positive but is not statistically significant.[6] This suggests that FDI produces positive horizontal (intra-industry) but no vertical (inter-industry) productivity spillovers in Greece. Moreover, the intra-industry effect is quite sizeable

[6] As a form of robustness check, following Peri and Urban (2006), we also estimated the model with alternative TFP indicators: a version of our current indicator but estimated without the use of firm-level fixed effects (OLS) and the 'superlative' index as developed by Caves et al. (1982). The results with the TFP(OLS) indicator are in line with those presented in Table 13.1. The findings with the superlative index are more varied, as the effects are estimated less precisely. Furthermore, the results are stable when we use temporal (one- and two-year) lags of the FDI variables and when we instrument the FDI variables to control for the possible selection of foreign firms into high-productivity sectors and regions (endogeneity). In these regressions, the FDI coefficients become less positive and less significant statistically, showing that, to some degree at least, selection is present. However, they do not change the thrust of the results and analysis presented here. As our focus is not on the issue of selection or TFP measurement, we do not report these results here, but we note that all results can be made available upon request.

and larger than estimated in other studies on Greece (Dimelis, 2005; Monastiriotis and Jordaan, 2010). Our further results, however, show that these horizontal spillovers are generally rather localised and that, moreover, significant vertical spillovers do exist – but at a much finer spatial scale. In column 2 we control for FDI at the national and regional (NUTS 2) levels. We find that intra-industry spillovers are only significant at the regional level, while inter-industry spillovers remain non-significant statistically at both geographical scales. When we control for FDI presence simultaneously at the national and local (NUTS 3) levels in column 3, we find not only a significant positive local-level intra-industry effect but also a highly significant (at 1 per cent) local-level inter-industry effect, which is moreover of a much larger magnitude. Column 4 contains the results from estimating the model when we control for FDI at all three spatial scales simultaneously. The findings indicate that intra-industry spillovers materialise at the regional level whereas intra-industry FDI effects are positive and significant at the local level.[7]

These results point to a very important finding, which to our knowledge has not been proposed in the literature in the form and with the level of detail offered here. For both intra-industry and inter-industry spillovers geographical proximity matters significantly, but whereas intra-industry spillovers are stronger at the meso-geographical scale, inter-industry spillovers are of a very localised nature. A tentative interpretation of these findings would be that for vertical spillovers the mechanism of sharing (networks, sourcing, supply linkages) plays a more prominent role, while competition for market shares does not apply. If so, close geographical proximity fosters the creation of inter-firm linkages, linkages that transmit positive spillovers. In the case of intra-industry spillovers, learning (in the form of imitation or demonstration effects) and labour pooling (matching) seem to take place at a larger (but still

[7] There is a considerable degree of correlation among the FDI variables measured at the three spatial scales. To assess the effect of this on the results, we also estimated the model of columns 2–4 without the national level FDI variables. The coefficients of the regional and local FDI variables are similar in these estimations in terms of size, sign and significance as to those reported in Table 13.1, indicating that the FDI effects are not affected by the correlation between the national, regional and local FDI measures. For similar reasons, we also estimated the model with and without the density variable. Again, the estimated coefficients are robust to the inclusion or exclusion of this variable.

sub-national) geographical scale.[8] As a result, positive horizontal FDI spillovers accrue predominantly to firms at the meso-geographical scale (NUTS 2) while positive vertical FDI spillovers accrue almost exclusively to firms within very narrow geographical areas (NUTS 3).

The significance of these results notwithstanding, the remaining results presented in Table 13.1 are also worthy of discussion. Starting with our controls for firm-level heterogeneity, we note that all appear to be highly significant. Interestingly, micro-firms (fewer than 10 employees) and small firms (fewer than 30 employees) seem to have a productivity advantage over medium and large firms, a result which is very consistent across a range of specifications that we have examined (not shown but available upon request). The technology gap (TechGap) also returns a highly significant negative effect (at 1 per cent), indicating that firms located further away from the technology frontier have an additional disadvantage in terms of TFP – or, alternatively, that the presence of highly advanced FDI firms in a regional industry hampers the productivity of domestic firms. Of the variables that control for regional/industry characteristics, only the industry mix (IndustryMix) is statistically significant, with its positive coefficient indicating that part of firm-level productivity is caused by non-spatial industry-level developments. The effect of the relative share of small firms is insignificant across the models, showing that this factor is of limited relative importance for firms' productivity performance. Last, concerning the performance of our agglomeration variables, it is quite noticeable that, at this level of analysis, they are not significantly associated with firm-level productivity. The indicator of relative specialisation carries a negative coefficient but has large standard errors and is almost precisely estimated to be equal to zero. Employment density, our proxy for inter-firm proximity and intensity of interactions, returns a consistently positive effect – which, notably, becomes statistically significant when the effects of FDI are not controlled for (not shown in table). Although these findings that indicate an extremely limited effect of agglomeration on firm-level performance in our sample are quite surprising and at odds with findings for other countries, they are not fully inconsistent with previous evidence for the case of Greece (Louri, 1988; Monastiriotis and Psycharis, 2014; Skuras et al., 2011; Petrakos et al., 2012; Vogiatzoglou and Tsekeris, 2013). In any case, as our interest here is not with the role of agglomeration per se

[8] See Martin (1999) and Parr (2002) for similar notions on the possibility that the varying spatial scales of different types of agglomeration economies may be linked to how their underlying mechanisms are affected by geographical space.

but rather with the influence that agglomeration has on the materialisation and size of FDI spillovers, we take the limited direct agglomeration effects found here as a motivation for the analysis that follows in the next sub-section.

13.4.2 The Influence of Agglomeration on FDI Spillovers

To examine the link between agglomeration and FDI spillovers we follow two estimation strategies. First, we augment the regression model with a set of interaction terms between the agglomeration variables and the indicators of intra- and inter-industry FDI. Second, we estimate the regression model for sub-samples of industries, where we distinguish between industries with a low or high degree of agglomeration.

The findings from estimating the regression model with the interaction variables at the national, regional and local levels are presented in Table 13.2. As can be seen, an important difference with the previous findings of Table 13.1 is that the inclusion of the interaction terms renders the large majority of the direct spillover effects from FDI insignificant at all spatial scales.[9] This indicates the importance of the interplay between FDI and agglomeration for spillovers from foreign firms. Subject to this interplay, the direct effect of density becomes negative and significant while the direct effect of relative specialisation remains insignificant. In contrast, the coefficients of the interaction terms are almost always positive and statistically significant in a majority of cases. Relative specialisation appears to enhance intra-industry FDI spillovers at the national, regional and local levels but its effect on inter-industry spillovers is not statistically significant. Employment density has a strong positive effect on intra-industry spillovers at the national level and also a positive effect on inter-industry spillovers that is most significant at the national and local levels.

Bearing in mind that the interpretation of interaction effects in models that contain multiple interaction terms may be problematic (Kam and Franzese, 2009), we do not attempt to offer a further interpretation of these findings. What is important for the question that we set out to analyse in this sub-section is that the evidence clearly points to the conclusion that FDI spillovers are indeed largely conditioned by the extent of industry agglomeration, both regionally and locally. In Table 13.2 we document this in two complementary ways. First, by looking at

[9] The exception is the positive effect of inter-industry FDI at the local level.

Table 13.2 Agglomeration and FDI spillovers: interaction effects

FDI measure	National		Regional		Local	
	β	s.e.	β	s.e.	β	s.e.
Direct effects						
Relative specialisation	–0.04	(0.06)	–0.01	(0.02)	–0.012	(0.02)
Employment density	–0.22**	(0.08)	–0.15*	(0.08)	–0.119*	(0.0587)
Intra-industry FDI	–0.17	(0.17)	–0.12	(0.12)	–0. 09	(0.10)
Inter-industry FDI	0.67	(071)	–0.02	(0.33)	0.78**	(0.36)
Interaction effects						
Intra-industry (x) RelSpec	0.14**	(0.07)	0.21**	(0.10)	0.17**	(0.09)
Intra-industry (x) Density	0.60**	(0.20)	0.20*	(0.12)	0.15	(0.12)
Joint significance (F-test)	6.03***	*0.000*	5.92***	*0.000*	4.83***	*0.000*
Inter-industry (x) RelSpec	0.14	(0.31)	0.03	(0.17)	–0.15	(0.17)
Inter-industry (x) Density	0.42**	(0.20)	0.28*	(0.16)	0.39**	(0.18)
Joint significance (F-test)	3.29**	*0.03*	1.54	*0.20*	8.47***	*0.000*
Marginal effects						
Intra-industry FDI	0.59***	(0.15)	0.34***	(0.09)	0.27***	(0.08)
Inter-industry FDI	1.28*	(0.71)	0.29*	(0. 16)	0.97***	(0.20)
Constant	–0.007	(0.21)	0.09	(0.09)	–0.03	(0.08)
Number of observations	24,588		24,588		24,588	
R-squared (within)	0.026		0.025		0.026	

Note: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All regressions include additional controls for firm-level and regional characteristics similar to those depicted in Table 13.1. Also included are year dummies and firm-specific fixed effects. Standard errors are clustered at the industry and regional level.

the joint significance of the interaction terms for the two types of FDI spillovers. Second, we report in the lower panel of Table 13.2 the marginal effects for the two FDI variables, calculated at the mean values

of the agglomeration variables.[10] Starting with the marginal effects, horizontal spillovers are stronger at the national level and lose significance as we move down to smaller spatial scales. In contrast, vertical spillovers are stronger and most significant at the local level. Similarly, on the measure of joint significance, the estimated intra-industry spillovers from FDI are statistically significant at all geographical scales, while the estimated inter-industry spillovers are most significant at the local scale. These findings are fully consistent with what was shown in the analysis of Table 13.1, but in this instance they show that the effect of FDI is intermediated through forces of agglomeration.

Another way of identifying the influence of agglomeration forces is to estimate the prevalence of FDI spillovers across separate groups of industries. We separate the regional industries into low and high agglomerated groups according to three agglomeration variables. One variable is the share of a regional industry in total regional employment (absolute specialisation). The other two variables are the level of relative specialisation and industry density as discussed earlier. For the subsets of industries, we re-estimate the model as presented in column 4 of Table 13.1. As mentioned earlier, there is a considerable degree of correlation between the FDI variables at the various spatial scales. In preliminary estimations of the model with all six FDI variables on the sub-samples, we found that high variance inflation factor scores prevent the inclusion of the full set of FDI variables. Importantly, in all these preliminary estimations, regional intra-industry and local inter-industry FDI consistently carry significant coefficients. Therefore, also given the findings of Tables 13.1 and 13.2, we control for these two FDI variables when estimating the model on the sub-samples. We present the results of these estimations in Table 13.3, focusing on the estimated coefficients of the FDI variables.[11]

The results are fully consistent with what we found earlier, but offer a more intimate picture of the interplay between agglomeration and FDI spillovers. The top panel contains the results for NUTS 2 industries. Absolute specialisation strongly fosters both regional intra- and local inter-industry spillovers, as these externalities only materialise in industries with an above median level of absolute specialisation. Findings for relative specialisation are less clear. Regional industries with a relatively

[10] We have used the command – margins, dydx – in Stata 13. Marginal effects at different values of the agglomeration variables are available upon request.

[11] As our measures of industry agglomeration are area-specific, we repeat the analysis for both the regional (NUTS 2) and local (NUTS 3) scales.

low level of specialisation are subject to slightly larger intra-industry FDI spillovers and moderately larger inter-industry spillovers. An explanation for the difference in the size of the estimated coefficients between the two sets of industries could be that a high level of relative specialisation creates negative competition effects within regional industries, lowering the positive spillovers. As for density, the findings indicate that positive regional and local spillovers only materialise in industries with an above median level of industry density, indicating the importance of spatial proximity and inter-firm linkages and interactions for FDI externalities.

Table 13.3 Agglomeration and FDI spillovers: regressions for sub-samples

	Specialisation (absolute)		Agglomeration (relative specialisation)		Density	
	Low	High	Low	High	Low	High
Agglomeration variables defined at the NUTS 2 level						
Regional intra-industry FDI	0.09 (0.07)	0.25*** (0.08)	0.25** (0.11)	0.22*** (0.06)	0.05 (0.07)	0.22** (0.08)
Local inter-industry FDI	0.28 (0.25)	1.42*** (0.34)	0.94** (0.43)	0.71*** (0.26)	0.39 (0.27)	0.53 (0.32)*
Agglomeration variables defined at the NUTS 3 level						
Regional intra-industry FDI	0.13 (0.10)	0.22 (0.08)**	0.28** (0.12)	0.20*** (0.05)	0.12 (0.08)	0.24*** (0.07)
Local inter-industry FDI	0.57* (0.30)	1.13* (0.67)	1.27*** (0.43	0.47* (0.26)	0.27 (0.27)	0.77** (0.35)

Notes: Standard errors reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All regressions include additional controls for firm-level and regional characteristics similar to those depicted in Table 13.1. They also include year dummies and firm-specific fixed effects. Standard errors are clustered at the industry and regional level. Industries are classified into 'low' and 'high' industries based on whether their levels of absolute specialisation, relative specialisation and density are lower or higher than the sample median.

The bottom panel of Table 13.3 shows the results when we measure the agglomeration variables at the NUTS 3 level. Again, regional intra-industry spillovers occur only in industries with a relative high level of absolute specialisation. Local inter-industry spillovers occur in industries with low or high degrees of absolute specialisation but are much larger in the latter type of industry. Again, a lower level of relative specialisation appears to foster positive FDI spillovers, especially in the case of local inter-industry spillovers. As for the effect of density, again the findings confirm that density is an important driver of positive regional and local FDI spillovers, as only industries with a high degree of density benefit from positive spillovers. Overall, our results from this exploration of the link between FDI spillovers and agglomeration are unambivalent: agglomeration plays an important role for the realisation of FDI spillovers. Controlling for the extent of agglomeration does not change the sign of these spillovers. Instead, it reveals that agglomeration is a key factor conditioning their materialisation. In that, we are confident that our evidence demonstrates convincingly that both localisation and agglomeration matter for FDI spillovers.

13.4.3 Spatial Heterogeneity

To conclude our exploration of the geographical dimension of FDI spillovers, we now turn our attention to the issue of spatial heterogeneity. To do so, we follow a similar approach to that used for Table 13.3 and re-estimate our FDI spillovers model, this time splitting the sample across sets of regions.[12] Similar to Menghinello et al. (2010), we divide the regions depending on their degree of geographical concentration of manufacturing activity and their level of regional FDI participation. Additionally, we distinguish between core and peripheral regions (Altomonte and Colantone, 2008; Menghinello et al., 2010).[13] Finally, following Merlevede and Purice (2016), we also divide regions based on

[12] We use NUTS 3 level measures to produce our categorical variables on which to split the sample, so as to have a finer disaggregation of space and maximum heterogeneity across our spatial units.

[13] We take the NUTS 2 regions of Central Macedonia and Athens as core regional economies. For the years covered by the sample, these two regions have an aggregate share in total manufacturing employment of 70 per cent, and their share in the total number of workers employed by FDI firms is about 80 per cent. Using this core–periphery distinction also captures the effect of agglomeration, as the core regions contain large shares of manufacturing activity and the highest population densities in the country.

whether their aggregate level of productivity is above or below the median level of regional productivity.[14] For reasons similar to the analysis of Table 13.3, we estimate the model controlling for regional intra-industry and local inter-industry FDI. The findings are presented in Table 13.4.

Table 13.4 Spatial heterogeneity and FDI spillovers

	Manufacturing		Centrality		FDI concentration		Productivity	
	Low	High	Periphery	Core	Low	High	Low	High
Regional Intra-industry FDI	0.23 (0.21)	0.22*** (0.07)	0.09 (0.07)	0.25*** (0.08)	0.13 (0.17)	0.20*** (0.06)	0.02 (0.08)	0.35*** (0.08)
Local Inter-industry FDI	0.98 (0.44)	0.83*** (0.23)	0.27 (0.25)	1.42*** (0.34)	0.41 (0.35)	0.86*** (0.28)	0.89** (0.42)	0.79*** (0.27)

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. All regressions include additional controls for firm-level and regional characteristics similar to those depicted in Table 13.1. They include additionally year dummies and firm-specific fixed effects and clustered standard errors at the industry and regional level. The categorical variables on which the sample is split are measured at the NUTS 3 level.

A region is classified as manufacturing intensive if the share of manufacturing in its total regional employment is larger than the sample median. Regions classified under Core are NUTS 3 regions located in Athens or Central Macedonia. A region is classified as having a high FDI concentration if its level of regional FDI participation in its total number of manufacturing employees is above the sample median. A high productivity region is a region with an above sample median level of aggregate productivity.

Starting with the estimates where we separate between regions with a high or low degree of manufacturing, we see that a certain level of manufacturing activity is required for positive spillovers to materialise. Both regional intra-industry and local inter-industry spillovers only materialise in regions with an above median share of manufacturing in total regional employment. Next, we obtain similar findings when we

[14] To obtain an indicator of the aggregate regional level of productivity, we follow the approach by Foster et al. (2001). For a given region, this involves calculating a weighted sum of TFP of all the manufacturing firms, where we use the firms' share in regional output as weight.

separate between core and peripheral regions, as positive spillovers only occur in the first type of region. This is consistent with findings elsewhere in the literature. Specifically, the core-regions effect reflects the importance of urban agglomeration and density for productivity spillovers (Altomonte and Colantone, 2008). In relation to this, regional intra-industry and local inter-industry spillovers only materialise in regions with an above median level of FDI participation. This suggests that a certain level of FDI participation is required for positive spillover effects to accrue to domestic firms. Finally, positive intra-industry spillovers materialise in regions with a relatively high level of productivity. This reflects the importance of absorptive capacity, whereby firms located in high productivity regions are able to absorb new technologies from FDI firms (Merlevede and Purice, 2016). Having said this, local inter-industry spillovers arise both in regions with high and low productivity levels, suggesting that for this type of spillovers absorptive capacity is less of a conditioning factor compared to the case of regional intra-industry spillovers.

13.5 CONCLUSIONS AND POLICY IMPLICATIONS

In response to the inconclusive nature of the evidence on the general prevalence of positive FDI spillovers, current research is concentrating on identifying factors that foster or even condition the materialisation of these externalities. Most of this research places a strong focus on the identification of the effects of firm-level characteristics on FDI spillovers at the national level. In comparison, the geographical dimension of FDI productivity effects is largely overlooked or only partially accounted for. This omission is particularly striking given the marked similarities between the mechanisms that underlie agglomeration economies and FDI spillovers, similarities that strongly suggest that the geographical dimension is likely to play an important role. In our chapter, we respond to this gap in the literature by conducting a comprehensive analysis of the spatial dimensions of FDI spillovers. In particular, we examine empirically whether and how spatial proximity (localisation), spatial concentration (agglomeration) and spatial heterogeneity (location) affect the size and sign of these externalities among domestic firms in the Greek manufacturing sector.

Our main findings can be summarised as follows. First, when controlling for national, regional and local FDI participation, we find that FDI spillovers occur at sub-national levels. In particular, intra-industry spillovers materialise at the regional level, whereas inter-industry spillovers

are maximised at the much finer local level. This marked difference suggests that the mechanisms that underlie these two types of spillovers have different relations with geographical space, presumably due to the different roles that proximity, intensity of interactions and market competition play for the materialisation of these spillovers. In any case, our findings clearly raise questions about approaches that do not consider the geographical elements of proximity and localisation in the estimation of FDI spillovers.

Second, we present a set of findings that show that agglomeration also plays a vital role. Our empirical investigation of the interactions between intra- and inter-industry FDI and regional industry relative specialisation and density show that these interactions are jointly significantly associated with domestic firm productivity. The inclusion of these interaction terms also renders the unconditional effects of intra- and inter-industry FDI insignificant at all three spatial scales, underlining the importance of the synergies between agglomeration and regional FDI. Furthermore, the examination of the marginal effects of FDI under the presence of the interaction terms confirms that inter-industry FDI spillovers are pronounced at the local level. Further evidence for this is obtained from estimating the regression model for different sets of industries, classified according to their regional industry level of agglomeration. Collectively, these findings clearly indicate that agglomeration plays a key role in influencing regional intra-industry and local inter-industry FDI spillovers.

Third, our findings also confirm that spatial heterogeneity needs to be accounted for when examining FDI spillovers. When estimating the regression model for different sets of NUTS 3 regions where we distinguish between regions based on the level of agglomeration of manufacturing activity, urban agglomeration, FDI participation and regional productivity, we find that regional intra-industry and local inter-industry FDI spillovers materialise almost exclusively in regions with externality-favouring characteristics.

We derive several policy recommendations from our findings. Of course, we acknowledge that our findings are for one particular host economy and that the geographical dimension of FDI spillovers may have different features in other host economies. Being fully aware of this caveat, the first policy implication of our findings is that, in a general sense, policies that attract FDI to foster economic and technological development in a host economy need to incorporate explicitly the recognition that the geographical dimension of FDI spillovers is likely to influence any externalities accruing to domestic firms. Notwithstanding the importance of research findings that show that firm-level characteristics may also foster or hinder the materialisation of FDI spillovers, our

findings clearly indicate the importance of carefully considering the location of FDI – within wider and finer local areas, as well as between areas of different profiles and degrees of urban agglomeration and industrial concentration – when designing and implementing development policies.

Second, our findings also suggest that development policies that are based on the attraction of new FDI need to be embedded in policies that aim to address regional growth and/or spatial imbalances in host economies. As our findings indicate, FDI spillovers occur at sub-national levels. This means that the benefits from new inward FDI – to a large extent at least – are spatially confined within host economies. Therefore, the attraction of FDI firms into particular regions will foster regional inequality, requiring additional counteracting measures. A further complicating factor is that the degree of spatial containment of FDI effects is likely to differ between intra- and inter-industry spillovers. This means that regional governments need to examine carefully the functioning of the mechanisms that underlie FDI spillovers, as they may be affected to different degrees by spatial decay effects. In other words, next to the recognition that the spatial containment of FDI spillovers is very likely to foster regional inequality, the regional scale at which such inequality materialises is influenced by the type of externalities that FDI firms create.

Third, our results reflect the limitations or strong challenges that regional policy making faces when trying to foster regional growth by attracting new FDI into lagging regions. It is likely that the characteristics of regional industries that foster positive externalities (agglomeration, specialisation, proximity) are not prominent among industries in these regions. Similarly, lagging regions are less likely to share the broader regional characteristics that generate the degree of spatial heterogeneity of FDI spillovers that we identified in our analysis. This means that FDI-based regional policy interventions aimed at promoting the growth of lagging regions will need to be combined with a range of additional measures to compensate for the absence of geographically based externality-favouring characteristics that may play an important role in the materialisation of FDI spillovers. In the absence of such supporting policies, it is likely that the geographical dimension of FDI spillovers will severely lower or prevent the materialisation of any spillovers to domestic firms in less advanced regions, even if FDI-attraction policies are successful in directing new foreign investments into such regions.

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APPENDIX

Table 13A.1 List of variables and definitions

Variable	Definition
FDI variables	
Intra-industry FDI	$\frac{\text{employeesFDI}_{s,r,t}}{\text{employees}_{s,r,t}}$
Inter-industry FDI	$\frac{\sum_s \text{employeesFDI}_{r,t} - \text{employeesFDI}_{s,r,t}}{\sum_s \text{employees}_{r,t} - \text{employees}_{s,r,t}}$
Regional variables	
IndustryMix	$\sum w \frac{turnover_{s,t}(nace4)}{employees_{s,t}(nace4)}$ $w = \frac{employees_{s,r,t}(nace4)}{employees_{r,t}(nace4)}$
Small firms ratio	$\frac{firms_{s,r,t} / employees_{s,r,t}}{firms_{s,t} / employees_{s,t}}$
Agglomeration variables	
Relative specialisation	$\frac{employees_{s,r,t} / \sum_s employees_{r,t}}{\sum_r employees_{s,t} / \sum_r employees_t}$
Employment density	$\frac{employees_{s,r,t}}{km^2_r}$
Firm-level variables	
Micro	1 if firm has fewer than 10 employees, 0 otherwise
Medium and large	1 if firm has more than 30 employees, 0 otherwise
TechGap	$\frac{maxTFPFDI_{s,r,t}}{TFP_{i,s,r,t}}$

Note: i,s,r,t capture firm, sector, region and time dimensions of the data. All data are calculated for NUTS 2 and NUTS 3 regions. Intra- and inter-industry FDI are also calculated for the national level.

Table 13A.2 Correlation matrix

	Intra-industry FDI National	Intra industry FDI Regional	Intra-industry FDI Local	Inter-industry FDI National	Inter-industry FDI Regional	Inter-industry FDI Local	Relative specialis-ation	Density	IndustryMix	Small firms ratio	TechGap	Micro	Medium and large
Intra-industry FDI National	1.0000												
Intra-industry FDI Regional	0.6143	1.0000											
Intra-industry FDI Local	0.6006	0.9441	1.0000										
Inter-industry FDI National	–0.5239	–0.3255	–0.3178	1.0000									
Inter-industry FDI Regional	–0.0222	0.4123	0.4230	0.1133	1.0000								
Inter-industry FDI Local	–0.0228	0.4102	0.4206	0.0806	0.9568	1.0000							
Relative specialisation	–0.0509	–0.1101	–0.1078	0.0230	–0.2148	–0.1950	1.0000						
Density	0.1020	0.5562	0.5584	–0.0431	0.7075	0.6985	–0.1084	1.0000					
IndustryMix	–0.1581	0.0569	0.0675	0.0816	0.3960	0.4078	0.1738	0.4485	1.0000				
Small firms ratio	–0.0026	0.2353	0.2210	0.0002	0.1675	0.1663	0.2465	0.2314	0.0932	1.0000			
TechGap	0.1845	–0.0197	–0.0242	–0.1586	–0.1832	–0.1757	0.0418	–0.1015	0.0615	–0.0109	1.0000		
Micro	–0.0220	–0.026	–0.0097	0.0169	0.0097	0.0129	–0.0347	–0.0231	0.0035	–0.0006	–0.0235	1.0000	
Medium and large	0.0009	0.0327	0.0235	–0.0027	0.0166	0.0177	0.0428	0.0347	0.0448	0.0718	0.0157	–0.506	1.0000

Note: Regional industry variables measured at the NUTS 2 level.

Table 13A.3 Summary statistics

	Mean	Std Dev.	Min.	Max.
Intra-industry FDI National	0.122	0.108	0	0.482
Intra-industry FDI Regional	0.11	0.156	0	0.99
Intra-industry FDI Local	0.107	0.160	0	0.99
Inter-industry FDI National	0.192	0.016	0.138	0.214
Inter-industry FDI Regional	0.168	0.126	0	0.444
Inter-industry FDI Local	0.121	0.106	0	0.566
Relative specialisation	1.281	0.744	0.002	15.224
Density	0.995	1.173	0.00007	4.358
IndustryMix	36.799	37.043	0.299	286.63
Small firms ratio	0.998	0.386	0.009	10.21
TechGap	1.743	1.268	0.105	51.835
Small firms	0.595	0.49	0	1
Medium firms	0.148	0.356	0	1

Note: Regional industry variables measured at the NUTS 2 level.