Agglomeration, Regional Grants and Firm Location

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THE INSTITUTE FOR FISCAL STUDIES
WP04/06

Executive Summary

This paper examines the determinants of new plant locations. In particular, the paper looks at whether discretionary government grants influence the location of new plants, and how effective these incentives are in the presence of agglomeration and urbanisation externalities – that is, benefits arising from locating near to other firms in the same industry or in an area with a diverse industrial structure. The specific government grants we consider are Regional Selective Assistance grants that are available in designated Assisted Areas of the UK.

We examine these questions using data on new plant entrants to the production sector in Great Britain, together with matched information on Regional Selective Assistance grant offers. We look at those new entrants that appear a priori to be more mobile – new plants owned by existing firms, (either UK groups or foreign multinationals).

Our findings are of interest in the context of government policies concerned with regional variation in economic performance. We find evidence that regional industrial structure affects the location of new entrants. Firms in more agglomerated industries locate new plants near to others in the same industry, and firms are also attracted to industrially diversified locations. In line with other work in this area we find that foreign multinationals locate new plants near to other foreign-owned plants in the same industry. Fiscal incentives in the form of Regional Selective Assistance grants are found to have some effect in attracting plants to Assisted Areas.

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December 2003

Abstract: We examine whether discretionary government grants influence the location of new plants, and how effective these incentives are in the presence of agglomeration and urbanisation externalities. We find evidence that regional industrial structure affects the location of new entrants. Firms in more agglomerated industries locate new plants near to others in the same industry. Firms are also attracted to industrially diversified locations. Foreign multinationals locate new plants near to other foreign-owned plants in the same industry. Fiscal incentives in the form of grants are found to have some effect in attracting plants to specific geographic areas eligible for such aid.

Acknowledgements: The authors would like to thank Stephen Bond, Gilles Duranton, Richard Harris, Hide Ichimura, Henry Overman, Stephen Redding, Tony Venables and participants at seminars at the LSE, CEPR, Nottingham, Athens University and the RES and CAED conferences for helpful comments. The analysis contained in this paper was funded by the Leverhulme Trust under grant F/368/I and the ESRC Centre for Microeconomic Analysis of Public Policy at the Institute for Fiscal Studies. This work contains statistical data from ONS which is Crown Copyright and reproduced with the permission of the controller of HMSO and Queen's Printer for Scotland. The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. All errors and omissions remain the responsibility of the authors.

JEL classification: R12, R3

Keywords: Firm location, agglomeration, selective assistance, regional policy

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1 Introduction

This paper examines the determinants of the location of new plants. In particular, it investigates whether the availability of government subsidies influences where firms locate activity, and the extent to which this type of intervention is effective in the face of countervailing incentives for firms to concentrate geographically. We examine these questions using data on new plant entrants to the production sector in Great Britain, together with matched information on discretionary government grants. We find evidence that regions' existing industrial structures have an important effect on entrants' location decisions, and that discretionary grants also have some effect.

The formation of new firms and plants is an important driver of both productivity growth and employment opportunities.[1] For example, the entry of high productivity firms affects the level and growth rate of productivity by introducing new ideas, new goods and new production techniques into the market, and by increasing competition. Entrants bring new ideas and production methods that may spillover to other firms, especially those in close geographic proximity to an entrant,[2] and new entry affects employment opportunities in local labour markets.

A number of factors may attract firms to particular locations. Firms may choose to locate in particular regions in order to be close to demand, or to access immobile factors such as natural resources or transport infrastructure. Externalities arising from the co-location of firms have also been emphasised as an important factor affecting entrants' location decisions. Two sets of externalities can be distinguished; those generated by the co-location or agglomeration of firms within the same or related industries, and those generated by the co-location of firms across diverse industries.

[1] See inter alia, Davis, Haltiwanger and Schuh (1996) who show that in the US new plants account for a significant fraction of new jobs created. Disney, Haskel and Heden (2003) provide evidence on the importance of entry in accounting for aggregate productivity growth in the UK.

Marshall (1890) identifies knowledge spillovers, labour market risk pooling, and vertical linkages as the main sources of industry agglomeration economies. More generally these have been classified as Marshallian or MAR (Marshall-Arrow-Romer) factor market externalities.[3] These theories suggest that firms that use similar technologies, inputs, and types of workers may co-locate. For example, firms that require similarly skilled labour, and workers that possess those skills may locate together in order to insure themselves from hiring and firing costs. Ellison and Glaeser (1999), using US plant level data, provide evidence that for some agglomerated sectors such as textiles, labour market pooling is the dominant factor driving co-location. Empirical evidence also suggests that technological spillovers may be geographically concentrated,[4] making it attractive for firms to locate together. When a component of knowledge is tacit and can only be transferred by direct contact, firms' ability to capture spillovers may diminish as geographical proximity decreases.

It is well established that the geographic distribution of plants is concentrated, both across sectors and within individual industries. Devereux, Griffith and Simpson (2002), henceforth DGS, and Duranton and Overman (2002) provide evidence on the geographic distribution of production activity in Great Britain, and find examples of industries such as the ceramics and lace industries that are highly localised. Studies in other countries find similar evidence.[5] Empirical work that has examined the dynamics of agglomeration includes Dumais, Ellison and Glaeser (2002) who use US data to show that new plant entries have acted to reduce the extent of industry agglomeration; industry concentrations have attracted less than their proportionate share of new entrants. This may be due a decrease in the extent of

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[2] See Jaffe et al (1993) for evidence that technological spillovers are geographically concentrated.

[3] See Henderson, V. (1999), David and Rosenbloom (1990), Arthur (1994), Krugman, Fujita, Venables (1999).

[4] See, inter alia, Jaffe et. al (1993) and Jaffe and Trajtenberg (2002).

[5] For evidence for the US see Ellison and Glaeser (1997), Krugman (1991); and for France see Maurel and Sédillot (1999).

agglomeration externalities over time, or due to the onset of congestion effects, as competition for immobile factors of production drives up the price of inputs, and creates incentives for firms to disperse geographically. Contrary to this, DGS (2002) find that in a number of the most agglomerated industries in Great Britain, new entry during the 1980s was acting to re-enforce geographic concentration, even though the agglomerations date back decades and in some cases even centuries.

In contrast to MAR externalities, Jacobs (1969) asserts that firms may benefit from externalities arising in regions with a diverse industrial structure, or from 'urbanisation economies'. For example, innovative firms may benefit from technological developments in industries other than their own, or from a local, varied science base.[6] This may make diversified regions more attractive than specialised regions. A region can both have a diversified industrial structure and have a significant proportion of activity in one industry, and so also contain an industry agglomeration.

As a result of the processes described above, and many other factors such as differences in local infrastructure, the relative attractiveness of locations differs and productive activity is unevenly distributed across geographic space. Many governments intervene in firms' location decisions and offer direct incentives that aim to attract mobile investment to specific geographic locations, such as areas with high unemployment.[7] In this paper we are interested in the interaction between co-location externalities and government intervention in the form of fiscal incentives. We investigate the role that Regional Selective Assistance (RSA), a large-scale discretionary policy instrument, has played in influencing plant location in specific areas of Great Britain, and how the responsiveness of plants to this financial incentive is affected by the presence of agglomeration externalities. For example, in industries

[6] In the Jovanovic (1982) model firms learn about their efficiency as they operate.

[7] For example in France the Prime d'Aménagement du Territoire aims to create or safeguard jobs in specific regions.

characterised by strong agglomeration externalities are larger financial incentives required to induce plants to locate away from a region with an existing concentration of plants?

Our model of entrant location considers new plants that are likely to be mobile. We apply this to new plants in the British production sector between 1986 and 1992 that are set up by foreign-owned multinationals or by existing UK-owned firms. One of the aims of RSA is to attract internationally mobile investment, which might be expected to apply to these types of new plants. The choice of location is modelled in a discrete choice framework as a function of characteristics of each region, plant and industrial sector.

The recent empirical literature on the location decisions of firms suggests that agglomeration externalities matter, i.e. that firms locate near similar firms, and that policy interventions, particularly in the form of fiscal incentives, can play a role.[8] Head et al (1999) use a discrete choice model to examine the locations of new Japanese-owned establishments across US states. Among the factors that they find influence location are positive effects of the number of US-owned establishments in the same industry, and the number of Japanese-owned establishments both within and outside the industry. The authors also found significant effects from certain policy instruments, including lower tax rates, job creation subsidies and the existence of foreign trade zones. Holmes (1998) uses a different approach to investigate the impact of US states' pro-business policies on the location of plants. Looking at plants located near borders, he finds that such policies have a significant effect. A paper that looks at the effects of policy instruments on the location choices of foreign multinationals within France, Crozet, Mayer and Mucchielli (2003), finds little evidence of an impact of either Eurpean regional policy or French national policy. The authors do find evidence of agglomeration effects that differ by industry and the nationality of the firm. Guimaraes et al (2000) investigate the impact of within-industry spillovers on the plant locations chosen by

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[8] See Hines (1999) and Devereux and Griffith (2002) for surveys of the impact of fiscal incentives on firms' location.

foreign multinational companies in Portugal. They use small regional units, in an attempt to identify the impact of very local spillovers. They too find significant agglomeration effects.

Harhoff (1999) conducts an empirical analysis of the relationship between historically given industry and regional structure and the rate of new firm formation in Germany. He examines whether there are differences in the structural conditions required for the formation of new high-tech versus new low-tech firms and whether regional specialisation and diversity have a positive or negative impact on the regional rate of firm formation in an industry. He finds that there is strong evidence of regional spillover effects. Regions that are specialised are found to be attractive to firms within the same industry. Industry diversity within a region is found to be more important for firm formation in high-tech industries than in low R&D intensity industries. The formation of high-tech start-ups is positively correlated with the number of knowledge workers and infrastructure within regions, for example the employment share of scientists and engineers.

At the international level Devereux and Griffith (1998) look at the effect of profits taxes on the location of US multinational firms. They find that corporate income taxes have an effect on a firm's decision of which country within Europe to locate in, but not on the choice between exporting, locating in Europe or not serving the foreign market at all. Agglomeration effects are also found to play a significant role. Ford and Strange (1999) investigate the choice of European country as a location for non-European multinationals, in this case Japanese-owned firms. Like Head et al (1999), they find that Japanese firms tend to locate in countries which have already had significant inward investment from Japan.

The structure of this paper is as follows. In the next section we outline a model of firm location choice. In section 3 we describe the data on RSA grants, on new entrants and on industry agglomeration that is used in estimation and in section 4 we present our empirical results. Section 5 concludes.

2 A model of firm location choice

We consider a model of firm location choice in which firms can benefit from locating near to other similar firms because of co-location externalities that arise through the labour market, technology spillovers and shared infrastructure. Factors that do not vary across geographic locations, such as firm and industry characteristics, will not affect firms' location choices except to the extent that they affect firms' sensitivity to other factors. We are interested in modelling the impact of regional grants in this model. Firms choose whether and where to apply for a grant. The policy maker then decides whether to make an offer, and finally the firm then decides whether or not to take up the offer and chooses where to locate production.

We consider a firm that has chosen to locate production in Great Britain and is choosing between regions, $k = 1 \ldots \mathrm{K}$. Expected profits for a firm i in industry j in region k at time t are denoted as Π_{ijkt}; below we use only these subscripts only where necessary. The firm will choose to locate in the region in which expected profits are highest. We define y_{ikt} as an indicator of whether a firm locates in region k

$$\begin{aligned} y_{ikt} &= 1 \quad \text{if } \Pi_{ikt} > \Pi_{imt} \qquad \forall\, \mathrm{m} \neq \mathrm{k} \\ &= 0 \quad \text{otherwise.} \end{aligned} \tag{1}$$

Profits are given by revenue minus costs. We assume that firms produce differentiated goods that are sold in a national (or international) product market so that the demand curve faced by the firm is fixed, and price is affected only by total quantity, and is independent of the region in which the firm is located. Thus regional variation in profits comes through the cost function. Profits depend on a number of firm (x), industry (v), region (z), firm-region (h) and industry-region (p) characteristics, all of which can (in principle) be time varying:

$$\Pi_{ijt} = \Pi\left(x_{it}, v_{jt}, z_{kt}, h_{ikt}, p_{jkt}\right). \tag{2}$$

The factors that enter the firm's decision over where to locate will be those that vary across regions. This means that factors that vary only over firm, industry or time, drop out of the location decision. Assuming a linear approximation of profits for each firm in each location implies

$$\Pi_{ikt} = a + b_1 z_{kt} + b_4 h_{ikt} + b_5 p_{jkt} + e_{ikt} . \qquad (3)$$

Region characteristics (z_{kt}) include a measure of region size, local government expenditure, demographics and region fixed effects. Region-industry characteristics (p_{kjt}) include industry agglomeration and diversity measures and wages, described below. Region-firm characteristics (h_{ikt}) include the grant offer a firm expects to receive in that region.

We estimate firms' location choice using a conditional logit model:

$$\Pr ob(y_{ikt} = 1) = \frac{\exp\left(a + b_1 z_{kt} + b_4 h_{ikt} + b_5 p_{jkt} + e_{ikt}\right)}{\sum_k \exp\left(a + b_1 z_{kt} + b_4 h_{ikt} + b_5 p_{jkt} + e_{ikt}\right)} . \qquad (4)$$

We model grants as a lump sum payment to the firm. The RSA rules (discussed later in more detail) stipulate that firms can only apply for a grant in one region and that the project must be marginal, in the sense that it would not otherwise take place in that location; we assume that these conditions hold for all firms. We assume that there is some cost (*c*) of applying for a grant so that firms only apply if there is some positive expectation of receiving an offer.

We denote whether and where firm i applies for a grant in region m as $A_{im} = 1$. The firm would apply in region m rather than n if

$$\Pi_{im} + E(g_{im}) - c_{im} > \Pi_{in} + E(g_{in}) - c_{in} \qquad (5)$$

where $E(g_{ik})$ is the expected grant in region k. If (5) holds for all n=1 ... K, then the firm applies for a grant in m if net profits are greater in region m than in all other regions, n:

$$A_{im} = 1 \quad \text{if } \Pi_{im} + E(g_{im}) - c_{in} > \Pi_{in} \qquad \forall\, m \neq n$$
$$= 0 \quad \text{otherwise.} \tag{6}$$

The policy maker decides whether or not to award a grant. Denote O_{im} as an indicator variable of whether a firm is offered a grant in m:

$$O_{im} = 1 \quad \text{if } g_{im} > 0$$
$$= 0 \quad \text{if } g_{im} = 0. \tag{7}$$

The firm then decides whether to accept the offer, and locate in m, or not accept the offer, in which case it locates in n.[9] Denote T_{im} as an indicator variable of whether a firm takes up an offer:[10]

$$T_{im} = 1 \quad \text{if } \Pi_{im} + g_{im} > \Pi_{in}$$
$$= 0 \quad \text{otherwise.} \tag{8}$$

We want to model the location choice of the firm. The unconditional probability of firm i locating in region m, $P(y_{im} = 1)$, is the product of the conditional probability that the firm takes up a grant offer, the conditional probability the firm receives a grant offer and the probability of making an application to m,

$$P_i(y_{im} = 1) = P_i(T_{im} = 1 | O_{im} = 1 \text{ and } A_{im} = 1) \cdot P(O_{im} = 1 | A_{im} = 1) \cdot P(A_{im} = 1)\,. \tag{9}$$

The model is depicted in Figure 1.

[Figure 1 here]

Our aim is to investigate the role of grants in location choice. Specifically, we would like to estimate a conditional logit model of firm location and include as an explanatory variable the

[9] A firm could also choose not to set up. We do not consider this possibility here.

[10] Note that at this stage, the cost of application is sunk.

expected grant available to each firm in each location, conditional on making an application in that location: $E(g_{im} | A_{im} = 1)$. That is, we would like to include the amount of grant each firm would expect to get if it applied to that region.

To estimate this directly would require data on unsuccessful applications as well as offers made, but unfortunately such data is not available. We observe where each plant locates, and we also observe all grant offers (in excess of £75,000). We are able to match data on grant offers with data on plants in cases where the firm accepts the offer (though not in cases where an offer is made but not taken up). We do not observe whether a firm applies for a grant.

This leaves us with a number of difficulties to do with identification and selection. In order to identify the impact of the grant we need exogenous variation in the grant offers made and taken up. We also need to be able to estimate the level of grant offer each firm would expect to get in each region. We identify the expected grant using industry and firm characteristics. These do not enter the location choice model, but they may affect the firm's probability of receiving a grant offer, and the amount it gets offered. Thus we identify the expected grant from:

- differences between domestic and foreign firms: we assume that the distribution of domestic projects is the same as foreign ones, conditional on observables, in their sensitivity to subsidy through the grant, but allow policy makers to favour foreign firms;

- industry differences in grant offers: we assume that projects are the same across industries, conditional on observables, in the externalities they get from agglomerations and their sensitivity to subsidy through the grant, but allow policy makers to favour some industries over others;

- differences between marginal and non-marginal projects: we assume that marginal projects are the same as non-marginal ones, conditional on observables, in the externalities they get from agglomerations and their sensitivity to subsidy through the grant, but allow policy makers to favour marginal projects over infra marginal projects (e.g. in terms of cost-effectiveness or for political reasons).

We estimate the grant equation in two ways, both of which are biased, but in opposite directions. We use the following estimates of the expected grant in place of $E(g_{im}|A_{im}=1)$:

(A) Using only the data on grant offers we estimate the expected grant conditional on applying and being made an offer. Explanatory variables include industry and regional characteristics, but not firm level data. In addition, this is a selected sample. Estimation should allow for the fact that only firms that receive offers are included in the observations used. We do not observe unsuccessful applications at the individual plant level, and so we cannot correct for this. However, the probability of receiving an offer on average, conditional on applying, is high at around 89 percent.[11] We estimate

$$E(g_{im} \mid \mathrm{O}_{im}=1, A_{im}=1) = E(g_{im} \mid A_{im}=1) / P(\mathrm{O}_{im}=1 \mid A_{im}=1) \quad (10)$$

which provides an overestimate of $E(g_{im}|A_{im}=1)$.

(B) Using grants offers matched to plant level data we estimate the unconditional expected value of the grant using a Tobit model based on all firm observations,

$$E(g_{im}|T_{im}=1, \mathrm{O}_{im}=1, A_{im}=1) * P(T_{im}=\mathrm{O}_{im}=A_{im}=1) \quad . \quad (11)$$

This is an underestimate of the variable $E(g_{im}|A_{im}=1)$, since it is based on an unconditional probability. Using this method of estimating the expected grant we can condition on firm level variables, unlike above in (A).

[11] PA Cambridge Economic Consultants (1993), Table 2.1 shows that over the period 1985-1988 there were 7953 applications, 1513 were then withdrawn and 5732 offers were made.

We have no direct empirical evidence on which of these approaches yields the best estimate of $E(g_{im} | A_{im} = 1)$. However, from aggregate data it is clear that the vast majority of firms do not apply for a grant in any region. The size of the underestimate in (B) is therefore likely to be large. By contrast, a high proportion of applications made result in offers. Of course firms may anticipate this and not apply if their probability is low. However, we believe that the overestimate in (A) is likely to be smaller (although subject to selection bias).

3 Data

Our data comes from two main sources. We use information on all production plants in Great Britain over the period 1986 to 1992 taken from the Annual Respondents Database (ARD) in order to identify entrants and where they locate. Our second data source is the list of all grant offers of £75,000 or more that is maintained by the Department of Trade and Industry.

3.1 Plant location data

The Annual Respondents Database (ARD) data contains basic information on all production plants located in Great Britain. Detailed information on inputs and outputs is collected at the establishment level, which can either be a single plant or a group of plants. We use the data at the plant level and identify greenfield entrants from the population of plants in each year over the period 1986 to 1992. Along with the year of entry we also have information on the entrant's industry, the nationality of the parent company, the group structure, and employment. We can therefore distinguish between new plants that are owned by foreign multinationals and those that are UK-owned, and between those that are part of an existing firm and those new plants that are not part of a group, and are therefore new firms.

We consider firms' location choices at the level of the 64 counties and Scottish regions[12] within Great Britain, 38 of which include an Assisted Area. Figure B1 in appendix B shows a map of counties and Scottish regions. This generates 102 potential bcation choices for each plant. We use the employment information in the ARD population to calculate a measure of the size of each of these location choice areas.

To provide a description of the data we use the ten administrative regions of Great Britain and again distinguish between Assisted and non-Assisted Areas within these regions. Figure B2 in appendix B shows a map of the ten administrative regions. The South East of England and East Anglia had no areas classified as Assisted during this period, creating 18 regions in total. The distribution of entrants over regions is shown in Table 1. The first column shows the distribution of all plants. The second column shows the distribution of all entrants, the third shows the distribution of new entrant plants owned by foreign-multinationals and the fourth shows the distribution of new plants set up by UK-owned groups. The distribution of new plants varies over regions and over time. It is similar to the distribution of the population of all plants. On average over a third of all new plants each year locate in the South East of England. Wales and Scotland account for around 10% of new plants over the period, but more new plants locate in Assisted Areas than in non-Assisted Areas within these regions.[13] The majority of new entrants are single plants that are not part of existing firms: new plants owned by foreign multinationals and UK groups make up approximately 17% of new entrants each year in terms of number of plants. They are however larger so make up a much more substantial portion of jobs in new plants. The regional distribution differs for new plants owned by foreign-multinationals, with a higher proportion locating in Scotland and Wales than for all new plants. The distribution of new entrants over counties is shown in Table B1 in Appendix B.

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[12] For brevity we refer to both the counties of England and Wales and the Regions of Scotland as counties.

[13] The size of Assisted Areas varies by region, as does the extent to which they are located in urban and more rural areas.

[Table 1 here]

Measures of co-location externalities

We use the ARD to construct a number of measures that will be used in estimation. First, in order to investigate the importance of co-location economies we include measures to capture both industry agglomeration externalities and diversification externalities.

Our measures of industry agglomeration externalities are: (i) the number of plants in each industry in each county-year; and (ii) the number of foreign-owned plants in each industry in each county-year. These are calculated at the 4-digit industry level, and for each of the 64 counties.[14] We also calculate a measure of *industry* agglomeration[15] denoted g^{MS}, that measures the extent of industry geographic concentration conditional on industrial concentration in the industry, and also taking into account the underlying geographic distribution of manufacturing activity. We use this measure calculated at the 4-digit industry level to differentiate between more and less agglomerated industries. This index varies between –1 and +1, with higher values indicating more agglomerated industries.

We measure the extent of diversification externalities using a locational Herfindahl index, calculated using employment shares of 4-digit industries for each county in each year, excluding a plant's own industry. We subtract this measure from 1, producing an index that varies between 0 and 1, the higher the value of the index, the more diverse is a county's industrial structure.

Table B2 in appendix B shows the mean values for each of these variables across the 64 countries. Table 2 summarises these values by showing the value for each county averaged

[14] We also experimented with using the proportion of total industry plants in each county-year and the proportion of total industry foreign-owned plants in each county-year. Using these measures does not change the overall pattern on results.

[15] For information on this measure see Maurel and Sédillot (1999) and Devereux, Griffith and Simpson (2002) who implement the measure on UK data, as used in this paper.

across the 10 administrative regions. The mean values in these tables are calculated across the dataset of entrants and possible location choices used in the conditional logit model in section 4.1. The mean value of the industry agglomeration measures is highest in the South East of England – on average an entrant in our data choosing whether to locate in the South East would observe 70 existing plants in a county in the South East its own industry. But not all industries are geographically concentrated in the South East. Indeed some of the most agglomerated industries such as cutlery, lace and hosiery are geographically concentrated outside of the South East, in Yorkshire and in the East Midlands. Examples of agglomerated industries, as measured by g^{MS}, include the ceramics industry where 47% of plants and 35% of new entrants are located in Staffordshire ($g^{MS} = 0.471$), and publishing of journals and magazines where 47% of plants and 45% of new entrants are located in Greater London ($g^{MS} = 0.237$). The most diversified counties are those centred around major cities such as Greater Manchester and Greater London, and the three least diversified areas are the Island Authorities, Borders and Highland Scottish regions.

[Table 2 here]

Measures of wages

We construct measures of wages for both skilled (Administrative, Technical and Clerical, ATC) workers and unskilled workers (Operatives, OPS) at the 2-digit industry-county level. To construct these measures we use the establishment-level ARD sample over the period 1985 to 1992, and gross up using sampling weights. Wages are then expressed in real terms in 1990 £.

3.2 Regional Selective Assistance data

Regional Selective Assistance (RSA) grants can be paid to both new entrants and existing firms within designated 'Assisted Areas'. These are areas designated as needing investment to re-vitalise their economies, are areas of high unemployment, and are areas in which regional aid may be granted under EU law.

The RSA scheme is primarily aimed at creating and safeguarding jobs, but other objectives include attracting internationally mobile investment.[16] It is a major form of financial incentive currently available to both inward and domestic investors. Grants are awarded to companies opening a new plant, or expanding or modernising an existing plant. Grants are available of up to 15% of eligible project costs, including plant and machinery, land, site preparation and buildings. For a grant to be awarded it must be demonstrated that the project would not go ahead in the planned form without the grant. The amount of the grant offered depends on the area, the needs of the project, the number of jobs safeguarded or created, and the impact the project will have on the economy, (job displacement elsewhere is taken into consideration). However the amount eventually negotiated will normally be the minimum amount necessary for the project to go ahead in the proposed form.

[Table 3 and Figure 2 here]

Figure 2 shows the distribution of the value of grant offers across counties, and Table 3 shows the generosity of grant offers across Assisted Areas in the ten administrative regions of Great Britain. Plants located in Scotland, Wales and the Northern region of England received the highest total value of grant offers over the period 1986 to 1992. The highest average grant offers were made in Scotland. The distribution of grant offers can be compared to the county level agglomeration and diversification measures described above in Tables 2 and B2. A number of the areas where industry agglomerations are highest, for example in counties in the South East of England, do not receive any grant offers. But in other cases, such as in the North West, the two coincide to a greater extent. On average our

[16] See PA Cambridge Economic Consultants (1993) and Arup Economics and Planning (2000). See discussion in Swales (1997) and the "ambiguity over the official rationale for UK regional policy and the RSA in particular." Also see Harris and Robinson (2002) for a survey of current industrial support policies in Britain.

measures of agglomeration and diversification are lower in Assisted Areas where grant offers can be made, compared to non-Assisted Areas.

In these data, between 1986 and 1992 over 90% of grants, by value, were given to firms in production industries. The industries receiving the highest values of grants were the motor vehicles, radio, TV and communication, machinery and equipment, chemicals and food and drinks industries.

3.3 Matched plant location and grant data

We match the ARD data on plant locations to information on all individual RSA grant offers of £75,000 or more made between 1986 and 1992 in England, Wales and Scotland. Over this period we have data on over 2,000 grant offers which includes the name of the firm receiving the grant offer, the postcode of the plant which receives the offer, its industry, the amount of the offer, and the year the offer was received. We match the data at the plant level using the postcode and industry information.

[Table 4 here]

The resulting dataset contains information on over 120,000 new plants set up in Great Britain, over 20,000 of which are part of existing UK or foreign-owned firms. We match 347 grant offers to new entrants.[17] Table 4 shows the total number of entrants split into domestic and foreign-owned categories. In the second row we show the number of entrants in Assisted Areas. The proportion of entrants going to Assisted Areas is similar across types. The third row uses the matched grant offers and shows the proportion of entrants in our sample that we observe receiving and taking up grant offers, by ownership category, between 1986 and 1992. A higher proportion of foreign-owned entrants received and took up a grant offer. On average foreign-owned entrants received larger grant offers than either

[17] We distinguish grant offers that match to new entrants, from those that match to existing plants.

class of domestic entrants (although this may be due to their larger size). Finally, in the last row of the table, we show that the average grant offer received by entrants is also highest for those that are part of foreign-owned multinationals. More details of the way the plant level data are matched to the grant offers data are given in Appendix A.

4 Empirical results

In this section we first describe the results of estimating the expected grant for each of the two options described above. We then investigate the effects of co-location externalities on the location choices of new plants that are either part of existing UK groups or part of foreign-owned multinationals. Finally we examine the effects of grants on location choices, conditional on co-location externalities.

4.1 Expected grant

As described in section 2, we take two approaches to measuring the expected grant. Under option (A) we regress data on all grant offers over the period 1986 to 1992 on broad industry groups h_j and region dummies RR_k and the local authority unemployment rate $unemp_{kt}$.

$$g_{ijkt} = F\left(h_j, unemp_{kt}, RR_k\right) \tag{12A}$$

Under option (B) we jointly estimate whether a firm applies for a grant, whether it gets an offer and how much it is offered. We use data on all entrants (both those within and outside of Assisted Areas, and all ownership types). We exclude plants where we are not sure if they received an offer.[18] As our data is truncated, (we do not observe offers below £75,000), we use a tobit. Our model is of the form:

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[18] The grant offer data is matched to the ARD on postcode and industry (4-digit sic92). Plants that definitely match are those where both the postcode and industry code match. Plants that definitely do not match are those

$$\ln(g_{ik}) = F(h_j, for_{it}, group_{it}, unemp_{kt}, RR_k) \quad (12B)$$

where $for_{it} = 1$ is a dummy variable indicating whether the plant is foreign-owned, and $group_{it} = 1$ is a dummy variable indicating whether the plant is part of a group.

The parameters in the models reflect the policy stance. The level of offers varies in England, Scotland and Wales. The amount of grant offered also varies with local economic conditions, reflected here by the unemployment rate. Grant offers are also linked to jobs created and capital expenditure undertaken; however we only include information on plant characteristics in their first year of entry (such as their ownership status), as receipt of an offer would be expected to affect investment and employment behaviour in subsequent periods (we do not observed planned expenditures). Table 5 shows the estimation results of each option.

[Table 5 here]

Column (A) indicates significant variation in grant offers across industries and regions. The unemployment rate is not significant. Note that grant offers can only made in Assisted Areas. This result implies only that the differences in unemployment rates between Assisted Areas do not affect grant offers. In column (B), higher grant offers are made to firms in areas of higher unemployment, that are part of existing groups, that apply in Wales or Scotland and those in some industries. In this case, unemployment reflects differences between Assisted Areas and non-Assisted areas. Since high unemployment is an important factor in determining Assisted Areas (and hence grant offers), it is not surprisingly that unemployment is significant.

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were the postcode does not appear in the grant offer data. Plants where we are not sure are those were the postcode appears in the grants data, but the industry code does not match (and that grant offer is not matched to another plant). Plants in this final category are excluded from the estimation of the predicted grant but are included in the models estimated in the next section.

We use the estimated parameters from each of the options to obtain an expected grant for each entrant in each location. For option (A) the expected grant varies across broad industries, over broad regions, and within that across counties (the geographic unit on which possible locations in our conditional logit model are based) and time (because the unemployment rate varies by local authority and over time). For option (B) the expected grant additionally varies with firm characteristics (group and foreign-ownership dummies). We set the expected grant to zero outside Assisted Areas.

Using the results from Table 5, Table 6a shows the expected grant offers for England, Wales and Scotland for each option, and compares them with actual offers observed for these regions. Table 6b does the same, comparing between domestic-owned and foreign-owned firms. Recall that the expected grant in option A is based on data on grant offers, and so the expected grant is conditional on a firm having applied for a grant (but not necessarily accepting it). By contrast, option B uses data on all entrants, whether or not they apply for or receive a grant. In the notation in the Tables, $E\left[g^{*}_{ijkt}\right]$ is the unconditional expected grant for any entrant i across all possible regions k. $E\left[g_{ijkt}\right]$ is the expected grant for firm i conditional on that firm actually receiving a grant, (above £75,000). It is $E\left[g^{*}_{ijkt}\right]$ which is used in estimation in Table 9.

There is to some extent a trade-off between option (A) which predicts the distribution across regions well and options (B) which uses information on whether plants are part of groups and whether they are foreign-owned, and hence gives a better prediction of the difference in the level of grant typically received by foreign and domestic-owned plants.

[Table 6A and 6B here]

4.2 Location choice

We now turn to the location choice model. We estimate the model on new plants that are part of foreign-owned multinationals or are set up by existing UK manufacturing groups over the period 1986 to 1992. We consider these plants on the grounds that their mobility is likely to be high. These new entrants choose between 102 geographic locations, defined from the 64 counties that are then split further into Assisted and non-Assisted Areas, if they contain areas eligible for support under the RSA scheme.

The dependent variable takes a value of 1 in the area the new entrant chose to locate. We investigate the effects of a number of factors on location choice. First, we include measures to capture the extent of industry agglomeration, and investigate separately the hypothesis that foreign-owned plants choose to locate in the vicinity of other foreign-owned firms (as has been found in the literature). We would expect the industry agglomeration measures to have a positive effect on the probability of location if firms benefit from externalities, for example in the form of cheaper inputs, that lead to lower costs and higher profits in these locations. But it is possible that there is a non-linear relationship between the probability of location and the extent of industry agglomeration in a region, if high levels of agglomeration mean that prices of immobile factors are driven up or there are congestion costs that induce plants to locate elsewhere. Second, we investigate the effects of fiscal incentives. Finally we investigate the interaction between fiscal incentives and the extent of industry agglomeration.

We include the size of each of the 102 location choices, measured by total manufacturing employment. It might be expected that locating near to a larger proportion of your customers reduces transport costs, however it is possible, as discussed above, that congestion effects may set in. We also include the measure of county diversity, and our 2-digit industry-county level measures of wages. From the theoretical argument above greater diversity might be expected to have a positive effect on profits and the probability that a plant chooses to locate in a particular region. The agglomeration measures are calculated at the level of the 64 counties, so this means for example that Assisted-Areas in Tyne-and-Wear and non-Assisted Areas in Tyne-and-Wear have the same agglomeration and diversity measures. These are all entered with a one-year lag.

We estimate a fixed effects conditional logit model. The estimation results are reported in Tables 7, 8 and 9. The numbers reported in Tables 7 and 9 are the log-odds ratio from the conditional logit model. Numbers greater than 1 indicate that the variable has a positive effect on the probability of location. Numbers less than 1 indicate that the variable has a negative effect on the probability of location. T-statistics are given in brackets. We present elasticities for the Table 7 final column specification in Table 8.

[Table 7 here]

In column (1) of Table 7 we estimate the model with only the measure of the size of each area, the 2-digit industry-county measures of wages and county dummies for the 64 counties. As suggested above we find that area size has a positive effect on the probability of location. In this specification a higher level of industry wages for both skilled workers (ATC) and unskilled workers (OPS) appears to have a positive effect on the probability of location. However once we include our measures of agglomeration and diversification we find a positive relationship between the probability of location and skilled wages and a negative relationship between the probability of location and unskilled wages. Reasons why wages might vary across regions include productivity differences and differences in costs of living, which have not been accounted for in our measures. A positive relationship between the probability of location and skilled wages may therefore indicate productivity differences across regions – firms being attracted to regions where the marginal product of skilled workers is higher.

In column (2) we include the one-year lags of the 4-digit industry agglomeration measure in an attempt to capture the extent of agglomeration in the firm's industry prior to the decision to invest. Industry agglomeration externalities appear to create incentives for plants within the same industry to co-locate. The number of plants in the county in the firm's industry, has a positive effect on the probability of locating there. Column (3) shows that the number of foreign-owned plants in the 4-digit industry in the county also has a positive effect on the probability of location. In addition we investigate whether a greater foreign presence makes a location even more attractive for new-entrants that are part of foreign-owned multinationals compared to those that are part of UK groups. We interact the number of foreign-owned plants measure with a dummy that takes the value of 1 for new entrants that are part of foreign-owned multinationals. Similar to other studies we find that foreign-owned entrants appear to value the geographic proximity of other foreign-owed activity. The inclusion of the agglomeration measures does not affect the log-odds ratios on the area size variable, although the inclusion of the foreign-agglomeration measures reduces the significance of the overall industry agglomeration measure.

In column (4) we include the Herfindahl diversity measure in an attempt to capture the effects of 'Jacobs' diversity externalities between plants across industries. The higher is the value of this index, the more diverse is a county's industrial structure. The log-odds ratio indicates that new entrants are attracted to more diverse regions. Finally in column (5) we examine whether, as we might expect, agglomeration effects are stronger for new entrants to more agglomerated industries, that is industries where activity is more geographically concentrated as measured by our industry agglomeration measure g^{MS}. This is supported by the data. We interact the number of plants in the county in the firm's industry with the industry-level agglomeration measure g^{MS}, and find that the previous positive effect of the number of plants in the county in the firm's industry was being driven by the geographic distribution of new entrants in more agglomerated industries – large numbers of plants have a stronger effect on firms' location choices in more agglomerated industries.

In Table 8 we report elasticities for this final specification. The elasticities for the agglomeration measures are very low. For example, at the mean, increasing the number of foreign-owned plants in a county by one increases the probability of location there by 0.00012, implying an elasticity of 0.008. The responsiveness of location choice to the number of foreign presence increases for foreign-owned new entrants.

[Table 8 here]

Table 9 investigates the effect of fiscal incentives. In the first column we simply include a dummy variable that is equal to 1 if the location choice is an Assisted Area. Our prior expectation is that the log-odds ratio on this dummy variable would be less than one, because these areas are designated as Assisted on the basis of their economic status. As can be seen the log-odds ratio is less than one but is insignificant, perhaps indicating that there is something attracting more new activity to these areas than would otherwise be expected.

In columns (2) and (4) we include our two measures of the expected grant. First in column (2) we include the expected grant from option (A). The expected grant has a positive and significant (at the 10% level) impact on the probability of location, and the effect of the Assisted Area dummy is now negative and significant. Grants appear to explain some of the attractiveness of Assisted Areas. This finding is supported by the results in column (4) for option (B). Here we find a positive and more strongly significant effect of the expected grant on the probability of location.

[Table 9 here]

We can use the results from column (2) and column (4) to provide an indication of the effect of grants on location. The elasticity of location with respect to the expected grant offer from column (2) at the mean is 0.04; that is, a 1% increase in the expected grant offer increases the probability of location by 0.04%. To achieve a 1% increase in the probability of location in particular would imply an increase in the average expected grant offer of around £100,000. The estimates from column (4) imply that a 1% increase in the unconditional expected grant leads to a 0.13% increase in the probability of location.

Finally we investigate further whether the responsiveness of new entrants to fiscal incentives is affected by the extent of industry agglomeration. Counties that contained Assisted Areas typically have lower values of our county-industry agglomeration measures, and it might be expected that new entrants to more agglomerated industries might be less responsive to fiscal incentives to induce them to locate away from existing agglomerations. For both methods of estimating the expected grant, we interact the expected grant measure with g^{MS}.

The results are shown in columns (3) and (5) of Table 9. They are insignificant (a the 5% level); we do not find any strong difference between the responsiveness of new entrants in more and less agglomerated industries to a given level of expected grant. We experimented with splitting the sample by the extent of industry agglomeration g^{MS}, and found some evidence that the expected grant no longer has a positive and significant effect on the probability of location for new entrants in the most agglomerated industries. But it is also the case that plants in the most agglomerated industries receive lower grant offers. Indeed the high-tech industries that received the highest grants are not among the most agglomerated.

5 Conclusions

This paper investigates the determinants of the location of new plant start-ups in Great Britain. This model is based on the assumption of plant mobility: a firm will choose the most profitable location for its new plant. In particular we investigate two factors potentially affecting the choice of location: (i) the presence of spillover effects from being located near to other plants in the same industry, or in a diversified region, and (ii) the impact of discretionary regional grants aimed at inducing new plants to locate in Assisted Areas, which are designated for such assistance based on their economic characteristics.

We use data on the location and other characteristics of 18,000 new plants from the ARD dataset over the period 1986-1992. We choose those plants that appear a priori to be more mobile: plants owned by existing firms, whether foreign or domestic. We also use data on all grant offers made over the same period and we are able to match a subset of these to new entrants in the ARD data. To identify the impact of discretionary grants on location choice, we would like to estimate the grant that a firm could expect to receive if it chose to locate in a particular region, conditional on having made an application for grant in that region. However, we do not observe this. Instead we follow two routes. We estimate the expected grant for a firm conditional on being made an offer in a region, and we estimate the unconditional expected grant for a firm in each region. We use these estimates of the expected grant in a fixed effects conditional logit model of location choice.

Our findings are of interest in the context of government policies concerned with regional variation in economic performance. We find that industry agglomeration effects play a role in location choice. Plants in more agglomerated industries choose to locate near to other plants within the same industry. New foreign-owned plants choose to locate near to other foreign-owned plants within the same industry. Our results therefore point to the existing geographic distribution of industries as being an important determinant of new plant location. Regional Selective Assistance grants are found to have a significant effect in attracting plants to specific locations. However, the effect is small. The estimated elasticity of the probability of choosing to locate in a particular region with respect to the expected grant offer ranges from 0.04 to 0.13. Taken together, our findings suggest that, to the extent that regional grants are effective in inducing firms to locate in particular areas, they may bring further dynamic benefits to those regions by increasing the probability that subsequent new plants locate there.

Appendix A

This section contains further information on the procedure for matching the RSA grants data to the ARD data.

The postcode information in the ARD data runs from 1985 onwards. As our analysis looks at entrants over the period 1986 to 1992, and as we only allow matches to plants either present in the year the grant is offered or that appear in the data up to 3 years after the offer is made we match the grant offers data from 1983 to 1992. Grants are matched to the population of plants on postcode and 4-digit industry. The grant offers data contains sic92 industry codes. For the period 1983-1991, a sic80-sic92 mapping is used (up to 15 mappings for each sic80) to adjust the ARD data, and for the period after 1991, sic92 codes in the ARD are used. For grants that match on both postcode and industry, any multiple matches are reduced as follows. Any multiple matches to the same enterprise group are all accepted. Matches are eliminated by ranking them according to the most likely industry code mapping where possible. The match closest to the year the grant is awarded is accepted.

Table A1 shows the proportion of grants we can match to the ARD population in for each year of the data on grant offers. We match around 50% of grants both in value and number. These matches are to both existing plants and new entrants. In our analysis we use only those matched to entrants. Plants in Scotland, Wales and the North region of England received the highest values of offers over the period. The South East and East Anglia did not contain significant areas classified as Assisted until 1993. Figure 2 also shows the geographic distribution of the value of grant offers over the period 1986 to 1992.

[Table A1 here]

Appendix B

[Figures B1 and B2 here]

Tables at county level

[Table B1 and B2 here]

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Figure 1: Grant application and location choice

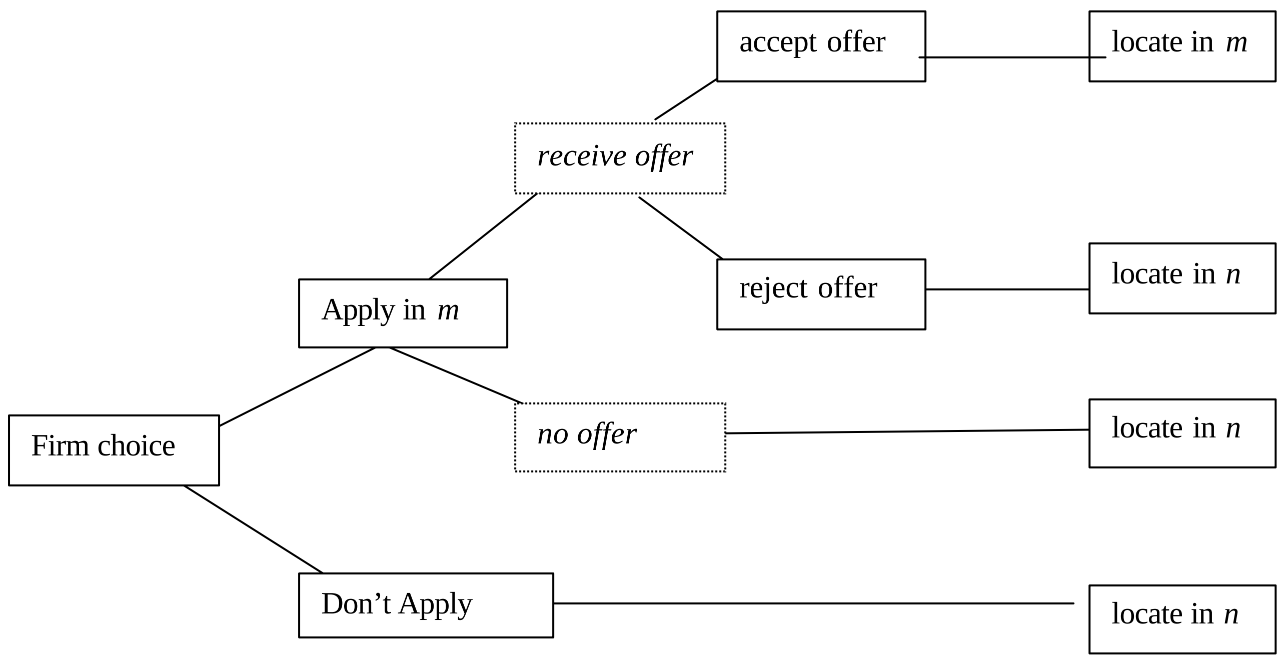
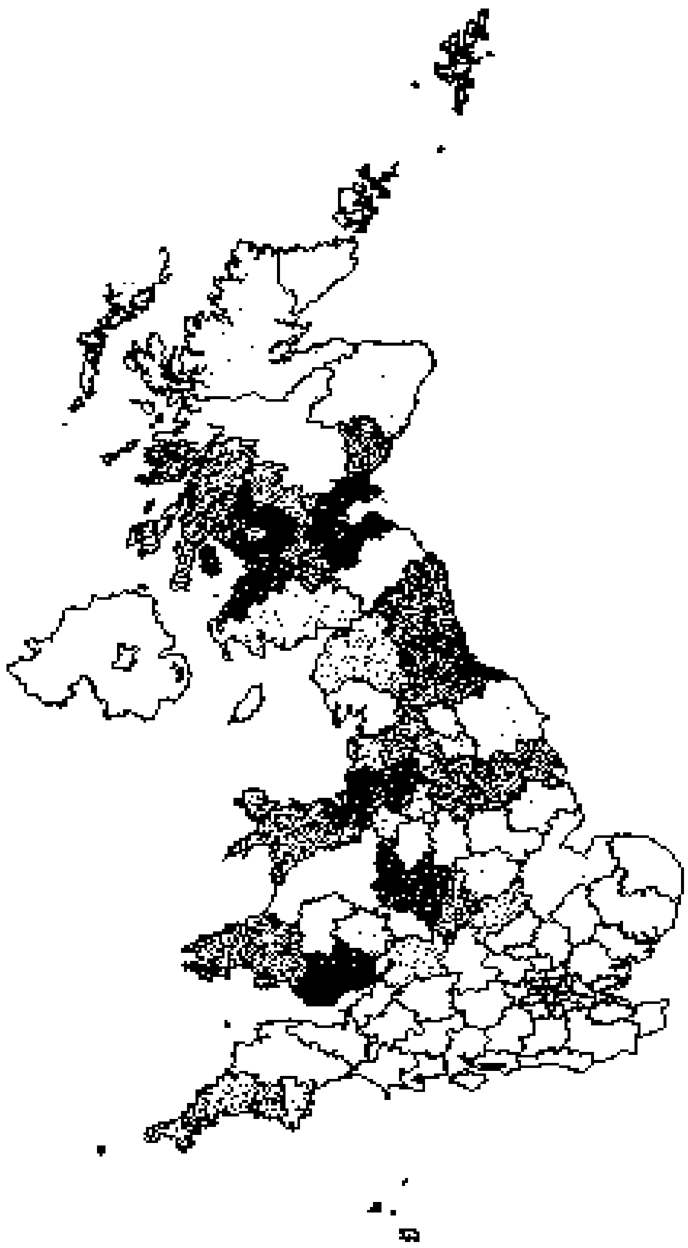


Figure 2: Distribution of grant offers by value 1985-1992



Note: Each dot represents £100,000
Source: RSA grant offers data

Table 1: Regional distribution of production plants and entrants, 1986-1992

Region	% all production plants	Entrants		
		All	Foreign	UK group
Assisted				
South East	-	-	-	-
East Anglia	-	-	-	-
South West	0.8	0.8	1.3	0.9
West Midlands	10.0	9.1	9.3	9.0
East Midlands	0.6	0.6	[a]	0.7
Yorkshire and Humberside	4.3	3.8	3.9	4.6
North West	7.6	7.1	6.5	7.0
North	3.0	3.0	4.4	3.5
Wales	3.4	3.6	5.4	3.8
Scotland	4.1	3.9	6.3	4.2
Unassisted				
South East	34.8	39.5	37.3	33.4
East Anglia	3.5	3.4	3.5	4.2
South West	6.1	5.6	5.4	7.1
West Midlands	3.0	2.7	2.5	3.1
East Midlands	8.2	7.4	6.5	7.9
Yorkshire and Humberside	4.3	3.7	3.8	4.5
North West	3.5	3.2	4.7	3.4
North	0.6	0.4	[a]	0.6
Wales	0.4	0.4	[a]	0.4
Scotland	2.1	2.0	3.3	2.6

Excludes entrants that are not yet in production. All figures are annual averages. Table B1 in Appendix B shows the distribution of new entrants across counties and Scottish regions. [a] Figure cannot be disclosed for data confidentiality reasons.

Source: authors' calculations using the ARD (Source: ONS)

Table 2: Descriptive statistics: mean values 1986-1992*

Region	Diversity measure	Agglomeration measures, number of 4-digit industry:	
		Plants	Foreign plants
South East	0.845	70	1
East Anglia	0.891	24	1
South West	0.838	21	1
West Midlands	0.866	52	1
East Midlands	0.876	32	1
Yorkshire and Humberside	0.889	39	1
North West	0.920	53	1
Northern	0.764	12	0
Wales	0.739	9	0
Scotland	0.655	11	0
Mean	*0.805*	*31*	*1*

Source: Authors' calculations using the ARD (Source: ONS).

* Note: Agglomeration measures are calculated for each of 64 counties at the 4-digit-industry-year level. Diversity measure is calculated at the county-year level. Figures in column (1) are averages over counties and years within region. Figures in columns (2) and (3) are averages over industries, counties and years within region. The averages are calculated across the dataset of entrants and possible location choices used in the conditional logit model in section 4.1. Measures at the county level are shown in table B2, Appendix B.

Table 3: RSA Grants – Regional distribution, 1986-1992

Region	Number grant offers	Total grant offers (£ million 1990)	Average grant offer (£1990)
England			
South East	-	-	-
East Anglia	-	-	-
South West	80	27	332,659
West Midlands	339	121	358,404
East Midlands	28	4	155,403
Yorkshire and Humberside	163	75	459,529
North West	348	157	452,093
Northern	365	243	665,200
Wales	442	273	618,053
Scotland	673	460	683,519

Note: No areas in the South East of England and East Anglia were classified as assisted during this period.

Source: Authors' calculations using RSA grant offers data. The total number of grants in this table does not co-incide with table A1 because some grants did not have sufficient postcode information to map them into regions.

Table 4: New entrant grant offer recipients by ownership nationality, 1986-1992

	All	Domestic single	Domestic group	Foreign
Total number of entrants	121,583	100,981	19,116	1,486
Total number of entrants in Assisted Areas	38,583	31,738	6,336	509
% entrants in Assisted Areas receiving grant offers [a]	0.9	0.6	2.0	3.3
Average grant offer to entrants (£1990)	445,921	413,712	442,830	866,339

[a] Authors' calculations using our sample of RSA grants matched to entrants in the ARD (Source: ONS). See Appendix A for more details. The proportion of entrants receiving grants will be an understatement as we do not match all grant offers to the ARD.

Table 5: Grant offer regression

Estimation option	Option (A)	Option (B)
Dependent variable	real grant offer (£1990)	real grant offer (£1990)
Observations	2120	77,253
No. grant offers	2120	312
Unemployment rate	1033550	5056584
	(0.50)	(4.77)
Group	-	289950
		(4.99)
Foreign-owned	-	296261
		(1.90)
West Midlands	39812	914971
	(0.44)	(7.64)
East Midlands	-145141	411683
	(-1.41)	(2.54)
Yorkshire and Humberside	250280	709809
	(2.01)	(5.19)
North West	201226	908007
	(2.14)	(7.48)
Northern	401832	1430305
	(2.38)	(10.46)
Wales	256559	1566227
	(3.35)	(11.54)
Scotland	370288	1403515
	(3.11)	(10.79)
Wales*Foreign-owned	-	-57951
		(-0.16)
Scotland*Foreign-owned	-	83670
		(0.28)
FdTx	176321	889795
	(1.37)	(2.29)
ChRu	351039	1438069
	(2.35)	(3.67)
Metl	132365	836435
	(1.01)	(2.16)
HiTc	854134	1238219
	(4.00)	(3.15)
Motr	1058346	1446148
	(2.76)	(3.57)
Othr	191027	982575
	(1.46)	(2.54)
Constant	-125762	-5443022
	(-0.58)	(-11.19)
Year dummies	No	Yes

Note: Industry dummies are defined as: FdTx (manufacture of food, drink, textiles, wearing apparel, and leather goods); ChRu (chemicals and rubber and plastic); Metl (other non-metallic mineral products, basic metals, fabricated metal products); HiTc (office machinery computers, electrical machinery n.e.c., radio tv communications, medical optical instruments); Motr (motor vehicles and other transp equipment); Othr (machinery and equip n.e.c., publishing, furniture and manuf n.e.c., wood and wood products, paper and paper products). Numbers in parentheses are t-statistics.
Source: authors' calculations using RSA grant offers data and the ARD (Source: ONS).

Table 6A: Expected grant offer

	(1) England-Assisted	(2) Wales-Assisted	(3) Scotland-Assisted
Actual mean grant (all grants £1990)	403,881	618,053	683,519
Actual mean grant (good matches to entrants £1990)	388,372	463,298	571,759
Option (A)	345,053	475,575	595,490
Option (B) $E[g^{*}_{ijkt}]$	5,048	17,103	13,678
Option (B) $E[g_{ijkt}]$	461,032	536,571	522,770

Notes: Figures shown here are means within each region. The expected grants used in the conditional logit estimation in tables 7 and 8 varies at the more dis-aggregated county-assisted area level.
Source: Authors' calculations using RSA grant offers data and the ARD (Source: ONS).

Table 6B: Expected grant offer

	(1) Domestic-owned	(2) Foreign-owned
Actual g (published figures 1985-1988)	95,000	818,000
Option (A)	414,983	505,226
Option (B) $E[g^{*}_{ijkt}]$	8,339	18,443
Option (B) $E[g_{ijkt}]$	484,995	525,125

Source: Authors' calculations using RSA grant offers data and the ARD (Source: ONS), and PA Cambridge Economic Consultants (1993).

Table 7: Location choice model: new plants owned by a foreign multinational and UK groups, log-odds ratios

	Dependent variable: Y_{ijkt} = 1 if entrant chooses region k, 0 otherwise				
1,840,590 Obs	(1)	(2)	(3)	(4)	(5)
Area size $_{t-1}$ (manufacturing employment)	1.000016 (48.41)	1.000016 (48.20)	1.000016 (48.17)	1.000016 (48.17)	1.000016 (48.21)
Industry wage OPS $_{t-1}$	1.000091 (13.47)	1.000012 (1.59)	0.999 (-2.40)	0.999 (-2.51)	0.999 (-4.83)
Industry wage ATC $_{t-1}$	1.000057 (9.29)	1.00004 (6.33)	1.000027 (4.09)	1.000027 (4.07)	1.000029 (4.45)
Agglomeration measures, number of:					
Industry plants$_{t-1}$		1.000603 (27.52)	1.000065 (1.69)	1.000087 (2.26)	0.999 (-1.53)
Industry plants$_{t-1}$ * g^{MS}					1.011 (13.76)
Industry foreign-owned plants $_{t-1}$			1.045 (16.97)	1.046 (17.03)	1.013 (3.77)
Industry foreign-owned plants $_{t-1}$ * FO			1.014 (2.97)	1.014 (2.98)	1.015 (3.10)
Diversity measure $_{t-1}$				4.355 (26.96)	4.288 (26.68)
County dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	*-71836*	*-71469*	*-71313*	*-70861*	*-70769*

Numbers in the table are log odds ratios, with z-ratios in parentheses. The sample includes 18,045 entrants in 1986-1992.

Source: Authors' calculations using the ARD (Source: ONS).

Table 8: Location choice model: elasticities

	Dependent variable: Y_{ijkt} = 1 if entrant chooses region k, 0 otherwise
1,840,590 Obs	Elasticities
Area size (manufacturing employment) $_{t-1}$	0.686
Industry wage OPS $_{t-1}$	-0.206
Industry wage ATC $_{t-1}$	0.212
Agglomeration measures, number of:	
Industry plants $_{t-1}$	-0.002
Industry plants $_{t-1}$ * g^{MS}	0.010
Industry foreign-owned plants $_{t-1}$	0.008
Industry foreign-owned plants $_{t-1}$ * FO	0.011
Diversity measure $_{t-1}$	1.16

Source: Authors' calculations using the ARD (Source: ONS).

Table 9: Location choice model: log-odds ratios

	Dependent variable: Y_{ijkt} = 1 if entrant chooses region k, 0 otherwise				
1,840,590 Obs	(1)	(2)	(3)	(4)	(5)
Assisted Area	0.962 (-1.50)	0.928 (-2.25)	0.927 (-2.26)	0.886 (-4.29)	0.892 (-4.08)
Expected grant (A)		1.000 (1.73)	1.000 (1.72)		
Expected grant (A) * g^{MS}			1.000 (0.24)		
Expected grant (B)				1.000014 (8.15)	1.000014 (8.17)
Expected grant (B) * g^{MS}					0.999 (-1.74)
Area size $_{t-1}$ (manufacturing employment)	1.000016 (48.02)	1.000016 (47.21)	1.000016 (47.17)	1.000016 (46.94)	1.000016 (46.96)
Industry wage OPS $_{t-1}$	0.999 (-4.82)	0.999 (-4.82)	0.999 (-4.82)	0.999 (-4.91)	0.999 (-4.93)
Industry wage ATC $_{t-1}$	1.000029 (4.45)	1.000029 (4.41)	1.000029 (4.41)	1.000028 (4.18)	1.000028 (4.20)
Agglomeration measures, number of:					
Industry plants$_{t-1}$	0.999 (-1.53)	0.999 (-1.51)	0.999 (-1.52)	0.999 (-1.55)	0.999 (-1.37)
Industry plants$_{t-1}$ * g^{MS}	1.011 (13.76)	1.011 (13.75)	1.011 (13.68)	1.011 (13.66)	1.011 (13.31)
Industry foreign-owned plants $_{t-1}$	1.013 (3.77)	1.013 (3.75)	1.013 (3.75)	1.014 (3.89)	1.014 (3.94)
Industry foreign-owned plants $_{t-1}$ * FO	1.015 (3.10)	1.015 (3.10)	1.015 (3.10)	1.016 (3.26)	1.015 (3.20)
Diversity measure $_{t-1}$	4.288 (26.68)	4.290 (26.68)	4.289 (26.68)	4.298 (26.72)	4.301 (26.74)
County dummies	Yes	Yes	Yes	Yes	Yes
Log likelihood	*-70769*	*-70767*	*-70767*	*-70737*	*-70736*

Numbers in the table are log odds ratios, with z-ratios in parentheses. The sample includes 18,045 entrants in 1986-1992.
Source: Authors' calculations using RSA grant offers data and the ARD (Source: ONS).

Table A1 : Number and value of grant offers matched to population of plants

Grant year	Number of grants	Number (%) matched		Value of offers £m	Value (%) of offers matched £m	
1983	227	108	(48%)	105.7	64.6	(61%)
1984	224	119	(53%)	109.7	67.7	(62%)
1985	275	167	(61%)	186.3	120.1	(64%)
1986	310	164	(53%)	139.1	78.3	(56%)
1987	340	192	(56%)	193.0	91.8	(48%)
1988	366	202	(55%)	173.3	68.7	(40%)
1989	383	223	(58%)	182.2	109.5	(60%)
1990	357	168	(47%)	254.8	119.2	(47%)
1991	348	169	(49%)	280.3	96.9	(35%)
1992	369	175	(47%)	180.0	81.4	(45%)
Total	*3,199*	*1,687*	*(53%)*	*1,804.4*	*898.2*	*(50%)*

Source: Authors' calculations using RSA grant offers data and the ARD (Source: ONS).

Figure B1: Counties and Scottish Regions

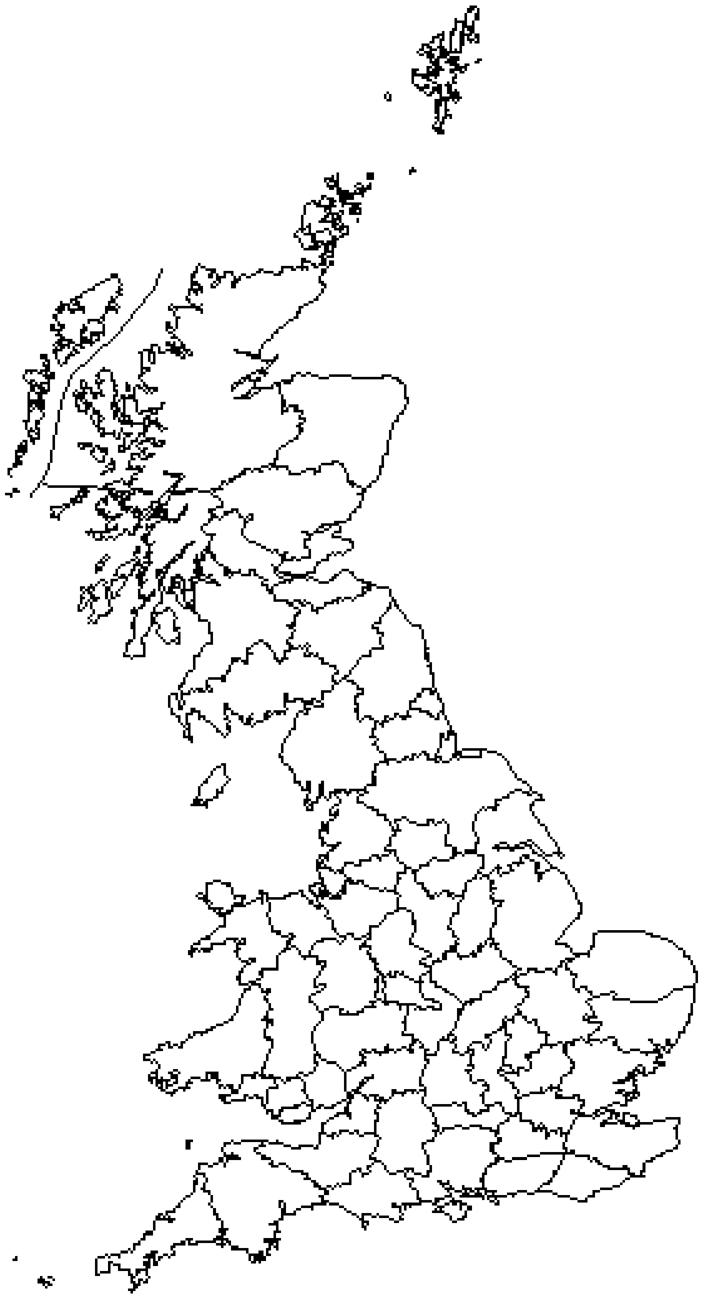


Figure B2: Administrative Regions in Great Britain

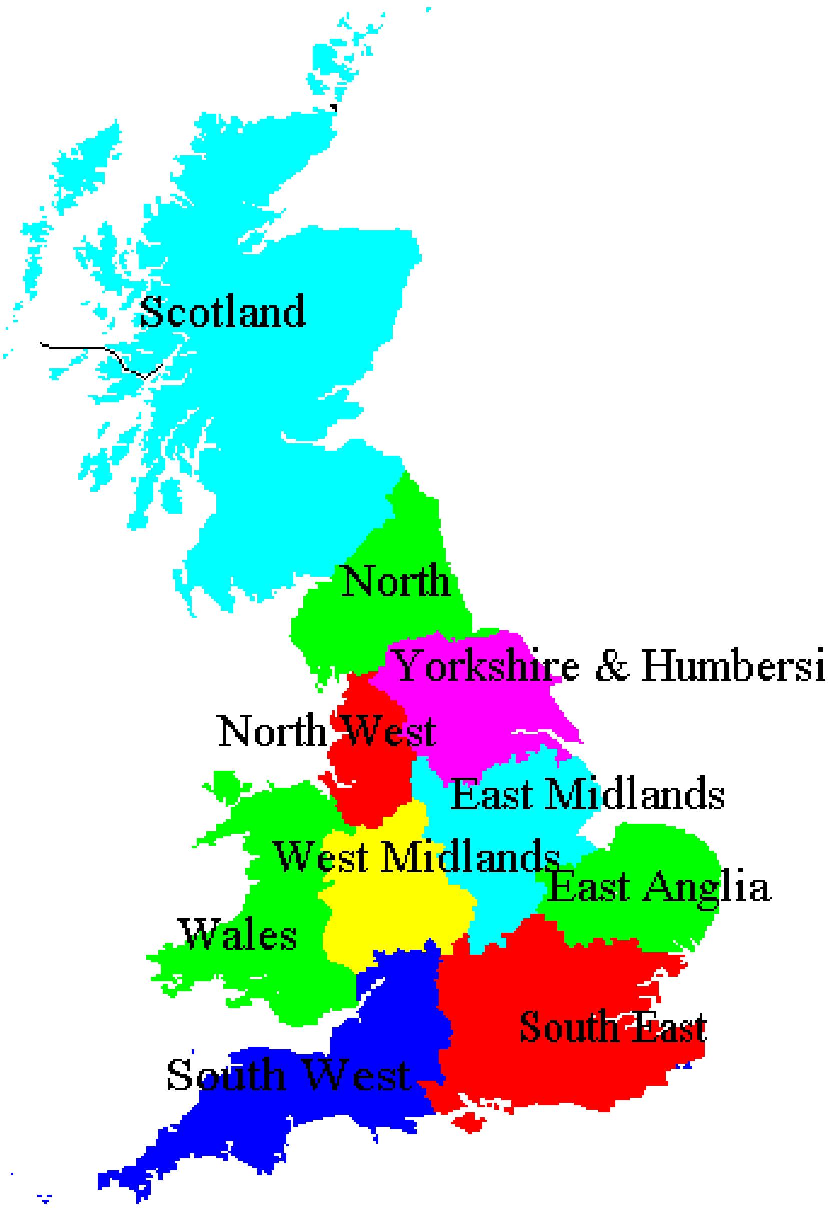


Table B1: Distribution of new entrants across counties, mean 1986-1992

County	% all production plants	Entrants		
		All	Foreign-owned[a]	UK-group
South East	**34.8**	**39.5**	**37.3**	**33.4**
02 Bedfordshire	1.1	1.0		1.1
03 Berkshire	1.5	1.7		1.6
04 Buckinghamshire	1.5	1.6		1.5
14 East Sussex	1.0	1.1		1.2
15 Essex	2.7	2.8		2.5
50 Greater London	15.4	19.7		13.3
17 Hampshire	2.6	3.0		3.4
19 Hertfordshire	2.2	2.2		2.2
21 Isle of Wight	0.2	0.2		0.3
22 Kent	2.3	2.3		2.5
31 Oxfordshire	0.9	1.0		1.3
36 Surrey	1.9	1.8		1.8
38 West Sussex	1.3	1.3		1.5
East Anglia	**3.5**	**3.4**	**3.5**	**4.2**
05 Cambridgeshire	1.3	1.4		1.5
26 Norfolk	1.1	1.0		1.4
35 Suffolk	1.1	1.0		1.4
South West	**6.9**	**6.4**		**8.0**
01 Avon	1.4	1.3		1.7
08 Cornwall	0.6	0.5		0.6
11 Devon	1.2	1.0		1.3
12 Dorset	1.1	1.1		1.2
16 Gloucestershire	1.2	1.0		1.4
33 Somerset	0.7	0.7		0.9
39 Wiltshire	0.8	0.8		1.0
West Midlands	**12.9**	**11.9**	**11.6**	**12.1**
18 Hereford and Worcester	1.5	1.5		1.6
32 Shropshire	0.7	0.8		0.9
34 Staffordshire	2.0	1.8		1.9
37 Warwickshire	1.1	1.0		1.1
46 West Midlands	7.6	6.8		6.7
East Midlands	**8.8**	**7.9**		**8.6**
10 Derbyshire	1.9	1.7		2.1
24 Leicestershire	2.9	2.7		2.3
25 Lincolnshire	0.8	0.7		0.9
28 Northamptonshire	1.4	1.4		1.5
30 Nottinghamshire	1.8	1.5		2.0
Yorkshire and Humberside	**8.6**	**7.4**	**7.4**	**9.0**
20 Humberside	1.3	1.3		1.4
27 North Yorkshire	0.8	0.7		0.9
44 South Yorkshire	1.9	1.7		2.1
47 West Yorkshire	4.6	3.8		4.8

North West	**11.1**	**10.3**	**10.8**	**10.3**
06 Cheshire	1.5	1.5		1.6
42 Greater Manchester	5.4	5.1		4.9
23 Lancashire	2.4	2.0		2.3
43 Merseyside	1.7	1.7		1.7
Northern	**3.5**	**3.4**	**4.9**	**4.1**
07 Cleveland	0.6	0.8		0.9
09 Cumbria	0.5	0.4		0.6
13 Durham	0.7	0.7		0.9
29 Northumberland	0.3	0.2		0.3
45 Tyne and Wear	1.4	1.3		1.5
Wales	**3.8**	**3.9**	**5.6**	**4.2**
60 Clwyd	0.7	0.7		0.9
61 Dyfed	0.3	0.4		0.3
62 Gwent	0.7	0.8		0.8
63 Gwynedd	0.2	0.2		0.2
64 Mid Glamorgan	0.7	0.7		0.8
65 Powys	0.2	0.2		0.3
66 South Glamorgan	0.5	0.6		0.7
67 West Glamorgan	0.4	0.5		0.5
Scotland	**6.1**	**5.9**	**9.3**	**6.8**
85 Highland	0.2	0.3		0.4
84 Grampian	0.7	0.8		1.0
89 Tayside	0.5	0.4		0.5
81 Central	0.3	0.2		0.3
83 Fife	0.4	0.4		0.4
87 Strathclyde	2.8	2.8		2.8
86 Lothian	0.7	0.8		0.9
82 Dumfries and Galloway	0.2	0.1		0.3
80 Borders	0.2	0.1		0.3
90 Island Authorities	0.1	0.1		0.1

[a] Full set of figures cannot be displayed for data confidentiality reasons.
Source: Authors' calculations using the ARD (Source: ONS). Figures are averages over years.

Table B2: Descriptive statistics: mean values by county, 1986-1992*

County	Diversity measure	Agglomeration measures: number of 4-digit industry	
		Plants	Foreign plants
Mean	**0.805**	**31**	**1**
South East	**0.845**	**70**	**1**
02 Bedfordshire	0.810	26	1
03 Berkshire	0.888	36	1
04 Buckinghamshire	0.880	37	1
14 East Sussex	0.859	27	0
15 Essex	0.916	65	1
50 Greater London	0.930	447	7
17 Hampshire	0.920	56	1
19 Hertfordshire	0.867	57	1
21 Isle of Wight	0.509	3	0
22 Kent	0.918	56	1
31 Oxfordshire	0.735	24	1
36 Surrey	0.888	47	1
38 West Sussex	0.859	31	1
East Anglia	**0.891**	**24**	**1**
05 Cambridgeshire	0.877	28	1
26 Norfolk	0.896	22	0
35 Suffolk	0.899	24	0
South West	**0.838**	**21**	**0**
01 Avon	0.799	33	1
08 Cornwall	0.775	13	0
11 Devon	0.864	24	1
12 Dorset	0.872	24	0
16 Gloucestershire	0.885	25	1
33 Somerset	0.799	14	0
39 Wiltshire	0.861	18	0
West Midlands	**0.866**	**52**	**1**
18 Hereford and Worcester	0.899	30	0
32 Shropshire	0.826	13	0
34 Staffordshire	0.831	36	1
37 Warwickshire	0.845	22	0
46 West Midlands	0.929	156	2
East Midlands	**0.876**	**32**	**1**
10 Derbyshire	0.913	33	1
24 Leicestershire	0.859	50	1
25 Lincolnshire	0.832	15	0
28 Northamptonshire	0.884	26	1
30 Nottinghamshire	0.891	35	0
Yorkshire and Humberside	**0.889**	**39**	**1**
20 Humberside	0.893	24	0
27 North Yorkshire	0.824	15	0
44 South Yorkshire	0.897	34	1
47 West Yorkshire	0.943	85	2
North West	**0.920**	**53**	**1**

06 Cheshire	0.902	28	1
42 Greater Manchester	0.958	104	2
23 Lancashire	0.911	45	1
43 Merseyside	0.908	36	0
Northern	**0.764**	**12**	**0**
07 Cleveland	0.774	13	0
09 Cumbria	0.675	10	0
13 Durham	0.847	12	0
29 Northumberland	0.737	5	0
45 Tyne and Wear	0.904	28	1
Wales	**0.739**	**9**	**0**
60 Clwyd	0.840	12	0
61 Dyfed	0.648	6	0
62 Gwent	0.854	13	0
63 Gwynedd	0.613	4	0
64 Mid Glamorgan	0.857	14	1
65 Powys	0.583	4	0
66 South Glamorgan	0.794	12	0
67 West Glamorgan	0.767	8	0
Scotland	**0.655**	**11**	**0**
85 Highland	0.397	4	0
84 Grampian	0.805	12	0
89 Tayside	0.805	8	1
81 Central	0.672	5	0
83 Fife	0.745	7	0
87 Strathclyde	0.944	54	2
86 Lothian	0.842	15	1
82 Dumfries and Galloway	0.560	2	0
80 Borders	0.334	3	0
90 Island Authorities	0.285	1	0

Source: Authors' calculations using the ARD (Source: ONS).
* Note: Agglomeration measures are calculated for each of 64 counties at the 4-digit-industry-year level. Diversity measure is calculated at the county-year level. Figures in column (1) are averages over years within county. Figures in columns (2) and (3) are averages over industries and years within county. The averages are calculated across the dataset of entrants and possible location choices used in the conditional logit model in section 4.1.