

# FDI Location Across British Regions and Inward Investment Policy

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## Abstract

The theory and empirical evidence on FDI location emphasise agglomeration economies over classical location factors, such as grants. This paper uses panel data to analyse the effect of the main instrument of inward investment policy, the UK regional policy grants, on the distribution of FDI projects across British regions over 1985-05. Using a GMM estimator the paper finds grants have a significant effect on FDI, even when agglomeration terms are included, but that its effect diminished over the 1990s. This is attributed to a redrawing of the eligible areas map. It concludes that in relation to foreign investment regional policy is no longer able to affect the regional distribution of FDI, so the grants are an instrument of national development policy.

Keywords: Foreign direct investment; location; regional policy; grants; and agglomeration

JEL Classifications: O12, L20, R58

## 1. Introduction

Globally, foreign direct investment (FDI) increased to \$1,500bn in 2000 from just \$13bn in 1970 (United Nations, 2004), making it an important policy target throughout the industrialised world. As a rationale for policy, the UK HM Treasury (2000) argues that FDI generates efficiency spillover benefits for domestic firms, although the evidence is not conclusive (see Driffield and Girma, 2003; Conyon *et al*, 2002; Görg and Greenaway, 2001). FDI is also an important source of economic development (Gabe and Kraybill, 2002), especially in the less-developed areas (Head *et al*, 1999; Kim *et al*, 2003), with countries like the UK and France devoting half their regional policy budgets to grant support this investment (Devereux *et al*, 2007; Crozet *et al*, 2004). Under European Union state aid rules, regional grants are one of the few opportunities by which governments can financially attract foreign investment (Wren, 2005).<sup>1</sup> In the UK, the regional policy grants amount to £4 billion since 1985 at 2005 prices.

Notwithstanding these policies, both theory and empirical evidence suggest the grants have a weak effect on plant location, raising doubts about the use of this resource. The new economic geography gives only a very limited role to locational policies (Puga, 2002), instead emphasising agglomeration economies, while there is a body of empirical work that suggests the agglomeration effects dominate classical location factors, causing them to lose significance or to become weak (Head *et al*, 1995; and Guimaraies *et al*, 2000), including grants (Devereux *et al*, 2003, 2007). Nevertheless, casual observation on UK regional policy suggests that it has had a strong impact on FDI location across regions. The designation of Assisted Areas and the introduction of large-scale regional grants in the early 1960s coincided with a step-change in the industrial location pattern across UK regions (Ashcroft and Taylor, 1977), including FDI (Hill and Munday, 1992), while a similar pattern is evident for the West Midlands region after it was later designated for grants (Jones and Wren, 2009).<sup>2</sup> It contrasts with the period 1945-65 when (the non-assisted areas of) southern England

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<sup>1</sup> Direct financial assistance is presumed to be prejudicial to competition but exemptions allow grants in defined areas for the purpose of economic development, either where the standard of living is abnormally low or there is serious underemployment (Article 87.3.a) or it facilitates certain activities without adversely affecting trading conditions (Article 87.3.c).

<sup>2</sup> Ashcroft and Taylor find that policy caused 500 plants to relocate to the Assisted Areas over the 1960s, and Hill and Munday show the steady shift of FDI to the regions.

accounted for two-thirds of manufacturing employment in foreign ownership (Dicken and Lloyd, 1976). One possibility is that the grants have an early-stage effect on FDI, after which the plants agglomerate.<sup>3</sup>

The upshot of this is that there is a discrepancy between theory and empirics on the one hand, and policy and casual observation on the other hand. This is complicated by the apparent recent reassertion of the early post-war location pattern, such that with the continued presence of grants the ‘core’ region of South East England has re-emerged as the primary destination for FDI. Its share of foreign-owned investment has increased year-on-year since 1990 and relative to its size it has attracted more FDI than any other British region since 2000.<sup>4</sup> This means that the traditionally assisted area regions of Scotland, Wales and North East England now receive an FDI share no greater than their share of total employment (Jones and Wren, 2009), raising questions about the role of the grants and about inward investment policy more broadly.

The purpose of this paper is to examine the distribution of FDI projects across British regions over the period 1985-05 in order to explore its determinants, and the role of grants. The paper makes important contributions to the debate on locational determinants, and it is perhaps the first time that FDI location has been explored over such a long period, especially for grants and recent years.<sup>5</sup> Of course, British regions are a high level of spatial aggregation, but it is the primary administrative unit by which the UK delivers its economic development policy and it offers several advantages. The regions are much less ‘open’ than smaller spatial units and data can be collected for a range of variables, providing valuable evidence for more disaggregated analysis. Further, the ‘regional problem’ continues to be of keen interest to both academics and policymakers (Overman and Puga, 2002; HM Treasury, 2001). We find that the regional grants have had a significant effect on FDI location across British regions, but that it has diminished with time, such that it is no longer able to affect the regional distribution of FDI.

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<sup>3</sup> The number of Japanese plants in the UK increased from 40 to 219 over 1984-91, and Taylor (1993) finds a strong policy effect on location for this early-stage FDI. Contrary to this, Head *et al* (1995) find that Japanese investors in the US prefer a location with a concentration of previous Japanese FDI, suggesting that they tend to agglomerate over time.

<sup>4</sup> Location quotients for these are reported in Jones and Wren (2009).

<sup>5</sup> Most FDI location studies in relation to fiscal instruments are for tax, for which Coughlin *et al* (1991) and Hines (1996) find that lower state taxes positively impact on FDI location, and Devereux and Griffiths (1998) find that corporate tax rates affect US FDI location across European countries. Contrary to this, some older but much-cited US studies fail to find an effect of taxation on FDI location, such as Glickman and Woodward (1989) and Wheeler and Mody (1992). A recent study at the plant level is Dimitropoulou *et al* (2008).

The structure of the paper is as follows. The next section outlines the pattern of FDI and policy context, and Section 3 carries out an exploratory spatial data analysis of FDI across regions. Section 4 sets out the estimation framework and Section 5 describes the data. Section 6 carries out the regression analysis and finally conclusions are drawn in Section 7.

## **2. The Pattern of FDI and Policy Context**

The analysis is carried out for the ten Government Office regions of Great Britain, equivalent to *Eurostat* NUTS I regions. Descriptive statistics for these regions are given in Table 1. For the purpose of the exploratory spatial data analysis, a distinction is made between six Assisted Area (AA) regions and four non-Assisted Area regions, where these are defined by the amount of regional grant offered over the study period 1985-05. The grants are available to plants in designated Assisted Areas, with these areas defined to reflect relative economic disadvantage. Table 1 shows that about 80 per cent of the grant has gone to plants located in Scotland, Wales and northern England (North East and North West). With these we include the West Midlands region, which has received substantial assistance since designation in 1984, and Yorkshire and Humberside, which is relatively disadvantaged (Table 1) and has received grants in respect of industrial decline since the 1960s. This categorisation provides a reasonably sharp distinction between areas, with the four ‘non-AA regions’ receiving just 6 per cent of total grant.<sup>6</sup>

While the six Assisted Area regions received virtually all the grant over 1985-05, Table 1 shows that they have done rather less well in the share of FDI, receiving a combined total of just under 60 per cent of total projects, but 75 per cent of manufacturing FDI. Of the non-AA regions, the South East has received 28% of total FDI, but it was noted above that foreign investment to this region has increased monotonically since 1990, but much of it in the service sector. The temporal pattern of FDI going to the six Assisted Area regions is shown in Figure 1, both for all projects and for manufacturing. This reveals a sharp decline in the share of FDI projects going to the AA regions over time, from about 90% in the early 1990s to 40% in 2005. This is less pronounced for manufacturing, but still marked, falling

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<sup>6</sup> Regional policy areas were designated for the first time in 1993 in the South East, London and East Anglia. The Corby steel closure area in East Midlands was designated for regional grants in 1979, while small parts of the South West were designated from 1966 onwards.

from 90% to 50% over the same period. As such, it suggests that the declining regional location pattern does not simply reflect the growing importance of service-based FDI in South East England.

Figure 1 also plots the temporal pattern of regional grants for Great Britain as a whole, both for total grants and for the grants offered to foreign-owned plants (all at 1995 prices). It shows that FDI was offered an increasing amount of grant over the early 1990s, which pushed up the total amount, but that grant offers have been falling in real terms since the mid-1990s, although it is only since 2003 that they have fallen below the level of the late 1980s. However, what is notable from this Figure is that the fall in the share of FDI in the AA regions actually preceded the decline in the grant. Thus, while there has been a dramatic reduction in the FDI share going to the Assisted Areas it seems to be only loosely related to the pattern of grants. It is also the case for manufacturing, where the grants are concentrated.

Before exploring this relationship in greater detail, we first outline the policy context, which proves useful for our subsequent analysis and interpretation of the results.

## 2.1 Regional Policy and Grants

For the past fifty years or so, the UK government has designated certain geographical parts of Great Britain for industrial grant support in a bid to promote economic development (see Wren, 1996, for a detailed chronology of developments). Initially, this sought to encourage industrial transfers within the UK, but since the mid-1980s policy has increasingly sought to promote inward investment to these areas from overseas, with FDI taking half the regional aid budget. Immediately prior to 1980 the whole of the landmass of Scotland, Wales and northern England was designated for grants, but since this time the Assisted Areas have been drawn more tightly around the disadvantaged areas, initially based on unemployment rates in travel-to-work-areas, but since 2000 on indicators for contiguous electoral wards.

This means that not every geographical part of an ‘Assisted Area region’ is designated for grants, although the Assisted Areas include the major urban areas where FDI tends to locate (Devereux *et al*, 2007). Where known, the coverage of Assisted Area by working population is 65% for Scotland and 76% for Wales (AEP, 2000), while for the ‘Assisted Area regions’ as a whole the coverage is likely to be somewhere in this range.<sup>7</sup> It suggests that the

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<sup>7</sup> The six ‘Assisted Area regions’ represent 47% of Britain’s working population, while the overall population coverage of the Assisted Areas is 35%, which suggests a ballpark figure of



regions are a suitable unit for analysis, especially as the grant is small in the non-Assisted Areas (Table 1). Despite changes, the overall coverage of the Assisted Areas has remained remarkably constant over time, at 35 per cent of the working population, but falling to 31% in 2000.<sup>8</sup> The major change to the Assisted Areas map occurred in August 1993, when areas in the South East and East Anglia regions were designated for grants for the first time, and as we see this may have been a major watering-down of the regional nature of the grants.<sup>9</sup> The other major revision to the map occurred in 2000, after which expenditure began to fall.

Throughout the period the main policy instrument is Regional Selective Assistance (RSA), a discretionary grant scheme seeking to “encourage sound projects which will improve employment opportunities in the Assisted Areas” (House of Commons, 1985). It has criteria relating to project viability; proof of need; benefit to the regional or national economy; and an employment link, usually the net jobs created. The grant was introduced in 1972 and little changed after 1984, except that in 2000 smaller grants in England (up to £75,000) were made available outside the Assisted Areas through an Enterprise Grant scheme. In 2004, this grant scheme and RSA were replaced by Selective Finance for Investment in England (SFIE), which is similar to RSA (Wren, 2005).<sup>10</sup> In Scotland and Wales, RSA remained in place throughout. Figure 1 shows the RSA and SFIE grant offers.

Under European Union (EU) state aid rules, eligible projects must involve fixed capital investment (plant, machinery or buildings), which has meant that over 1985-05 ninety per cent of the total grant has gone to manufacturing, even though services are eligible (National Audit Office, 2003). The EU applies ceilings on the grant rate relative to eligible investment, and in the UK there are two tiers of Assisted Area, with more generous rates in the higher tier.<sup>11</sup> The individual offered grant rates are not publicly disclosed, but there are substantial differences between regions, even for the same tier of Assisted Area.<sup>12</sup> This is

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around 75%. It assumes that there are no Assisted Areas in the ‘non-Assisted Area’ regions, so it is a slight over-estimate. The reported figures for Scotland and Wales relate to 1992.

<sup>8</sup> As a cost-cutting measure the coverage by working population fell from 40% to 28% in 1982, but increasing to 35% in 1984 with the inclusion of the West Midlands region.

<sup>9</sup> Maps for the coverage of the Assisted Areas can be found in the Annual Reports on the 1982 Industrial Development Act (House of Commons papers) and in Wren (1996).

<sup>10</sup> SFIE was replaced by the Grant for Business Investment scheme in October 2008.

<sup>11</sup> These are the Development and Intermediate Areas prior to 2000, and Tier 1 and Tier 2 areas since then. At 2000, the grant ceilings for regional investment aid to large firms were 35% in the higher tier and 20% in lower tier

<sup>12</sup> In Tier 1 Assisted Areas in 2004/05, the ratio of offered grant to associated project costs was 18% for Great Britain, but 32% for Wales and 10% for England (Annual Reports on the 1982 Industrial Development Act). It series is not available on a consistent basis over time.

attributed to differences in the grant per job by PACEC (1993), but it may reflect the distribution of FDI between regions, as foreign-owned projects receive higher grant amounts and possibly higher grant rates in order to secure location.<sup>13</sup> Table 1 shows Wales devotes a greater share of its grant to FDI compared to Scotland, and the North West a smaller share compared to North East England.

The regional grant budgets are set centrally for the UK, but the regions are able to exercise discretion within this framework. In England, grant applications are dealt with by regional Industrial Development Boards (IDBs), staffed mainly by local industrialists, with large grants (above £2m in 2000) handled by a central Industrial Development Advisory Board (IDAB) in London, with cases above £250,000 also approved centrally.<sup>14</sup> This does not avoid some regional competition for projects, despite firms being able to formally apply for a grant in one region only, with central government occasionally having to arbitrate between regions. In Scotland and Wales, all applications are assessed by the respective IDABs for each country. A Memorandum of Understanding was prepared for these countries to prevent the competitive bidding for projects, but it was unsigned. Regional agencies may also promote the availability of grants in their region to FDI to differing extents.

### **3. Exploratory Spatial Data Analysis**

A useful way to examine the distribution of FDI across British regions over time using a single index number is to investigate its spatial autocorrelation; this is the coincidence between value similarity and locational similarity (Anselin, 2001). It is based on the Moran's *I* (Moran, 1950; Cliff and Ord, 1973).<sup>15</sup> In the present context, it tells us how regions are related in terms of the distribution of FDI, and whether FDI in one region is associated with more or less FDI in 'neighbouring' regions (i.e. positive or negative spatial autocorrelation). Relatedness is defined by a spatial weights matrix, *W*, which gives the 'connectivity' between regions. Here, alternative forms of *W* are considered, one of which is the policy status.

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<sup>13</sup> FDI received half the total regional grant over 1985-2000 but accounting for 10% of projects (Wren, 2005), increasing to 20% since 2000, reflecting smaller project scales.

<sup>14</sup> IDBs advise the Government Regional Offices, but since 2002 they reported to the Regional Development Agencies that now administer the cases, suggesting greater discretion.

<sup>15</sup> Moran's *I* is the most well known test for spatial effects, but others exist, e.g. the Geary *c* statistic (Cliff and Ord, 1973). Each has the characteristic of an autocorrelation coefficient, i.e., the numerator is a measure of covariance and the denominator a measure of variance.

Formally, for a variable  $x$ , Moran's  $I$  is defined as follows, where the  $r$  and  $s$  subscript the  $R$  regions, and  $w$  are the elements of the spatial weights matrix  $W$ :

$$I = \frac{\sum_{r=1}^R \sum_{s=1}^R w_{rs} (x_r - \bar{x})(x_s - \bar{x})}{\sum_{r=1}^R (x_r - \bar{x})^2} \quad (1)$$

The Moran's  $I$  lies in the range  $[-1, +1]$ , where a positive [negative] value represents positive [negative] spatial autocorrelation indicating that regions with high FDI are 'connected' to other regions with high [low] FDI, and conversely. The index is asymptotically normally distributed as  $R$  increases (Cliff and Ord, 1973). The three alternative weighting regimes are:

- (a) *Contiguity*:  $w_{rs} = 1$  if  $r$  and  $s$  share a common land boundary, but zero otherwise.
- (b) *Distance*:  $w_{rs} = d$ , where  $d$  is the inverse distance between the major economic centres of  $r$  and  $s$ , which is row standardised.
- (c) *Status*:  $w_{rs} = 1$  if  $r$  and  $s$  have the same Assisted Area status, but zero otherwise.

The first of these is an extreme view of geographical 'connectivity', as it assumes only regions that border one another (i.e., 'first-order' contiguity) interact in terms of their attractiveness to FDI. The second is used in empirical work in some form, e.g., Patacchini and Rice (2007), and in our case it is measured as the physical road distance between major economic centres.<sup>16</sup> This is reasonable as plant entry is skewed towards these cities (Devereux *et al*, 2007). Unlike the first two, the third is independent of topology and treats the UK landmass as two unconnected islands. These are the six Assisted Area regions and four non-AA regions given by Table 1. It reveals the extent to which FDI co-locates across the Assisted Areas, but for which the first two weighting matrices may be rather poor. This is because the geography of Britain means some AA regions are more 'connected' to non-AA regions in terms of contiguity and distance, e.g. the economic centre of Wales places it towards the south of the British landmass.

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<sup>16</sup> Economic centres are: South East: London; South West: Bristol; East Anglia: Norwich; East Midlands: Nottingham; West Midlands: Birmingham; Yorkshire and Humberside: Leeds; North West: Manchester; North East: Newcastle; Scotland: Glasgow; Wales: Cardiff.

### 3.1 Results for Spatial Autocorrelation

The plot of the Moran's  $I$  statistics for FDI for each year 1985-05 is shown in Figure 2. This is for the number of FDI projects locating in each region in each year (details of the data source are outlined below). Since larger regions are expected to receive more FDI by virtue of their size, the regional data are weighted by the respective shares of national employment. The null hypothesis of positive spatial autocorrelation is examined under a one-tail test, for which the critical statistical value varies by year. Figure 2 reveals that positive spatial autocorrelation can be comfortably rejected for the contiguity and distance weighting regimes (for (a) the p-value peaks at 8% in years 1991 and 1997, and for regime (b) the  $I$  statistic is uniformly negative), but for regime (c) the  $I$  statistic is significant at the 10% level for all years up to 1998 and at the 1% level for all but three of these years. After this time, not only is the  $I$  statistic insignificant, but it is negative from 2000. This suggests significant positive spatial autocorrelation exists, but only up until about the turn of the century.

Of course, virtually all of the grant has gone to manufacturing, and Figure 3 repeats the analysis for this sector only, but the basic result is unchanged. The contiguity regime never achieves significance at the 5% level, while the  $I$  statistic for the distance regime continues to be uniformly negative. However, for the same status regime the  $I$  statistic is significant at the 5% level for all years 1985 to 1999, and nearly always at the 1% level. Neither of these make recognition of the project scales, but when repeated for the project job scales, the pattern for all plants is much the same (not shown).<sup>17</sup> In summary, the exploratory data analysis suggests that the designation of areas for regional grants appears to be a powerful attraction for FDI location, but only up until about the turn of the century. This is now examined in greater detail.

## 4. Econometric Model of Regional Location

Location models commence with an index of area attractiveness  $V_{irt}$ , such that a firm  $i$  locates its project in area  $r$  ( $r = 1, 2, \dots, R$ ) at time  $t$  if  $V_{irt} > V_{ist}$ ,  $\forall s \neq r$  and  $s \in \{1, 2, \dots, R\}$ . It is

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<sup>17</sup> As before, the Moran's  $I$  is never significant at the 5% level for the contiguity regime, while for distance it is uniformly negative. For the same status regime it is significant at the 5% level in all but two of the years over 1985-99, although it is also significant for three of six years after this period. See Jones and Wren (2004) for a discussion of the job data.

assumed that there are  $N_t$  firms, each with a single investment project at time  $t$ , and each independently deciding where to locate its project between  $R$  regions. Attractiveness depends on the expected profits  $\pi_{rt}$  that can be earned in a region  $r$  at time  $t$ , and on the time-invariant unobserved effects,  $\alpha_{ir} \equiv \alpha_i + \alpha_r + \alpha$ , where respectively these are firm-specific effects (e.g. management preferences); region-specific (quality of life, culture, climate, etc); and national effects that are common to all regions. A firm locates in region  $r$  if  $\alpha + \alpha_r + \pi_{rt} - \pi_{st} > -\alpha_i$  ( $\forall s \neq r$ ).<sup>18</sup> Further, supposing that the firm-specific effects  $-\alpha_i$  are approximately normally distributed across firms, and in a cumulative form according to the logistic function, the share of firms locating in region  $r$  at time  $t$ , denoted  $n_{rt}$  ( $= N_{rt} / N_t$ ), is given by:<sup>19</sup>

$$l(n_{rt}) = \alpha + \alpha_r + \pi_{rt} \quad (2)$$

where  $l$  denotes the logit function,  $l(n_{rt}) = \ln(n_{rt} / 1 - n_{rt})$ , and  $\sum_{r \in R} n_{rt} = 1$ . Equation (2) is the basic relationship between the regional share of FDI projects and regional attractiveness. The variables that measure the expected profits  $\pi_{rt}$  are considered below.

#### 4.1. Spatial Linkage Effects

The spatial linkage effects are of two types: inter-regional and intra-regional. In the case of the former, the exploratory spatial data analysis suggests that in FDI the regions are neither linked by contiguity nor by distance, which is perhaps to be expected given that these are relatively large spatial units. Further, while there is positive spatial autocorrelation by policy status, this does not mean that the regions are economically linked, since to receive a grant in region  $r$  the plant must locate in that region and not in a neighbouring region. Nevertheless, we have argued that regions compete for FDI and this is a source of *negative* autocorrelation across regions, i.e. if other regions are more successful in attracting FDI then region  $r$  will be adversely affected. It suggests the inclusion of a spatial lag term in the share of FDI going to other regions that are ‘related’ in some way.

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<sup>18</sup> Systems of  $R$  equations such as (2) are estimated in a single regression across all  $R$  regions, so that  $\pi_{st}$  ( $\forall s \neq r$ ) is omitted from the right-hand side at this stage, as is the term  $\alpha_{is}$ .

<sup>19</sup> Broadly, the approach supposes preferences  $\alpha_i$  are normally distributed across firms, with the region-specific fixed effect  $\alpha_r$  acting as a shift factor on this distribution between regions. The profits term  $\pi_{rt}$  indicates where a region  $r$  is in relation to the distribution at any time  $t$ , which then determines the logit of its share of projects,  $l(n_{rt})$ .

In the case of the intra-regional linkage effects, we previously noted the importance of agglomeration economies that arise from proximity to other firms, e.g. knowledge spillovers or technological transfer (Rosenthal and Strange, 2004), which may dominate classical location factors. There is a strong literature on regional agglomeration economies that dates back to Isard (Parr, 2002), and usually these are classified as either urbanisation (or Jacobs) economies that flow across industries and arise from industrial diversity, or MAR externalities (Marshall-Arrow-Romer) that are intra-industry and stem from static localisation economies. Empirical evidence tends to support the MAR externalities over the Jacobs form (e.g., Henderson, 2003; Rosenthal and Strange, 2003; and Devereux *et al*, 2007).

On the former, we include a term for industrial diversity based on employment in foreign-owned plants. This may be a good measure of diversity, as it reflects the industries in which FDI arrives, with Crozet *et al* (2004) finding that an increase in the number of foreign firms has a greater effect on location compared to that of domestic firms. On the second, we include the FDI project share locating in the region in the previous year. This is reasonable as recently-arriving FDI has the greatest influence on new FDI (Head *et al*, 1995), although no attempt is made to disaggregate this by activity, which is beyond this paper's scope.<sup>20</sup>

## 4.2 Estimating Equation

With these points in mind, we generalise (2) and write the estimating equation as:

$$l(n_{rt}) = \alpha + \gamma l(n_{rt-1}) + \beta_1 DIVERSE_{rt-1} - \beta_2 l(n_{st}) + \beta_3 \pi_{rt-1} - \beta_4 N_{rt-1} + \alpha_r + \alpha_t + \eta_r + \nu_{rt}, \quad (3)$$

where  $\alpha$ ,  $\beta$  and  $\gamma$  are the parameters to be estimated. The lagged dependent variable for MAR externalities gives (3) the form of an autoregressive-distributed lag model. Other terms are for Jacobs externalities  $DIVERSE_{rt-1}$ , the spatial lag  $l(n_{st})$  and expected profits  $\pi_{rt-1}$ , where the latter includes the grant, on which more is said below. The total number of projects  $N_{rt}$  is included as greater volumes of FDI may become more geographically spread out. Equation (2) has regional fixed effects  $\alpha_r$ , but time fixed effects  $\alpha_t$  are added to (3) for the possibility that a change in national attractiveness is felt unequally across the regions. The error term is  $\eta_r + \nu_{rt}$ , where  $\nu_{rt}$  is serially uncorrelated. Signs on coefficients in (3) are *a priori* positive.

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<sup>20</sup> To explore this, we would have to specify industry-specific MAR terms, but also to measure the dependent variable in (3) below for each industry, which we leave for elsewhere.

Equation (3) is estimated using panel data for ten British regions over 1985-05. Since  $\eta_r$  is correlated with  $l(n_{r,t-1})$  and there is potential endogeneity in the grant, it is regressed using the Generalized Method of Moments (GMM) estimator of Arellano and Bond (1991). This is a popular approach that involves first-differencing equation (3) to eliminate regional effects in order to obtain valid moment conditions in the transformed equation, and then using the lagged values of the instrumented variables to deal with the above issues.

In using the GMM estimator there are several issues. The first is that GMM tends to be used for short-wide panels (and the systems GMM estimator was developed precisely to address the issue of a small number of time periods; Bond, 2002). However, in our case a long time-series raises the possibility that the instruments overfit the endogenous variables, even if they are relatively small in number (see Roodman, 2007).<sup>21</sup> This means parsimony is required in the terms that are treated as endogenous and in the use of lags. Judson and Owen (1999) find that this restricted procedure does not materially affect the performance of the GMM estimator for a similar number of time periods as here. Further they find that a least squares dummy variable (LSDV) estimator performs just as well as viable alternatives.

The second econometric issue is that (3) includes a spatial lag term,  $l(n_{st})$ . Methods are developed for dynamic-non-spatial panel data and for spatial-non-dynamic panel data models, but given the contemporaneous nature of the spatial lag term in (3), combining these can lead to biased and inconsistent estimates (Elhorst, 2003).<sup>22</sup> Of course, we are primarily interested in the significance of the grant term and there is a trade-off with efficiency, but since the source of negative spatial autocorrelation across regions could be the grant offered in other regions, as an alternative we consider including this but in a lagged form.

## 5. The Data and Variables

The data were supplied by the national inward investment agency, UK Trade and Investment (UKTI), and give information on all known investments carried out by foreign-plants in

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<sup>21</sup> Over-fitting the endogenous variables can bias the coefficients estimates towards those from an uninstrumented estimator, even though the Hansen-Sargan test for the absence of correlation between the instruments and error term is satisfied.

<sup>22</sup> An exception to this is Badinger *et al* (2004), who in a two-step procedure filter the variables to allow for spatial dependencies and then in a second step apply GMM, but the filtering can only be applied to variables in levels (Madariaga *et al*, 2005), and so it is not appropriate here.

Great Britain for each year over the period 1985-05. They are on a project basis and include start-up, acquisition, joint ventures and re-investments, where the latter involve a substantial upgrading of a plant, e.g. a new production line. These data are used by the Government to report FDI for the UK as a whole and it has advantages over other data sources, as it is for gross inflows over a long time period, whereas the regional summary tables in the *Business Monitor* (PA1002) are in net terms and for manufacturing only.<sup>23</sup> Further, the *Annual Business Inquiry* samples as little as 1 in 5 plants with less than 100 employees (Griffith, 1999), but in fact most FDI start-ups fall within this size band (Jones and Wren, 2006).

The information is notified to UKTI by the regional agencies, grant bodies and from its own involvement with investors. The data were checked and cleaned, and give information on 11,488 FDI projects, which are aggregated to the regional level. These are the data reported in Figures 1 to 3 above. The dataset gives information on the 2-digit industrial activity and gross number of project jobs (the latter for 91% of cases). To gain confidence, comparison is made in Appendix Table 1 between our data for the ten years 1996-05 with a single recent year of the *Annual Business Inquiry* (for which data are held). For the reasons above we do not expect the series to be identical, but the table shows a broadly similar pattern. Indeed, the null hypothesis that they are identical across regions cannot be rejected, even at the 10 per cent level.<sup>24</sup>

As a further point, changes were made to the regional boundaries in 1996 when the UK moved from Standard Regions to Government Office Regions, mainly affecting the South East and East Anglia regions.<sup>25</sup> However, this makes little or no practical difference to the variables expressed as either a ratio or rate, although for other variables (e.g. market size, knowledge and grant) the data were rescaled over 1985-95 according to their value at 1996, but again making no qualitative difference to the results that are obtained.

## 5.1 The Variables

The dependent variable,  $l(n_{rt})$  in (3), is the logit of the regional share of the annual number of FDI projects for Great Britain as a whole. The spatial lag term  $l(n_{st})$  is the logit of the share

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<sup>23</sup> The PA1002 summary tables exist for 1971-97 only, and give a breakdown of employment in foreign-owned enterprises by the two tiers of Assisted Area, but only up to 1992.

<sup>24</sup> Based on UKTI data for 1996-05 the Chi-square statistic for goodness-of-fit is 12.9, against critical values of 15.5 and 13.4 at the 5% and 10% levels.

<sup>25</sup> Prior to this time the North East region included Cumbria (now in the North West), which is a rural county, and South East included the counties of Bedfordshire, Hertfordshire and Essex, which are now in the East Anglia region, although officially known as the East region.



of projects in related regions, where regime ( $c$ ) for policy status is used as the row-standardised spatial weights matrix. This is reasonable as competition for projects is between Assisted Area regions, and likewise for non-Assisted Area regions. The MAR externality term is the first lag of the dependent variable, and the Jacobs term *DIVERSE* is measured as the standard deviation of the number of jobs in FDI projects across 46 two-digit industries. Clearly, alternatives for the Jacobs term exist, but this should give a good measure of industrial diversity.

As regards the profits term  $\pi_{t-1}$  in (3), there is no over-arching theory of plant location, with Head *et al* (1995) arguing that it is not possible to list all relevant variables for profits. The approach is to express profits in terms of a project's net present value,  $\pi = f(OR - OC - I)$ , and to include regional terms for each component, comprising operating revenue *OR*, operating cost *OC* and investment cost *I*, where  $f$  indicates the forward-looking nature of the investment. It is possible to go on adding variables, but we take comfort from the fact that in the empirical work we have significant terms for each component. In the choice of variables we are guided by the literature and theory. We now consider each component, except in the case of *I* we suppose it is the same across regions save for the policy terms below. Details on the source and measurement of the variables are given in the Data Appendix.

*Operating Revenue:* Market size is included in FDI location studies (Barrell and Pain, 1999; Billington, 1999; Wei *et al*, 1999) and here it is measured by the regional population size (*POP*) and by spending power (*INCOME*). Two other terms are suggested by theory. The first derives from the new economic geography (Krugman, 1991), which finds that transport costs are important to economic development. Proxies for these costs are based on distance (Combes and Lafourcade, 2005), and here it is the distance to each of the other main regional economic centres, weighted by the respective market sizes (*DISTANCE*). Overseas markets are assumed to be equally accessible. The other term is knowledge as an input to production (Romer, 1986), which is measured by the number of students in higher and further education (*KNOWLEDGE*). Alternatives to these were used, e.g. the distance to the core market of South East England and the share of the top 30 research Universities by region (based on the 2001 Research Assessment Exercise), but these are time invariant and they dropped out of the GMM estimation.

*Operating Cost:* These classical location factors include labour costs (*WAGE*) and the availability of skilled (*SKILL*) and unskilled (*UNSKILL*) labour. Respectively, they are the real average weekly earnings, the proportion of school-leavers obtaining at least 5 GCSEs at

grade C or higher and the unemployment rate. Barrell and Pain (1999), Coughlin *et al* (1991) and Wei *et al* (1999) all find that unit labour costs negatively affect FDI location, while Billington (1999) and Friedman *et al* (1992) find that the unemployment rate has a positive effect. To these, we add road expenditure per kilometre squared (*ROAD*), reflecting the cost of moving goods and inputs within a region. Low values of this variable suggest rurality, while high values indicate congestion, so that this term is included in a quadratic form.

*Forward-looking terms:* Several terms are added to reflect the forward-looking nature of the investment decision. These are the regional growth rate (*GROWTH*), and three measures of risk, comprising the unemployment rate squared (*DEPRESSED*), days lost from industrial action (*STRIKE*) and expenditure under the EU regional funds is included, which has gone to support infrastructure (*EUFUND*). Some studies find that the growth rate has a positive effect on FDI location, which is more important than market size (Billington, 1999), although cross-country studies generally find that the size dominates (Kravis and Lipsey, 1982; Wheeler and Mody, 1992; Braunerhjelm and Svensson, 1996). Taylor (1993) finds that if the unemployment rate is too high it has a negative effect on location, signalling that an area is depressed. Labour disputes may play a similar role, but the logarithm of this is taken as the number of strikes was much higher in the 1980s, especially during the miners' strike. In the case of the EU regional policy term no attempt is made to control for selection, and like elsewhere (e.g. Ederveen *et al*, 2006) it is plausible that it will simply pick-up the depressed areas that receive little FDI.

## 5.2 The Policy Terms

Save for the profits terms above (and grant term below), it is assumed that the investment cost is the same across all regions. It is reasonable as the UK has no regionally differentiated tax incentives, so the grant is the main financial instrument varying across geographic space. In deciding where to locate the *average* or project grant rate is relevant to the investor, and on the assumption that the grant rates do not vary, the sum of these grants is likely to determine the total number of FDI projects and hence the regional FDI shares. However, according to our earlier discussion the grant rates may vary across regions for several reasons.

First, regions may compete for FDI, and the extent to which a region offers higher grant rates it is reasonable that it will associated with more projects and grant, but a smaller share of FDI projects *relative* to the total amount of grant that is offered, suggesting smaller regression coefficients. To see this, suppose all projects are of the same investment scale *I*

and that there are two regions,  $H$  and  $L$ . Assume relatively higher grant rates  $g$  are offered in  $H$ , generating a larger number of projects  $n$ , i.e.,  $g_H > g_L$  and  $n_H > n_L$ . Then,  $H$  has more a larger share of FDI projects  $n_H / (n_L + n_H) > n_L / (n_L + n_H)$  and offers more grant  $g_H n_H I > g_L n_L I$ , but the ratio of these is smaller in  $H$  since  $1 / g_H < 1 / g_L$ . Second, higher grant rate ceilings apply in the higher tier of Assisted Area, but just about all regions had higher tier areas (although confined to certain geographical parts since 2000).

To address the issue of variable regional grant rates, it was noted that apparently similar regions devote quite different proportions of their total regional grant to FDI (see Table 1), and it is believed that this reflects differences in the regional competition for FDI.<sup>26</sup> In the analysis we therefore include two grant terms. The first is the total offered amount of regional grant (*GRANT*). This is our primary interest, and it is like that used in studies such as Devereux *et al* (2007). The second is the share of a region's total grant that is offered to foreign-owned plants (*FDISHARE*). This controls for the differences in the project grant rates across regions, and its expected sign is negative.

Finally, foreign investors may get other non-financial help to secure their location in a region. We do not have data on all these sources of assistance, but what we do have is a term that tells us if the UK inward investment agency was 'involved' with a project (*AGENCY*). An involvement is if at least two of the following are satisfied: an arrangement of regional tour, location search, provision of other substantial information or preparation of a tailor-made presentation. These are indicative of other forms of assistance received by the plants, e.g. help with land, training needs, etc. In total, it was involved with 20% of projects.

## 6. Regression Results

The regression results are reported in Table 2, based on estimating equation (3) with panel data for British regions for 1985-05. The first column reports the LSDV results, and the others use the GMM difference estimator. As well as the results for all plants, we also report those for the manufacturing sector, where the grants have been concentrated, and for start-up or 'greenfield' FDI, which strips out the acquisition projects (and re-investments). In the

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<sup>26</sup> The other possibility is that it reflects differences in the investment scales  $I$ , which can overturn the above result. However, while service projects are smaller in scale on average, virtually all the grant goes to manufacturing, and there is no clear reason to believe that these investment scales vary across regions.

GMM estimations the three policy terms (*GRANT*, *FDISHARE* and *AGENCY*) are treated as endogenous, but for the reasons outlined above they are each instrumented using a single lagged value.<sup>27</sup> The regression diagnostics indicate that the own-lagged terms serve as valid instruments for these terms.

In general, the results in Table 2 provide a good fit to the data, and there are significant coefficients of the correct sign for each of the components in the net present value expression. They vary to some extent between the LSDV estimator and GMM estimates, although they are much the same in the latter case between all projects and manufacturing. Focusing on these last two regressions, the coefficient on the lagged dependent variable is significant, suggesting the presence of MAR-type agglomeration, but the Jacobs diversity term is insignificant, which is like elsewhere. The spatial lag term is of the expected sign and indicates higher FDI in related regions has a negative effect on a region's FDI. Tests on the residuals and indicate the absence of spatial autocorrelation.<sup>28</sup> The estimate on the number of projects suggests that FDI becomes more geographically spread out as it increases.

In terms of the profits terms, on the revenue side income and knowledge have a positive effect on FDI shares, while distance has a negative effect and seems to pick-up peripherality. On the cost side, important factors are the availability of skilled and unskilled labour, while as expected the unemployment rate squared and EU regional policy terms have negative signs, indicating that these areas are less attractive to FDI. For the LSDV estimator many of the same variables are significant, although neither the knowledge or distance terms now come through, while the road, population and growth terms are all significant. Finally, the results for start-ups are less good, possibly because it strips out re-investments, although knowledge and skilled labour are more important to these projects, which is plausible.

## 6.1 The Grant Term

For the *GRANT* term a key issue is the appropriate length of lag, which to some extent is an empirical matter. The correlation coefficient is about 0.75 for successive lagged values of the grant up to the third lag, but when jointly entered in the LSDV equation the t-statistics on the *GRANT* terms are 0.39, 0.80, 2.01 and 0.23 for time lags of 0, 1, 2 and 3 years respectively. Of course, we cannot put too much faith in the direction of causality, as more FDI might

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<sup>27</sup> Due to the long time series, lags of three periods over-fit the endogenous variables and generate the OLS results, so that caution is required in instrumenting these terms.

<sup>28</sup> Based on the Moran's *I* for all plants for each of the three weighting regimes outlined above, and carried out for the years 1990 and 2000 only. The p-values never fell below 0.39.

simply mean more grant irrespective of its effect, while there is the lagged dependent variable, but it suggests a 2-year grant lag is optimal. This is plausible as the grant data relate to offers, while the UKTI data generally relate to project commitments (virtually all projects do in fact go ahead (Jones and Wren, 2004).

As a first step, efforts were made to address the endogeneity of the *GRANT* term in the LSDV equation. Of course, as we have seen, using its own lagged value as an instrument leads to an insignificant estimate, possibly because of correlation with the lagged dependent variable. However, as alternatives to *GRANT*, several other approaches suggest a significant grant effect. The first simply summed the grant in each region over the entire study period, giving a t-ratio on this term of 2.99. Second, a dummy variable was included for the six Assisted Area regions in Table 1, which was significant at the one per cent level. Third, the grant was included as a three-year moving average, which is likely to dampen the reverse causality, and here the t-ratios were 2.02, 1.62 and 1.16 lagged 1, 2 and 3 years respectively.

These are suggestive of a positive grant effect, although it is best examined using the GMM estimator. Table 2 shows that the *GRANT* is significant in each of these regressions, but at about the ten per cent level for manufacturing, on which more is said below. In the case of all FDI projects and manufacturing the *FDISHARE* term is negative and significant, which is believed to be picking-up regional differences in the grant rate, while the *AGENCY* term is also significant, which captures the other public support given to firms. Overall, these indicate that the grant appears to have a significant effect on FDI location, which at the mean means around an extra £27m of grant is needed to increase a region's share of manufacturing FDI by one percentage point, assuming that the grant is held constant in other regions.

Finally, an issue that was raised earlier is that the contemporaneous nature of the spatial lag term  $l(n_{st})$  in (3) may produce biased and inconsistent estimates of the coefficients. As the grant is potentially the source of negative autocorrelation, instead of measuring this using FDI shares, we use the grant amount in 'related' regions with the same spatial weights regime. This enables it to be lagged in the GMM framework, although it lacked significance, possibly due to multicollinearity with the *GRANT* term. Nevertheless, the findings regarding the *GRANT* term in Table 2 are robust to the inclusion of the spatial lag term.

## 6.2 The Grant Effect over Time

In the introduction it was noted that there is a strand of literature that suggests agglomeration effects dominate classical location factors, while other studies perhaps suggest an early-stage

for grants. We find the significance of the grant term co-exists with the lagged dependent variable, which is an agglomeration effect, indicating persistence in the location of new FDI across UK regions. Further, the exploratory spatial data analysis finds that FDI co-locates across Assisted Area regions, but up to the year 1999 only. This may indicate an early-stage effect, although it could reflect other factors and it is worthy of investigation.

The *GRANT* was included in spline form in the GMM estimations in Table 2 for three sub-periods over 1987-05, and the results are presented in Table 3. They show a clear pattern, with a significant effect in the first sub-period 1987-92 for each of all, manufacturing and start-up FDI, but insignificant thereafter. When a time trend is included on *GRANT* it is also significant and negative (Table 3). At the mid-year (1996) it reveals an estimated effect similar to that obtained overall, but a policy effect that is close to zero by the year 2000.

These results point to the declining effect over time of policy in the regional FDI shares and indeed including the *GRANT* term in spline form for every single year for all FDI we find that it is significant at about the 5 per cent level for years up to 1992, at about the 10 per cent level for years 1993 to 1995, but then insignificant for every year thereafter. To reconcile this with the exploratory spatial data analysis (which finds a zero effect from 2000 only) the analysis of Figure 2 was repeated, for the same policy status weighting regime but disaggregated by the FDI type, i.e. start-up, acquisition or re-investment (a project after the project by which the plant commences in foreign ownership). This is shown in Figure 4.

In the case of start-ups, Figure 4 shows that there is positive spatial autocorrelation over 1988-93, but for re-investments the autocorrelation is for all years 1985-99 (at the 5% level). Wren and Jones (2009) find that foreign-owned plants carry out their first re-investment within about seven years of the initial investment or not at all, suggesting that while policy ran out of steam in the early 1990s, FDI continued to locate in favour of the Assisted Area regions up to 1999 due to the re-investment by these plants.

As to why the grants ran out of steam there are several possible explanations. The first is the sectoral shift in the nature of FDI with increased service investment. However, while this may explain the better estimates obtained for the *GRANT* term in Tables 2 and 3 (service FDI increased towards the end of the study period but in the non-Assisted Area region, while grant expenditure diminished in the Assisted Area regions – Figure 1), the same pattern is apparent for manufacturing, where the grants were concentrated. As a second explanation, it could be an early-stage effect. However, the grant effect co-exists with the significant lagged dependent variable, which is interpreted as an agglomeration, suggesting

that this is also not a satisfactory explanation (although it would be useful to also consider this at the industry level).

Finally, we mentioned above that a substantial change was made to the map in 1993, when areas outside of the traditional Assisted Area regions were available for the grants for the first time. It appears to have been a significant weakening in the attractiveness of these areas, and is perhaps the most plausible explanation for a declining effect of the grants.

## **7. Conclusions**

The paper investigates the distribution of FDI projects across British regions over 1985-05 in order to examine its determinants, including the regional grants, which are the main financial instrument of UK inward investment policy. Overall, the paper finds that there are significant classical location factors explaining FDI location across regions, and that these factors co-exist with an agglomeration term, which elsewhere is sometimes found to dominate. The classical factors of importance are those regional terms that affect a firm's revenue (per capita income, distance and knowledge), its costs (availability of skilled and unskilled labour) and prospects (growth and risk factors). The agglomeration term is the lagged regional share of FDI.

In relation to the grant, then unlike some studies, we are able to find a significant effect, with higher grant amounts leading to higher FDI shares, allowing for differences in grant rates and for regional FDI competition. However, we also find that the grant effect diminishes over time, such that after 1992 it has ceased to affect the distribution of FDI across British regions (although FDI continued to be biased in favour of these areas up to 1999 due to re-investment by existing plants). This is believed to be related to the redrawing of the Assisted Areas map in 1993, which designated parts of South East England for the grants. While these non-Assisted Areas regions received just six per cent of the total grant over 1985-05 (Table 1), much of it since the mid-1990s, it also reduced the grant going to the Assisted Area regions.

As regards policy, the implication of the paper is stark. It is that regional policy is no longer able to alter the distribution of FDI in favour of the regions. This is the case whether we consider all FDI or manufacturing where the grants are concentrated. A response to this is that under EU state aid rules the grants are the only feasible opportunity for the UK to

financially assist foreign investment, so that they are an instrument of national inward investment policy, bringing FDI to the UK as a whole. While there is certainly truth in this, the grants are also the means by which the government allocates FDI across regions, and development appears to be the principal benefit of this investment. In this respect regional policy no longer seems to work in favour of the regions, which is important as many of the other classical location factors work against these areas (e.g. per capita income, distance, knowledge, availability of skilled labour, etc). Further, given the weakening of policy and the presence of agglomeration, it suggests that the regions will be at a long-term disadvantage in relation to the attraction of FDI.



Table 1: Summary Statistics for Regions, 1985 - 2005

	Grant (%) <sup>1</sup>		FDI (%)		Unemployment (%)	
	All	FDI	All	Manufacturing	1985	2005
<i>Assisted Area regions</i>						
Scotland	31.2	31.8	11.0	13.2	12.9	5.9
Wales	25.8	31.9	10.2	14.5	13.8	4.5
North East <sup>2</sup>	11.5	11.8	8.0	9.8	15.5	6.4
North West	11.4	8.4	9.9	11.3	13.7	4.3
West Midlands	8.6	7.2	13.5	17.5	12.7	4.4
Yorks. and Humber	5.6	3.0	6.7	8.5	12.1	5.1
<i>Non-Assisted Area regions</i>						
South West	2.6	2.4	4.4	4.5	9.3	3.3
East Midlands	1.4	1.3	4.4	5.0	9.9	4.1
South East	1.3	1.7	27.6	12.7	8.1	5.3
East Anglia <sup>2</sup>	0.4	0.5	4.3	3.0	8.1	3.7

Sources: *Annual Reports on the 1982 Industrial Development Act* and *Regional Trends*.

Notes: Grant by value of offers and FDI by number of projects; both for period 1985-2005. 1. Regional Selective Assistance and Selective Finance for Investment in England; 'All' includes FDI and UK plants. 2. Prior to 1996 the North East included Cumbria (now in North West), and South East included the counties of Bedfordshire, Hertfordshire and Essex (now in East Anglia).

Table 2: Regression Results for FDI Location

	LSDV	GMM		
		All	Manufacturing	Start-ups
Constant term	-35.44***	-0.221**	-0.241**	-0.301**
$l(n_{t-1})$	0.561***	0.536***	0.324***	0.209*
$DIVERSE_{t-1}$	0.034	0.061	0.093	0.112
$l(n_{st})$	-0.033	-0.422**	-0.627***	-0.182
$N_{t-1}$	-0.004**	-0.008***	-0.005**	-0.002
<u>Revenue</u>				
$POP_{t-1}$	1.723***	-0.126	-1.183	0.130
$INCOME_{t-1}$	0.380**	1.006***	0.976***	0.390
$DISTANCE_{t-1}$ (x $10^{-3}$ )	0.032	-0.464**	-0.662***	-0.279
$KNOWLEDGE_{t-1}$	0.158	0.701**	0.664**	0.828**
<u>Cost</u>				
$WAGE_{t-1}$	-0.004	-0.011	-0.001	0.004
$SKILL_{t-1}$	0.053**	0.081**	0.059*	0.116***
$UNSKILL_{t-1}$	0.219**	0.324***	0.435***	0.293*
$ROAD_{t-1}$	0.019*	-0.003	0.005	0.025
$ROAD_{t-1}^2$ (x $10^{-3}$ )	-0.236**	-0.112	-0.118	-0.286
<u>Prospects</u>				
$GROWTH_{t-1}$	0.056**	0.035	0.044	0.021
$DEPRESSED_{t-1}$	-0.013***	-0.018***	-0.029***	-0.019**
$STRIKE_{t-1}$	-0.044	-0.018	-0.056	0.018
$EUFUND_{t-1}$ (x $10^{-3}$ )	-1.751*	-4.787***	-4.507***	-3.860**
<u>Policy terms</u>				
$GRANT_{t-2}$ (x $10^{-3}$ )	2.955**	6.309***	4.076*	6.384**
$FDISHARE_{t-2}$	-0.266*	-0.793***	-0.755***	-0.545
$AGENCY_{t-2}$	0.469*	0.759**	0.797**	0.365
n	190	180	180	180
$\bar{R}^2$	0.85	-	-	-
Wald $\chi^2$	-	178.1	120.5	85.8
Hansen-Sargan $\chi^2$ (d.f. = 51)	-	62.5	65.8	62.9
AR(2)	-	-0.22	0.42	-1.54

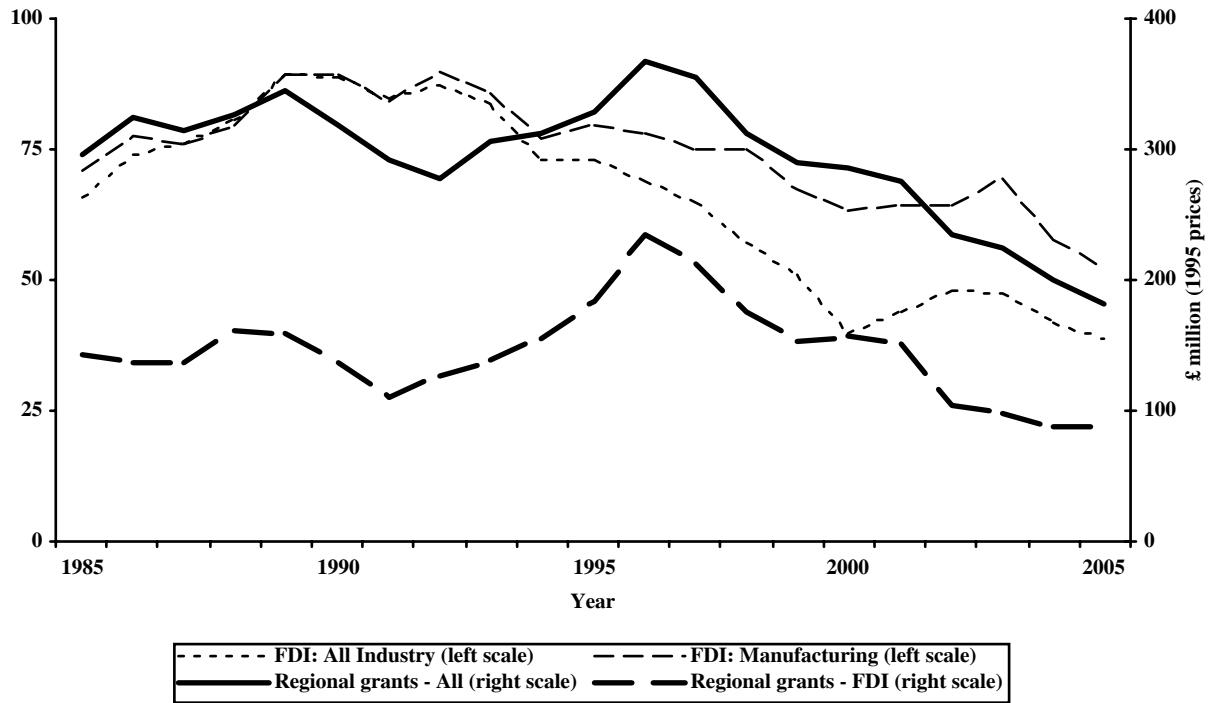
Notes: Estimation of (3) using LSDV and GMM difference estimators with annual data for 1985-05. Data Appendix and text describe variables. Dependent variable is logit of share of FDI projects. All terms are lagged one year apart from policy terms, which are lagged two years. Time fixed effects included and regional fixed effects in LSDV. Policy terms ( $GRANT$ ,  $FDISHARE$  and  $AGENCY$ ) are endogenous in GMM and each is instrumented using one lag value. \*\*\* = significant at 1, \*\* = 5 and \* = 10% level.

Table 3: Estimates of the Grant Effect over Time

	All	Manufacturing	Start-ups	All	Time trend
$GRANT_{t-2}$	-	-	-	6.309***	17.793***
$GRANT_{t-2}$ : 1987-92	9.278***	6.285**	9.454***	-	-
$GRANT_{t-2}$ : 1993-99	2.801	1.646	2.136	-	-
$GRANT_{t-2}$ : 2000-05	5.928	3.563	6.624	-	-
$GRANT_{t-2} \times time$	-	-	-	-	-1.025***
n	180	180	180	180	180
Hansen-Sargan ( $\chi^2$ )	55.5	61.9	53.3	62.5	59.1
AR(2)	-0.46	0.24	-1.91	-0.22	-0.44

Notes: Re-estimation of GMM equations in Table 2, with all other terms included, but not shown. First three columns include  $GRANT$  term in spline form, and final two columns re-produce result from Table 2 and include time trend for All plants. Estimates multiplied by 1000. \*\*\* = significant at the 1, \*\* = 5 and \* = 10% level.

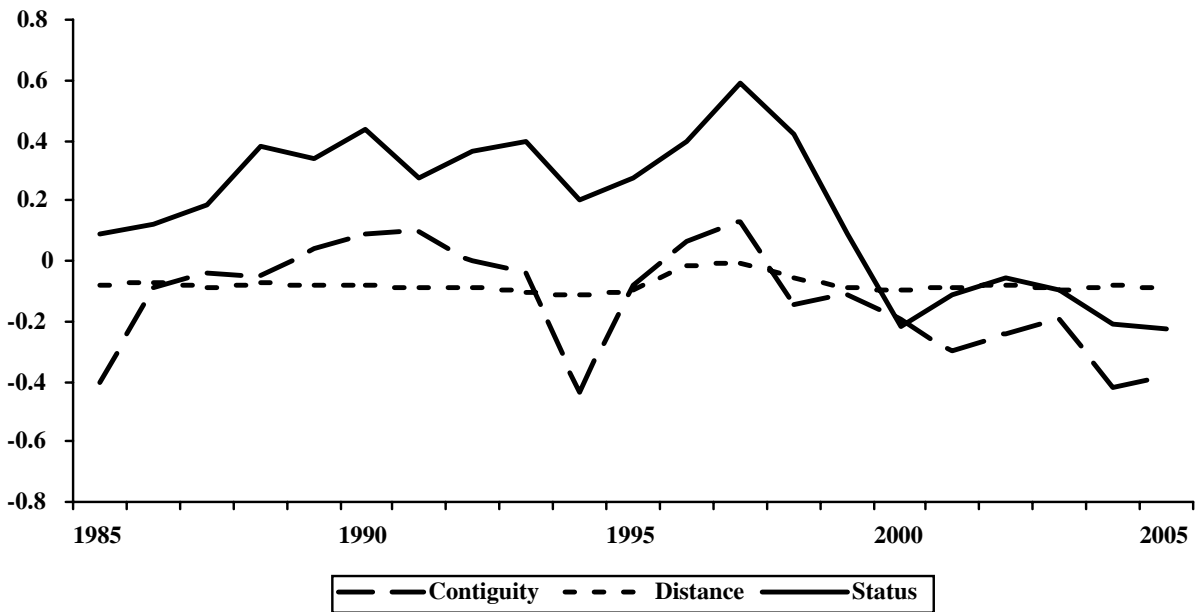
Figure 1: Grant Expenditure and FDI in Assisted Area Regions, 1985-05



Notes: FDI is the share of total projects in the six Assisted Area regions (Scotland, Wales and North East, North West, Yorkshire & Humberside and West Midlands). Grants offers are for Great Britain, comprising Regional Selective Assistance and Selective Finance for Investment in England (1995 prices). FDI and grant series are smoothed as 3-year moving averages.

Source: Authors' own dataset and *Annual Reports on the 1982 Industrial Development Act*.

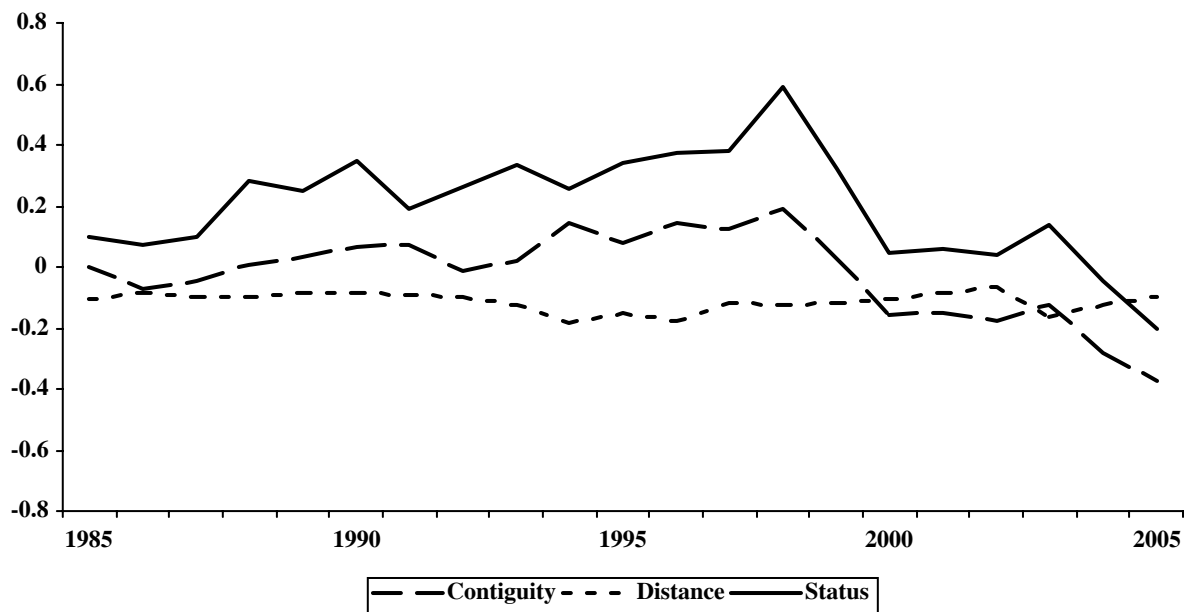
Figure 2: Moran's  $I$ : Total FDI Projects by Weighting Regime



Notes: Number of FDI projects in each region in each year relative to the region's share of national employment. The different weighting regimes are described in text.

Source: Authors' own dataset.

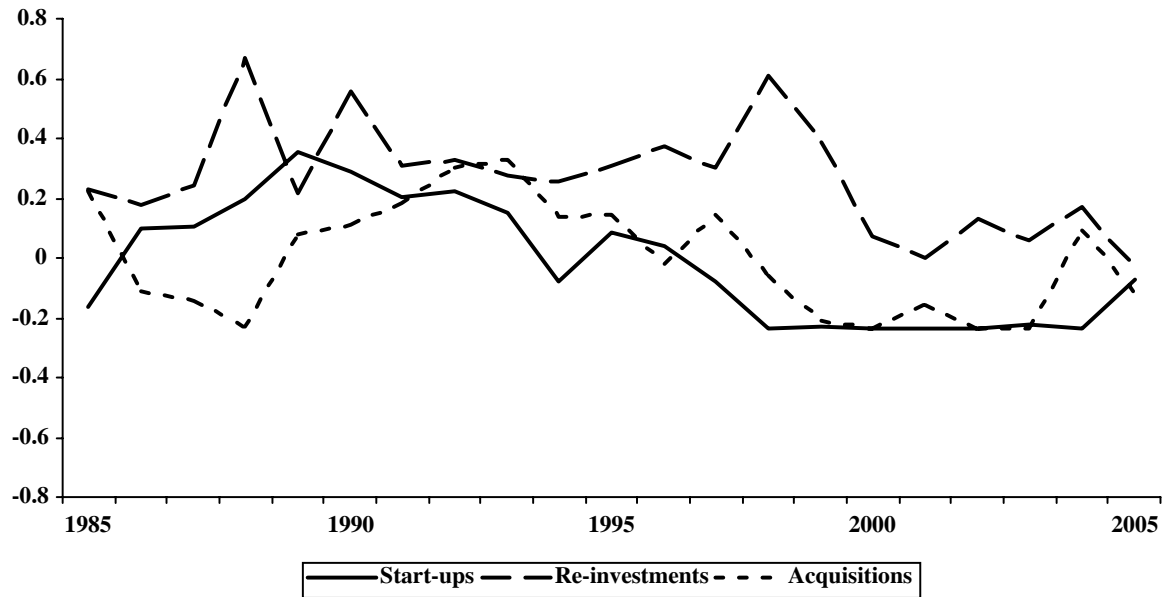
Figure 3: Moran's  $I$ : Manufacturing FDI Projects by Weighting Regime



Notes: Number of manufacturing FDI projects in each region in each year relative to the region's share of national employment. The different weighting regimes are described in text.

Source: Authors' own dataset.

Figure 4: Moran's  $I$ : Type of FDI Project by Same Status Regime



Notes: Total number of FDI projects in each region in each year relative to the region's share of national employment. The same status weighting regime ( $c$ ) is used, as described in text.

Source: Authors' own dataset.

Appendix Table 1: Comparison of Datasets

	<i>UKTI dataset<sup>1</sup></i>	<i>Annual Business Inquiry<sup>2</sup></i>
<i>Assisted Area regions</i>		
Scotland	9.0	8.4
Wales	7.0	4.5
North East <sup>3</sup>	6.8	5.1
North West <sup>3</sup>	8.8	11.3
West Midlands	10.6	11.0
Yorks and Humber	6.3	8.4
<i>Non-Assisted Area regions</i>		
South West	5.1	7.6
East Midlands	4.3	6.9
South East <sup>3</sup>	35.9	34.8
East Anglia <sup>3</sup>	6.2	2.1

Sources: Authors' own dataset and *Office for National Statistics*.

Notes: Percentage in each region. 1. UK Trade and Investment data for FDI projects for 1996-05. 2. Employment in foreign-owned plants at 2003. 3. Prior to 1996 the North East includes Cumbria, and the South East includes the counties of Bedfordshire, Hertfordshire and Essex.



## Data Appendix

Variables are measured for each of ten regions over 1985-05, where relevant at constant 1995 prices using HM Treasury GDP deflator. Unless otherwise indicated, data source is *Regional Trends* (various years), plus additional sources as indicated below.

Operating revenue: *POP* – population size (millions); *INCOME* – GDP per capita (£'000s); *DISTANCE* – sum of distance in '00s miles to economic centre of all other regions weighted by relative size of population of other region (source: *AA Route Planner*); *KNOWLEDGE* – number of students in higher and further education by residence in log thousands (additional sources: *Scottish Abstract of Statistics*, *Digest of Welsh Statistics*).

Operating cost: *WAGE* – real average weekly earnings in £'s, males and females (additional source: *Annual Survey of Hours and Earnings*); *SKILL* – % of exam entrants achieving 5 GCSEs at grade A-C (additional sources: Department of Education and Skills, *Education Statistics for the UK*, *Scottish Abstract of Statistics*, *Digest of Welsh Statistics*); *UNSKILL* – % unemployment rate; and *ROAD* – road spending in £'000s per km<sup>2</sup> (additional sources: *Regional Transport Statistics*, *Scottish Transport Statistics*, *Welsh Transport Statistics*).

Regional prospects: *GROWTH* – % GDP growth rate; *DEPRESSED* – % unemployment rate squared; *STRIKE* – log of days lost from industrial action per 1000 employees; *EUFUND* – regional spending commitments under ERDF and EU Structural Funds (Objectives 1 and 2) in £'ms, converted at rate 1 ECU = £0.65 (additional sources: *Annual Reports on the ERDF* and *Annual Reports on the Structural Funds*).

Policy terms: *GRANT* – Offered grant amount accepted of Regional Selective Assistance and Selective Finance for Investment in England in £'ms (source: *Annual Reports on the 1982 Industrial Development Act*); *FDISHARE* – grant offered to foreign-owned plants as a ratio of total grant (source: as above); and *AGENCY* – involvement of UK Trade and Investment with FDI projects relative to Great Britain (source: UK Trade and Investment).

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