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1. Introduction

Probably the most important policy-relevant insight generated by the recent theoretical literature in economic geography is that, in a world of low trade costs and mobile capital, agglomeration economies can tie firms to certain locations and thereby generate taxable rents. If agglomeration forces are sufficiently strong and governments are aware of them, the race to the bottom in capital taxation, a typical feature of neoclassical tax competition models, may not happen. Building on a number of prior theoretical contributions, this point was made prominently by Baldwin and Krugman (2004), who found that the government of a jurisdiction that hosts a cluster of mobile industry will act like a limit-pricing monopolist, extracting a fiscal rent from its *de facto* immobile tax base up to the point where it can just hold on to the agglomeration in the face of a low-tax competitor.[1] Thanks to its compelling logic and profound implications, this argument has had a considerable impact on policy thinking.[2]

Agglomerations of firms, however, could conceivably have the exact opposite effect on local taxation, if, rather than having some of their agglomeration rents taxed away, they instead were able to exploit their bargaining position to exert political influence on local government and obtain favourable treatment. The political-economy literature points to such policy capture as being stronger at the local than at the national level (Bardhan and Mookherjee, 2000; Bardhan, 2002; Redoano, 2010). It also suggests that incumbent declining firms and industries expend greater lobbying effort than entrants (Brainard and Verdier, 1997; Baldwin and Robert-Nicoud, 2007), and that geographically concentrated industries are particularly active in seeking to influence policy (Busch and Reinhardt, 2000).

In this paper we examine whether government policy reacts to agglomeration economies as predicted by these alternative theories. We analyse the generosity of a place-based subsidy scheme, which aims to induce firms to locate jobs in economically lagging and mostly remote regions, i.e. *away* from existing agglomerations. Subsidies can be thought of as negative taxes,

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[1] Other important theoretical treatments of this idea include Ludema and Wooton (2000), Kind, Midelfart-Knarvik and Schjelderup (2000), Anderson and Forslid (2003), Borck and Pflüger (2006) and Konrad and Kovenock (2009). For an overview, see Baldwin, Forslid, Martin, Ottaviano and Robert-Nicoud (2003, chapters 15 and 16).

[2] In a discussion of the Baldwin-Krugman paper, *The Economist* (29 March 2001) summarised the key point as follows: "(i)f policymakers accept the benefits of agglomeration, one big argument for tax harmonisation falls apart".

and applicants can be categorised by the agglomeration intensity of the industry they belong to.[3] We exploit detailed data on both applications for grants by firms and subsequent grant offers by policy authorities. Hence, we can study whether firms themselves internalise the presence of industry localisation externalities in the per-job subsidy they request from the government; that is, whether firms in more agglomerated industries request higher or lower per-job subsidies to locate in a peripheral region. Then, we examine whether the government pays more or less generous per-job subsidies to plants in more agglomerated industries, and how the subsidy rate in such industries varies with geographic distance to existing activity. Finally, we explore how grant offers vary with the jurisdictional tier of policy making, with the degree of area-industry specialisation, and with applicant firm incumbency, allowing us to assess the predictions of political-economy models.

Using administrative data on a major place-based policy in Great Britain, we find partial evidence of firms internalising localisation benefits in their grant applications to government. Firms in more localised industries request higher per-job subsidies, but we find no evidence that this increases in locations more remote from the bulk of industry employment. While on average government agencies appear to follow suit in their offers, we find that decentralised, local government authorities appear to be structuring their offers so as to favour, and potentially try and preserve, existing employment in more agglomerated industries in those areas with a higher concentration of industry employment. Such behaviour is consistent with models of local policy capture rather than with government appropriation of agglomeration rents.

Our analysis addresses two identification problems which complicate the empirical examination of the hypothesis that governments tax agglomeration rents. The first is two-way causation. In economic geography models, tax rates depend on the location of the tax base, as in our hypothesis, but the location of the tax base also depends on tax rates. A regression of location-specific tax rates on location-specific measures of agglomeration will likely suffer from simultaneity bias, unless valid instruments are found for agglomeration. We partly circumvent this issue by taking a fiscal variable that is specific to firms, and by regressing that variable on an industry-specific agglomeration measure. In this setting, reverse causation (whereby the subsidy

[3] For a model of agglomeration and taxation that allows taxes to be positive or negative, see Haufler and Wooton (2010).

paid to an individual firm would impact on the pre-existing degree of agglomeration of that firm's industry) is not a plausible concern.

The second problem arises from the potential for omitted variables: taxes (and subsidies) depend on tax bases but also on other factors such as revenue needs and voter preferences. A regression of location-specific tax rates on location-specific measures of agglomeration can never be entirely free of the suspicion that some relevant right-hand side variable is missing. This is of particular concern since, in the data, "agglomerated" locations usually correspond to urban areas, and urban areas tend to have higher revenue needs for a host of reasons. Hence, any estimate suggesting that larger or denser regions levy higher taxes will inevitably be tainted by the omitted-variable suspicion. Our approach to this issue is to estimate the hypothesis at least in part not across locations but across industries.[4]

The hypothesis that governments tax agglomeration rents has been explored empirically before.[5] All of the existing studies use a cross-location regression design, and all of them conclude that observed tax rates are higher in places that are host to an agglomeration. Buettner (2001) finds that more populous German municipalities set higher local business tax rates, and Charlot and Paty (2006) find that French municipalities with greater market potential set higher business tax rates.[6] In recent work the reverse-causation problem is addressed by instrumenting the right-hand-side agglomeration measure with agglomeration measured at a date prior to the introduction of the tax that represents the left-hand-side variable (Jofre-Monseny, 2013; Koh, Riedel and Böhm, 2013; and Luthi and Schmidheiny, 2014).

Our study builds on two precursor papers. Brülhart, Jametti and Schmidheiny (2012) use the cross-industry dimension to test the hypothesis that firm births in more agglomerated industries are less sensitive to regional tax differences than firm births in less agglomerated industries. Their analysis uses Swiss data, where tax rates are sector invariant, and finds that agglomeration has a statistically significant but quantitatively rather modest attenuating effect on the tax sensitivity of firms' location choices. In the present paper, we take advantage of a policy

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[4] Concerns about omitted variables in the cross-industry dimension may of course still apply. We discuss this below.

[5] See Brülhart, Bucovetsky and Schmidheiny (forthcoming) for a survey.

[6] The same basic regression design is applied to international data by Garretsen and Peeters (2007), who report that effective average tax rates on corporate income across OECD countries correlate positively with country size and market potential. In a similar vein, Carlsen, Langset and Rattsø (2005) find that, other things equal, Norwegian municipalities set higher infrastructure fees if their local economies are dominated by firms in immobile sectors.

setting where the subsidy can be varied across industries, to test whether the rate offered takes account of firms' differential spatial mobility according to the extent of industry localisation. We also build on Devereux, Griffith and Simpson (2007), who examined whether plant location choices are actually influenced by the availability of regional subsidies. They find that, other things equal, entrant location decisions are more responsive to financial incentives in areas with pre-existing industry activity compared to more peripheral locations.[7] Our research question in this paper differs in that we focus on how the subsidy applied for by firms and the amount then offered by the government vary with the degree of industry agglomeration.[8]

The paper is structured as follows. In Section 2 we set out our empirical model and in Section 3 present the data. In Section 4 presents the results and Section 5 concludes.

2. Theoretical background and empirical strategy

2.1 *Economic geography*

Our starting question is as follows: does a purely benevolent government pay more per job to attract a given firm to a peripheral region if the firm belongs to an industry with relatively strong returns to spatial agglomeration? This can be represented by the following simple model. Suppose that the national government's regional policy objective is to maximise the number of jobs generated in peripheral regions. Moreover, suppose that the government seeks a certain diversity of jobs across firms.[9] This can most simply be represented by an objective function such as the standard constant-elasticity specification:

$$U^{gov} = \ln\left(\sum_i \delta_i e_i^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}} + G, \qquad \sigma > 1, \tag{1}$$

[7] A comparable result is found by Henderson (1994). Studying locational choices and subsidies to new firms in Brazil, he finds that, for a given amount of subsidy, more additional activity can be generated in cities where other firms of the same industry are already present than in cities without an established industry.

[8] In addition, we use more comprehensive administrative data on both grant applications and offers to a much wider set of entrant and incumbent plants, made under the same programme.

[9] This taste for diversity could result from a desire to mitigate exposure to firm-specific shocks or from a perception that diversity of firms has other economic or non-economic benefits. Note that if we assumed that the government is perfectly indifferent about the firm in which jobs are created, and abstracting from firm-level capacity limits, the government would concentrate all its subsidies on the firm with the lowest perceived cost per job. Note also that a taste for diversity across firms implies a taste for diversity across industries.

where i denotes firms, e_i is the number of jobs created in the periphery, δ_i is a parameter expressing particular preferences for or against certain firms, σ is the elasticity of substitution between jobs in different firms (and thus an inverse measure of the government's taste for industrial diversity), and G summarises government services other than its regional job-creation policy.

Assuming a balanced budget, the government will face the following constraint:

$$T = \sum_i e_i c_i + G, \tag{2}$$

where T is government revenue, c_i is the cost to the government of attracting a firm-i job to the periphery, and where the cost to the government of supplying G is normalised to unity. We think of c_i as the government's best guess of the minimum per-job subsidy required for firm i to locate such a job in the periphery rather than in a central region.

Maximisation of (1) subject to (2) yields the following subsidy per firm, S_i :

$$S_i = c_i e_i = \frac{c_i^{1-\sigma} \delta_i^{\sigma} T}{\sum_j c_j^{1-\sigma}}. \tag{3}$$

The derivative of S_i with respect to c_i is negative. Hence, for a higher required per-job subsidy c_i, the government pays more *per job* but less *per firm*.

We can write c_i as $c_i = g\left(\mathbf{W}_i, \mathbf{X}_s, \mathbf{Y}_r, \mathbf{Z}_{rs}\right)$, where s denotes industries, r denotes local labour market areas within the periphery, $\mathbf{W}_i$ is a vector of firm-specific attributes, $\mathbf{X}_s$ is a vector of industry-specific attributes, $\mathbf{Y}_r$ is a vector of area-specific attributes, and $\mathbf{Z}_{rs}$ is a vector of industry-area-specific attributes. Assuming linearity and considering a panel with t indexing years, our basic empirical specification for $c_i = c_{isrt}$ can be written as:

$$c_{isrt} = \alpha + \boldsymbol{W}_{it}\boldsymbol{\beta}_1 + \boldsymbol{X}_{st}\boldsymbol{\beta}_2 + \boldsymbol{Y}_{rt}\boldsymbol{\beta}_3 + \boldsymbol{Z}_{rst}\boldsymbol{\beta}_4 + T_t + J_j + P_p + e_{isrt}, \tag{4}$$

where T_t is a set of time dummies to reflect general variation in the generosity of the policy over time, J_j are a set of broader 2-digit industry dummies, and P_p is a set of dummy variables representing the jurisdictional policy authority that is making the offer.

Our main focus is on one element of $\mathbf{X}_{st}$: the agglomeration intensity of individual industries, which we denote with A_{st}. The central hypothesis emerging from economic geography models is that the higher the agglomeration intensity of an industry, the lower is the sensitivity of firms in that industry to locational determinants other than the distribution of existing same-industry firms.[10] Subsidies are one such "other" locational determinant. Hence, provided that the locus of the industry's agglomeration is in the central region, the required *per-job* subsidy will be higher for firms in more agglomerated industries: $\frac{\partial c_i}{\partial A_s} > 0$. Conversely, according to (3), the subsidy paid *per firm* will be lower for firms in more agglomerated industries: $\frac{\partial S_i}{\partial A_s} < 0$.

Prediction 1 (economic geography): *Firms in more agglomerated industries attract higher subsidies per job but lower subsidies per firm.*

In our empirical analysis the relationship between subsidy rates and the degree of industry agglomeration is identified from cross-industry variation. It is therefore important that we control for other industry-level factors that may be correlated with the size of grant applications and offers. As discussed in Section 3, we aim to control for a range of characteristics at the plant, firm, industry and area level that capture different potential correlates of the policy.

One source of within-industry heterogeneity is the proposed or pre-existing location of the plant relative to the geographical core of the industry. Empirically, the locus of agglomeration will be different across industries, and may, for some of them, even lie within the set of peripheral regions that are eligible for subsidies. Our second focus is on an element of $\mathbf{Z}_{rst}$, an interaction term between A_{st} and D_{rst}, where the latter is a measure of geographic distance to existing activity in the industry. We expect the coefficient on the interaction term to be positive, ${\partial c_i}/{\partial A_s \partial D_{rs}} > 0$ implying that as industry agglomeration increases, applicants located further away from existing employment in the industry – and hence less likely to benefit from industry agglomeration economies – receive higher offers per job. Put differently, the more agglomerated an industry, the more expensive it should be to create or retain jobs in a location far away from the locus of the industry.

[10] For a formal derivation of this result, see Brülhart *et al*. (2012).

Prediction 2 (economic geography): *Firms located close to their industry's geographical core attract lower subsidies per job. This effect is stronger the more agglomerated the industry.*

Predictions 1 and 2 capture the economic geography result that governments tax agglomeration rents, applied to a setting with subsidies.[11]

2.2 *Policy capture*

The alternative model of government behaviour we consider is policy capture by rent-seeking firms. There is evidence to suggest that lobbying and political mobilisation increase when the degree of industry agglomeration is higher (Busch and Reinhart, 2000). Indeed it is quite plausible that in areas that exhibit stronger industrial specialisation the local bargaining power of firms belonging to predominant sectors might be greater, as larger groups are more likely to organise into a lobby (Redoano, 2010). Taken together, these arguments imply that firms in more agglomerated industries might in fact have greater scope to extract rents from policy makers in those areas where the industry is localised. In this case, we would expect the coefficient on the interaction term discussed above to take the opposite sign, $\partial c_i / \partial A_s \partial D_{rs} < 0$. That is, as the degree of industry agglomeration rises, per-job subsidies would be expected to be increasing in geographic proximity to industry employment – the reverse of Prediction 2.

Prediction 3 (policy capture): *Firms located close to their industry's geographical core attract higher subsidies per job. This effect is stronger the more agglomerated the industry.*

More generally, theory implies that lobbying may be more successful at a local rather than at a national level, as voters may be less well informed by the media about the actions of local governments than about those of the national government (due, for instance, to less intensive competition among media organisations at the local level); and interests may be easier to organise locally (Bardhan and Mookherjee, 2000; Bardhan, 2002). Local-level lobbying may also be easier due to a "preference dilution effect" at the national level, where firm-level

[11] An alternative situation is that considered in Moretti (2010) and in Greenstone, Hornbeck and Moretti (2010), where the main direction of agglomeration externalities is not from the surrounding industry to a given firm but from a particular (large) firm to the surrounding industry. We consider this to be an improbable configuration in our particular empirical setting for reasons set out in our concluding discussion.

preferences are more heterogeneous than at the local level (de Melo, Panagariya and Rodrik, 1993; Redoano, 2010).

Prediction 4 (policy capture): *Firms located close to their industry's geographical core attract more generous subsidies from local government than from national government.*

With respect to lobbying, a third theoretical prediction we explore is that incumbent firms in mature or declining industries might lobby harder in the face of negative shocks, and that lobbying in such industries might persist over time (Brainard and Verdier, 1997). Baldwin and Robert-Nicoud (2007) show how the presence of sunk costs in declining industries implies that the payoff to lobbying may be higher than in growing industries, since the resulting rents are less likely to attract new entry. This behaviour on the part of incumbents would then explain the observation that 'losers' appear to be afforded greater protection by government. To examine this we look at whether incumbents seeking subsidies to protect existing employment are offered more favourable terms than those offering to create new jobs, and whether this is more prevalent in declining industries.

Prediction 5 (policy capture): *Firms attract higher subsidies per job the greater their focus on maintaining existing jobs, and the lower the local growth rate of their industry.*

Predictions 3 to 5 set out the hypotheses we use to evaluate the alternative model of policy capture.

3. Policy background and data

3.1 *British regional grant schemes*

The policies we exploit are the Regional Selective Assistance (RSA) and Enterprise Grant schemes in Great Britain (see NAO, 2003; Wren, 2005; Devereux *et al.*, 2007 and Criscuolo, Martin, Overman and Van Reenen, 2012) over the period 1985-2004. These are discretionary schemes which offer grants to firms with the stated aim of creating or safeguarding employment in specific economically disadvantaged areas. A further official aim of the RSA scheme is to attract internationally mobile investment. After 2004 both schemes were replaced by a new programme in England, hence our sample ends in that year.

The government agency which administered each scheme, and hence determined the level of grant offered, depended on the size and location of the grant application. For England, large applications (above GBP 1 million up to 1996, and above GBP 2 million thereafter) were administered by central government in London. Smaller projects were handled by the authorities of the nine English administrative regions. Decisions are typically made by formally independent boards comprised of appointed representatives from the private and public sectors and working closely with government officials. Projects located in Scotland and in Wales were handled by their respective government offices. Budgets for the various schemes were allocated centrally in London, with the scheme budgets being "based around historical demand [for the scheme] and affordability conditions" (National Audit Office, 2003, p. 17).

Grants could only be paid to projects located in specific "Assisted Areas", characterised by relatively low income per capita, low labour-market participation and/or high unemployment rates. Assisted Areas were further classified into three "Tiers" depending on their perceived economic needs. Tier 1 (Development Areas) were the most deprived and qualified for the highest subsidy rates, Tier 2 (Intermediate Areas) qualified for lower rates, and in Tier 3 areas firms could only apply for Enterprise Grants. Assisted-Area status was assigned in roughly five-year intervals (1984-88, 1988-93, 1994-99, 2000-06), according to EU rules on area characteristics.[12]

Eligible applicants included both pre-existing plants in Assisted Areas, which could apply for grants to either expand employment or safeguard existing jobs, and new plants that considered locating in those areas. Around 90 percent of applicants were in the manufacturing sector (DTI, 2003). RSA grants were available for up to 15 percent of eligible project costs, which included investment in plant and machinery, land and buildings. The programme was targeted at marginal projects, in the sense that a grant needed to be necessary for the project to go ahead on the scale proposed, and the government agency aimed to award the minimum grant necessary for the project to proceed – often below the maximum grant rate permitted under EU legislation.[13] Applicants could submit proposals in only one location within Great Britain.

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[12] A map showing the Assisted Areas as defined for the period 2000-2006 plus the regional administrative authority boundaries, is available here: http://www.berr.gov.uk/files/file36163.png.

[13] The EU sets a maximum admissible grant rate in a category of regions in terms of the 'Net Grant Equivalent', which is a percentage of the investment after corporate tax.

3.2 *Data*

We use information on all applications filed and offers made in Great Britain under these schemes from 1985 to 2004, although the data on the Enterprise Grant scheme only cover England and Scotland. Some 90 percent of applicants in our data received an offer. The information includes the amount of grant applied for, together with the number of jobs to be created and/or safeguarded as stated in the application. The data also include information on the value of the of grant offered, the associated number of jobs to be safeguarded and/or created as estimated by the government, as well as the capital costs associated with the offer. In order to account for further parameters of the policy-making process, and variation in these over time, we also use data on the Tier to which Assisted Areas are classified and on the maximum grant rate allowable in specific locations (postcodes) as mandated by the EU.[14]

Our second information source are plant and establishment-level data from the British Annual Respondents Database (ARD), where an establishment can comprise one or more plants under common ownership in the same line of business.[15] We use data for the manufacturing sector from 1984 to 2006.[16] The data on government grants can be linked to the ARD at the plant, establishment or firm level (see Appendix).

We use the plant-level population data to construct measures of the characteristics of the applicant plant and its parent firm. These include: an indicator of whether the plant is owned by a foreign multinational, and whether it is part of a multi-plant firm, total employment within the firm, whether the plant is a greenfield entrant (all dated year *t*), and plant employment growth over the previous period (*t*-1 to *t*).[17] The plant-level data also contain information on the plant's five-digit industry, and on its precise location (full postcode).

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[14] Assisted Area eligibility and Tier designation are defined using different spatial units in different periods. Prior to 2000 "Travel to Work Areas" were used (see footnote 19). From 2000 onwards, smaller, administrative electoral wards were used. The maximum grant rate can vary within a Tier. For example, within Tier 2 areas it varied according to area GDP, unemployment and population density, and according to whether or not the area adjoined a Tier 1 area. Hence we use data on maximum grant rates at a finer spatial level than the level of the Tier or Travel to Work Area.

[15] See Barnes and Martin (2002) and Griffith (1999) for a full description. Firms are legally required to respond to the survey.

[16] 1984 is the first year for which postcode level location information is available.

[17] This is defined as (employment_{it} – $\text{employment}_{it\text{-}1}$) / $\text{employment}_{it\text{-}1}$ and is set equal to zero for new entrants.

To measure the degree to which each industry is localised, we use the Ellison and Glaeser (1997) index of agglomeration. We calculate this at the five-digit industry level for each year.[18] We construct further five-digit industry-level measures which reflect the policy process and which more generally might be correlated with the size of grants applied for and offered. Based on the establishment-level sample, we construct measures of investment intensity of the industry (defined as investment in physical capital – plant and machinery, buildings and land and vehicles – per worker), and of the skill intensity of the industry (defined as the skilled-to-unskilled worker wage bill ratio). We use the plant-level sample to measure average employment growth and average plant age, across plants within each industry-year.[19]

Finally, we construct location-specific variables based on 303 Travel to Work Areas (TTWA).[20] We measure the straight-line distance between the centres of each possible pair of TTWAs and construct indicators of whether TTWAs are within a radius of 25, 50 or 100 kilometres of each other. As a measure of the industry-specific remoteness of a TTWA, we calculate the percentage of total industry employment that lies in TTWAs outside a 25 kilometre radius, referring to this measure as "industry peripherality".[21] We additionally control for the mean industry wage by TTWA and year, and the unemployment rate by year and broad administrative region (nine regions within England, plus Wales and Scotland).

Descriptive statistics on all our variables are provided in Table 1. The table shows that the average amount applied for (measured in 2005 GBP) was around £228,000, with the average offer made by government at around £190,000. Part of the reason for this difference is that the number of jobs to be created or safeguarded that are stipulated in the government offer is typically lower than that which the firm had specified at the application stage. The majority of offers (70 percent) are made to firms that are applying to create new jobs, rather than protect

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[18] The Ellison and Glaeser (1997) index for an industry is given by: $\gamma = \left\{ \frac{\sum_{r=1}^{R}\left(s_r^2 - x_r^2\right)}{1-\sum_{r=1}^{R} x_r^2} - H \right\} / (1-H)$, where s_r and x_r are the share of industry employment and total manufacturing employment in Travel to Work Area *r*, respectively, and *H* is the industry Herfindahl index.

[19] Plant age is truncated as the earliest year in which we can observe plants in is 1973.

[20] These are area definitions based on commuting patterns designed to capture local labour markets. The UK Office for National Statistics provides a formal definition. http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/other/travel-to-work-areas/index.html

[21] We report robustness tests with radii of 50 and 100 kilometres.

Table 1. Descriptive statistics

Variable	Mean	Standard deviation	10^{th} Percentile	90^{th} Percentile	Min	Max
Application characteristics						
Application amount$_i$ (£1000s)	227.840	462.477	16.130	611.593	-	-
Dummy job creation only application$_i$	0.617	0.486	0	1	-	-
Dummy jobs safeguarded only application$_i$	0.058	0.235	0	1	-	-
Estimated new jobs at application$_i$	22.380	43.083	2	50	-	-
Estimated safeguarded jobs at application$_i$	16.869	79.069	0	38	-	-
Offer characteristics						
Offer amount$_i$ (£1000s)	190.380	417.807	13.723	496.311	-	-
Capital costs$_i$ (£1000s)	1,308.621	6,317.441	70.088	2,768.470	-	-
Dummy job creation only offer$_i$	0.706	0.456	0	1	-	-
Dummy jobs safeguarded only offer$_i$	0.065	0.247	0	0	-	-
New jobs associated with offer$_i$	20.420	38.804	2	45	-	-
Safeguarded jobs associated with offer$_i$	14.095	51.503	0	32	-	-
Firm characteristics						
Dummy multi-plant firm$_i$	0.921	0.269	1	1	-	-
Total employment in firm$_i$	5.477	34.330	0	4,810	-	-
Foreign-owned MNE$_i$	0.070	0.255	0	0	-	-
Entrant$_i$	0.387	0.487	0	1	-	-
Employment growth$_{it-1}$	0.482	3.435	-0.066	1.000	-	-
Industry characteristics						
EG index$_{st-1}$	0.018	0.040	0.001	0.042	-.050	0.639
Real investment per worker$_{st-1}$	3.876	3.255	1.462	6.769	-10.531	48.839
Skilled/unskilled worker wage bill ratio$_{st-1}$	0.853	0.086	0.804	0.920	0.000	0.983
Mean plant age$_{st-1}$	6.745	2.363	3.768	9.882	0.12	17.389
Mean employment growth$_{st-1}$	0.004	0.435	-0.224	0.161	-0.950	12.854
Area and area-industry characteristics						
Dummy Tier 1 Assisted Area$_{rt}$	0.491	0.500	0	1	0	1
Maximum grant rate $_{rt}$	0.237	.075	0.20	0.30	0	0.35
Real industry wage$_{srt-1}$	19.451	4.696	14.585	24.468	0	91.203
Unemployment rate$_{rt-1}$	5.665	1.897	3.0	7.9	1.5	9.0
Industry peripherality$_{srt-1}$	94.457	9.102	86.656	99.749	9.594	100.0
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$	1.561	3.001	0.127	3.808	-4.667	61.530

Note: all statistics calculated across 5,953 applications.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

existing ones. Over 90 percent of applicants are part of multi-site firms and around 7 percent are owned by foreign multinationals. There is also considerable variation in the degree of industry localisation as measured by the EG index, and industry peripherality is high for Assisted Areas, with on average nearly 95% of industry employment lying outside the TTWA in which an applicant is located.

4 Results

In this section, we begin by examining whether firms themselves internalise industry agglomeration economies when applying for a grant. We then turn to our main research question by examining the determinants of grant offers.

4.1 *Grant applications*

We first investigate the relationship between the amount applied for and the degree of industry localisation. Our estimating equation takes the general form of equation (4) above, but rather than using the per-job subsidy requested by the firm, we allow for some flexibility by replacing the dependent variable with the amount applied for, a_{isrt}, and controlling for the number of jobs to be created or safeguarded as specified at the application stage among the set of firm characteristics $\boldsymbol{W_{it}}$ on the right hand side:

$$a_{isrt} = \alpha_1 + \boldsymbol{W_{it}\beta_1} + \boldsymbol{X_{st}\beta_2} + \boldsymbol{Y_{rt}\beta_3} + \boldsymbol{Z_{rst}\beta_4} + T_t + J_j + P_p + \epsilon_{isrt}, \quad (5)$$

In the first column of Table 2 we include only our control variables and find them to behave largely as expected. For instance, the results indicate that application values are higher in the most deprived (Tier 1) Assisted Areas and more generally are increasing in the maximum admissible grant rate. Per-job subsidies requested by foreign multinationals are also higher, as are those by larger, multi-plant firms. Per-job subsidies requested by new entrants appear to be lower, and plants with lower employment growth request higher per-job subsidies. Applications which specify that they will only safeguard jobs tend to be associated with higher-value applications, and those which only create jobs with lower-value applications compared to applications that involve both. But a greater amount is on average applied for per additional job created (around £5,300 per job) compared to an additional job safeguarded (around £1,000).

Conditional on this an increase in the capital costs of the project of £1,000 is associated with an increase in the value of the application of £17.

In the second column we add in our variable of interest with respect to Prediction 1, the EG index, together with further industry characteristics. The estimated coefficient on the EG index, shown in the top panel of the table, is positive and statistically significant, implying that firms in industries that are more highly localised apply for higher per-job subsidies and thus conforming with Prediction 1. The results imply that, conditional on the other controls, including the number of jobs, an increase of one standard deviation in the EG index (around 0.04) is associated with an increase of around £11,100 in the amount applied for (around 4.9% of the average application amount). This is in line with firms themselves internalising the presence of agglomeration benefits in their per-job subsidy applications. In columns (3) and (4) we add 2-digit industry dummies and policy authority dummies. The latter reflect the government authority that assesses the application, as outlined in Section 3.1. In both columns the coefficient on the EG index, while reducing in magnitude somewhat, remains positive and statistically significant.

In columns (5) and (6) we include our measure of industry peripherality and the interaction term between this measure and the EG index. The coefficient on this interaction term should allow us to distinguish between Predictions 2 and 3. It turns out, however, that the coefficients on both the industry peripherality measure and interaction term, shown in the top panel of the table, are not statistically significant. In addition, the coefficient on the EG index, although still positive, is no longer precisely determined. In part this may be due to insufficient variation in the data to precisely identify the coefficients on the industry localisation measure and the interaction term separately. That our estimated interaction term turns out to be negative is not consistent with firms in more peripheral locations asking for higher subsidies in compensation for foregoing agglomeration benefits, and therefore casts doubt on the applicability of Prediction 2, as derived from geography models, in this case.

Table 2. Applications

Dep. variable: Application amount £1000s	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
EG index$_{st-1}$		277.492	231.458	207.383	218.525	127.561
		(87.855)***	(98.227)**	(104.892)**	(283.801)	(329.486)
Industry peripherality$_{srt-1}$					-0.214	-1.026
					(0.628)	(0.649)
Industry peripherality$_{srt-1}$ *					-0.087	-0.094
EG index$_{st-1}$					(4.188)	(4.574)
Dummy job creation only$_i$	-62.616	-56.838	-56.005	-54.657	-55.869	-54.202
	(20.625)***	(20.406)***	(20.429)***	(17.499)***	(20.386)***	(17.489)***
Dummy jobs safeguarded	143.290	143.326	142.718	124.701	142.533	123.640
only$_i$	(42.770)***	(42.354)***	(41.864)***	(35.303)***	(41.791)***	(35.280)***
Estimated new jobs at	5.297	5.252	5.196	4.817	5.195	4.809
application$_i$	(0.310)***	(0.311)***	(0.318)***	(0.307)***	(0.318)***	(0.307)***
Estimated safeguarded jobs at	1.054	1.060	1.053	0.878	1.052	0.874
application$_i$	(0.662)	(0.657)	(0.655)	(0.546)	(0.656)	(0.546)
Capital costs £1000$_i$	0.017	0.016	0.016	0.014	0.016	0.014
	(0.008)**	(0.007)**	(0.007)**	(0.006)**	(0.007)**	(0.006)**
Dummy multi-plant firm$_i$	24.514	25.374	28.453	27.080	28.459	27.303
	(9.910)**	(9.408)***	(10.039)***	(10.178)***	(10.058)***	(10.255)***
Total firm employment$_i$	1.481	1.469	1.429	1.350	1.429	1.347
	(0.418)***	(0.412)***	(0.396)***	(0.360)***	(0.396)***	(0.359)***
Foreign-owned MNE$_i$	283.344	268.865	262.231	235.420	262.324	235.219
	(53.699)***	(51.452)***	(50.598)***	(45.426)***	(50.601)***	(45.295)***
Entrant$_i$	-21.077	-19.988	-19.457	-17.026	-19.374	-16.632
	(7.130)***	(6.950)***	(7.100)***	(7.030)**	(7.134)***	(7.078)**
Plant employment growth$_i$	-6.587	-6.215	-6.159	-5.199	-6.151	-5.187
	(3.547)*	(3.596)*	(3.584)*	(3.237)	(3.581)*	(3.241)
Investment in plant and		8.398	7.185	6.076	7.207	6.153
machinery per worker $_{st-1s}$		(1.766)***	(2.202)***	(2.274)***	(2.210)***	(2.283)***
Skilled/unskilled worker		27.368	68.958	85.997	68.509	84.387
wage bill ratio $_{st-1s}$		(58.411)	(57.279)	(48.019)*	(57.405)	(48.285)*
Mean plant age $_{st-1}$		0.724	-0.855	-0.388	-0.906	-0.615
		(2.121)	(2.369)	(2.183)	(2.393)	(2.201)
Mean employment growth $_{st-1}$		4.364	5.407	4.173	5.514	4.810
		(7.610)	(7.930)	(7.270)	(7.903)	(7.224)
Dummy Tier 1 Assisted	65.229	77.079	76.310	68.176	76.844	68.625
Area$_{rt}$	(10.099)***	(10.857)***	(10.577)***	(12.291)***	(11.149)***	(12.323)***
Maximum grant rate$_{rt}$	387.946	373.641	374.742	268.257	374.727	266.775
	(77.478)***	(76.466)***	(76.137)***	(73.976)***	(76.119)***	(73.912)***
Real industry wage$_{srt-1}$		1.112	-0.079	0.035	-0.074	-0.003
		(0.884)	(0.964)	(0.865)	(0.965)	(0.867)
Unemployment rate$_{rt-1}$		-36.101	-34.365	-13.808	-34.587	-13.926
		(5.724)***	(5.838)***	(14.416)	(5.912)***	(14.452)
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	No	No	Yes	Yes	Yes	Yes
Policy authority dummies	No	No	No	Yes	No	Yes
Observations	5,953	5,953	5,953	5,953	5,953	5,953
R-squared	0.59	0.60	0.60	0.64	0.60	0.64

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported).
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

4.2 *Grant offers*

We now turn to our central question by examining grant offers made by government. Given the nature of the application and offer process, and hence the potential interdependence between decision making by the firm and government at each stage, we begin by estimating a specification for the grant offer jointly with that for the application using a two-equation seemingly unrelated regression (SUR) model, which allows for correlation between the two error terms. We estimate equation (5) above alongside a second equation for the grant offer given by:

$$o_{isrt} = \alpha_2 + \boldsymbol{W_{it}\beta_5} + \boldsymbol{X_{st}\beta_6} + \boldsymbol{Y_{rt}\beta_7} + \boldsymbol{Z_{rst}\beta_8} + T_t + J_j + P_p + \varepsilon_{isrt} \qquad (6)$$

Where, o_{isrt}, is the value of the offer and where, among the set of firm characteristics $\boldsymbol{W_{it}}$ on the right hand side, we control for the number of jobs to be created or safeguarded associated with the offer.

Table 3 shows the results of this estimation. We focus first on the estimated coefficients on the EG index (Prediction 1) and the interaction between the EG index and the industry peripherality measure (Prediction 2), which are shown in the top panel of the table. In each case we also test whether the estimated coefficients on these variables in the application and offer equations are significantly different from each other.

In specification (1), we continue to find a positive and significant coefficient on the EG index in the application equation. In the offer equation the coefficient is also positive, (although lower in magnitude), but is not quite significant at conventional levels. However, the test of equality of the two coefficients shown at the foot of the table cannot be rejected. Specification (2) confirms that these results are robust to the inclusion of a set of dummies for the policy authority that administers the grant offer. The data therefore lend some support to Prediction 1 and consequently to the economic geography models.[22]

[22] In Appendix Table A1 we check the robustness of Prediction 1. Because the distribution of the EG index is skewed, with a small number of highly agglomerated industries, we replace the continuous measure with dummy variables indicating different percentiles of the EG index distribution (top 10%, 25% and 50%). The results are comparable to specification (2) in Table 3. Specification (3) in Table A1 indicates that on average an applicant in the top 50% of localised industries applies for a grant that is around £28,000 higher than a firm in the lower half of the distribution, and is offered a grant around £24,000 higher, conditional on other characteristics. We cannot reject equality of the estimated coefficients on these dummy variables in the application and offer equations.

Table 3. Applications and offers: seemingly unrelated regressions

Dependent variable:	**(1)**		**(2)**		**(3)**		**(4)**	
	Application	**Offer**	**Application**	**Offer**	**Application**	**Offer**	**Application**	**Offer**
EG index$_{st-1}$	242.212	142.941	214.532	132.563	197.882	206.596	83.395	51.990
	(102.352)**	(88.268)	(97.901)**	(87.022)	(261.841)	(225.761)	(255.595)	(227.186)
Industry peripherality$_{srt-1}$					-0.481	-0.183	-1.427	-1.273
					(0.565)	(0.487)	(0.606)**	(0.538)**
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$					0.039	-1.224	0.174	-0.401
					(3.262)	(2.813)	(3.155)	(2.803)
Dummy job creation only$_i$	-40.583***	-14.827**	-37.239***	-11.057	-40.359***	-14.744**	-36.829***	-10.662
	(7.050)	(6.905)	(6.745)	(6.804)	(7.054)	(6.906)	(6.743)	(6.803)
Dummy jobs safeguarded only$_i$	146.299***	83.181***	127.246***	75.395***	146.032***	83.038***	126.159***	74.663***
	(15.923)	(13.602)	(15.189)	(13.347)	(15.929)	(13.605)	(15.190)	(13.344)
Estimated new jobs at application$_{i\,/}$ offer$_i$	4.040***	4.268***	3.683***	3.971***	4.038***	4.268***	3.674***	3.961***
	(0.091)	(0.095)	(0.087)	(0.095)	(0.091)	(0.095)	(0.087)	(0.095)
Estimated safeguarded jobs at application$_{i\,/}$ offer$_i$	0.738***	1.750***	0.596***	1.601***	0.737***	1.748***	0.593***	1.594***
	(0.043)	(0.064)	(0.041)	(0.064)	(0.042)	(0.064)	(0.041)	(0.064)
Capital costs £1000$_i$	0.019***	0.012***	0.016***	0.010***	0.019***	0.012***	0.016***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Dummy Multi-plant firm$_i$	37.103**	28.131**	34.881**	27.200**	37.099**	28.145**	35.140**	27.456**
	(15.019)	(12.950)	(14.353)	(12.756)	(15.019)	(12.950)	(14.349)	(12.754)
Total firm employment$_i$	1.617***	0.899***	1.505***	0.856***	1.615***	0.899***	1.499***	0.852***
	(0.115)	(0.100)	(0.110)	(0.099)	(0.115)	(0.100)	(0.110)	(0.099)
Foreign-owned MNE$_i$	303.289***	238.917***	269.878***	217.967***	303.416***	239.115***	269.380***	217.668***
	(15.951)	(13.855)	(15.304)	(13.685)	(15.954)	(13.858)	(15.304)	(13.686)
Entrant$_i$	-17.229**	-13.727*	-14.716*	-12.551*	-17.048**	-13.566*	-14.160*	-12.019*
	(8.148)	(7.022)	(7.781)	(6.912)	(8.151)	(7.025)	(7.782)	(6.913)
Plant employment growth$_i$	-7.272***	-7.814***	-6.093***	-7.267***	-7.251***	-7.805***	-6.072***	-7.249***
	(1.164)	(1.003)	(1.113)	(0.989)	(1.163)	(1.003)	(1.112)	(0.989)
Investment per worker $_{st-1}$	6.836***	3.780***	5.613	2.919**	6.889***	3.815***	5.718***	3.019***
	(1.514)	(1.308)	(1.447)	(1.288)	(1.516)	(1.308)	(1.448)	(1.288)
Skilled/unskilled worker wage bill ratio $_{st-1}$	73.129	92.981*	94.013*	94.731*	72.118	92.609**	91.737*	92.651*
	(57.301)	(49.410)	(55.012)	(48.888)	(57.314)	(49.422)	(55.007)	(48.890)
Mean plant age $_{st-1}$	-0.527	-0.432	-0.021	-0.018	-0.643	-0.472	-0.343	-0.299
	(2.209)	(1.905)	(2.109)	(1.874)	(2.213)	(1.908)	(2.113)	(1.878)
Mean employment growth $_{st-1}$	4.713	1.182	3.447	0.235	4.921	1.449	4.296	1.084
	(8.904)	(7.675)	(8.502)	(7.554)	(8.914)	(7.684)	(8.510)	(7.562)
Dummy highest level Assisted Area$_{rt}$	75.331 ***	58.178***	64.273***	43.994***	76.510***	58.765***	64.921***	44.588***
	(10.469)	(9.022)	(11.157)	(9.913)	(10.542)	(9.086)	(11.156)	(9.914)
Maximum grant rate$_{rt}$	403.956 ***	371.989***	294.425***	278.266***	403.904***	372.034***	292.303***	276.299***
	(69.882)	(60.262)	(69.104)	(61.399)	(69.899)	(60.263)	(69.087)	(61.391)

Real industry wage$_{srt-1}$	-0.042	0.602	0.073	0.659	-0.032	0.614	0.021	0.613
	(0.999)	(0.861)	(0.962)	(0.855)	(0.999)	(0.861)	(0.962)	(0.855)
Claimant count rate$_{rt-1}$	-38.220***	-43.350***	-18.879	-33.520***	-38.706***	-43.570***	-19.038	-33.669***
	(6.589)	(5.682)	(13.530)	(12.024)	(6.610)	(5.700)	(13.526)	(12.022)
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	No	No	Yes	Yes	No	No	Yes	Yes
Observations	5,953	5,953	5,953	5,953	5,953	5,953	5,953	5,953
R-squared	0.59	0.61	0.63	0.62	0.59	0.61	0.63	0.62
Test statistics								
Equality of EG index $_{st-1}$ coefficients	chi2(1) = 1.58		chi2(1) = 1.18		chi2(1) = 0.001		chi2(1) = 0.03	
	Prob > chi2 = 0.2092		Prob > chi2 = 0.2772		Prob > chi2 = 0.9656		Prob > chi2 = 0.8732	
Equality of Industry peripherality$_{srt-1}$					chi2(1) = 0.47		chi2(1) = 0.11	
coefficients					Prob > chi2 = 0.4941		Prob > chi2 = 0.7402	
Equality of Industry peripherality$_{srt-1}$* EG					chi2(1) = 0.25		chi2(1) = 0.06	
index$_{st-1}$ coefficients					Prob > chi2 = 0.6160		Prob > chi2 = 0.8129	

Note: ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported).

Source: authors’ calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

In specifications (3) and (4) we include the industry peripherality measure and the interaction term between the EG index and industry peripherality. In specification (3), we condition only on 2-digit industry dummies and in (4) additionally on the policy authority dummies. The estimated coefficients on the EG index remain positive, but are now statistically insignificant in both equations. Again we cannot reject equality of the coefficients across the two equations. Once we condition on the policy authority dummies in specification (4) the estimated coefficients on the EG index decrease in magnitude, as do those on our measure of industry peripherality, and the latter also becomes statistically significant. Since the policy authority dummies to a large degree control for the broad region in which the application is being made, this latter result implies that within-region per-job subsidies requested and offered in locations closer to industry employment are higher value, and the absence of a significant coefficient on the interaction term with EG implies that this does not vary with the degree of industry agglomeration, a result that contradicts Prediction 2.[23]

We also explore the second element of Prediction 1, that subsidies *per-firm* should be decreasing in the degree of industry localisation. In Table 4, we use data at the 5-digit industry-year level and estimate how the value of offers at the industry level varies with EG index, and control for other potentially confounding industry-level characteristics as in the previous tables. Column (1) shows that the value of offers at the industry-level is decreasing in the degree of industry localisation. In columns (2) and (3) we then experiment with controlling for either the total number of plants or firms in each industry-year, so that the results are informative about the generosity of subsidy offers to the average firm or plant in that sector. In both cases the results indicate that industries with greater numbers of plants or firms tend to receive higher offers, but conditional on this there remains a negative relationship between the value of offers and our industry localisation measure. In the final two columns we show what happens if we instead condition on total employment in the

[23] In Appendix Table A2 we investigate the robustness of our results for Prediction 2 using alternative measures of area-level industry localisation. In the first two specifications, we measure industry peripherality by the percentage of industry employment outside a 50km and 100km radius of the TTWA in which the application is made. In the third, we capture remoteness using a distance squared weighted measure of the percentage of industry employment across all TTWAs, where distance is measured from the TTWA associated with the application. Across all three specifications the interaction terms between industry peripherality and the EG index are never significantly different from zero, while the coefficient on the industry peripherality measure is generally significant and negative. Hence, these results lend no support to Prediction 2, and point towards the opposite being the case, as stipulated by Prediction 3. The results in Table 3 are also robust to two variations in the estimation sample: a) dropping Enterprise Grants and b) a less strict, 5-year window for matching grant applications to the plant population data (see Appendix).

industry – a specification more akin to a per-job subsidy. Here the results suggest that agglomerated industries attract larger funding; the coefficient on the EG index becomes positive (though this result is not statistically significant). In addition, the coefficients on the other industry-level measures do not change sign when we condition on number of firms versus total employment. Overall these findings are in line with Prediction 1 of the economic geography models: more agglomerated industries receive small funding per firm but greater funding per job.

Table 4. Total value of offers – industry-level

Dependent variable: value of offers$_{st}$ £1000s	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
EG Index$_{st-1}$	-1,799.420 (430.638)***	-1,215.390 (412.077)***	-1,227.815 (407.680)***	585.154 (734.810)	560.993 (702.698)
Total plants$_{st}$		0.193 (0.035)***			-0.540 (0.146)***
Total firms$_{st}$			0.261 (0.045)***		0.364 (0.064)***
Total employment$_{st}$				0.040 (0.008)***	0.054 (0.013)***
Investment in plant and machinery per worker $_{st-1s}$	123.570 (43.760)***	132.320 (43.793)***	131.790 (43.756)***	115.486 (39.910)***	99.650 (33.767)***
Skilled/unskilled worker wage bill ratio$_{st-1}$	546.386 (326.950)*	822.442 (334.567)**	750.858 (331.785)**	1,165.579 (330.209)***	888.721 (287.561)***
Mean plant age$_{st-1}$	-74.743 (25.946)***	-37.468 (26.711)	-44.215 (26.450)*	-31.844 (18.775)*	-79.092 (32.241)**
Mean employment growth$_{st-1}$	-88.309 (36.898)**	-74,325 (35.602)**	-74.290 (35.917)**	-47.441 (33.266)	-53.110 (35.963)
Application year dummies	Yes	Yes	Yes	Yes	Yes
Observations	2,556	2,556	2,556	2,556	2,556
R-squared	0.04	0.05	0.05	0.13	0.15

Note: Robust standard errors in parentheses. ***, **, * significant at the 1%, 5%, 10% level.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

As a final exercise in examining how the generosity of per-job subsidies varies at the application versus offer stage, we estimate an alternative specification using the data on individual offers. In Table 5, the dependent variable remains the amount offered, but we now directly condition on the amount applied for, by including this variable on the right hand side. The results imply that conditional on other characteristics the amount offered amounts to some 73 percent of that applied for. Mark-downs of offers relative to applications appear to be lower for plants that are part of foreign-owned multinationals, for plants that have experienced lower employment growth and for plants in industries that are more capital intensive. Across all specifications, there is no evidence that the mark-down implied in the amounts offered varies systematically with the degree of industry localisation; the coefficients on the EG index are all insignificantly different from zero. Hence, the government's treatment of agglomeration effects does not appear to differ systematically from firms' implied pricing.

In the final two columns, (4) and (5), we include the industry peripherality measure and the interaction term between industry peripherality and the EG index. In column (4) when we only include 2-digit industry dummies the coefficient on industry peripherality measure is positive and marginally significant and the coefficient on the interaction term is negative and significant. This latter result directly contradicts Prediction 2, suggesting that as the degree of industry agglomeration increases, firms are in fact receiving higher offers, conditional on the amount they applied for, in areas that are closer to industry employment, i.e. in those areas where they are more likely to benefit from localisation externalities or other natural or location-specific advantages. Hence, of the two contradictory Predictions 2 and 3, it is Prediction 3 that is supported by the data, consistent with policy capture rather than the economic geography mechanism. In the final column we condition on the policy authority dummies. Once we do this, the coefficient on the interaction term becomes insignificant, suggesting that this 'policy capture' behaviour on part of government may be explained by individual government agencies. We investigate this further below, and also examine whether the data support the two further hypotheses, Predictions 4 and 5, with regard to policy capture.

Table 5. Offers, conditional on application amount

Dep. variable: Offer amount £1000s	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Application amount £1000s	0.723	0.722	0.731	0.722	0.730
	(0.028)***	(0.027)***	(0.028)***	(0.027)***	(0.028)***
EG index$_{st-1}$	5.718	5.245	-0.824	4.548	-0.791
	(8.646)	(8.526)	(6.899)	(8.427)	(6.915)
Industry peripherality$_{srt-1}$				0.357	-0.061
				(0.198)*	(0.233)
Industry peripherality$_{srt-1}$* EG index$_{st-1}$				-1.839	-0.996
				(0.880)**	(1.049)
Dummy job creation only offer$_i$	7.172	7.255	9.015	7.211	9.064
	(10.390)	(10.436)	(11.386)	(10.417)	(11.365)
Dummy jobs safeguarded only offer$_i$	6.401	6.422	5.105	6.551	5.035
	(15.895)	(16.164)	(16.588)	(16.175)	(16.602)
New jobs associated with offer$_i$	0.989	0.987	0.964	0.988	0.964
	(0.232)***	(0.233)***	(0.231)***	(0.233)***	(0.231)***
Safeguarded jobs associated with offer$_i$	0.633	0.647	0.702	0.647	0.701
	(0.322)*	(0.323)**	(0.339)**	(0.324)**	(0.340)**
Capital costs £1000$_i$	0.003	0.003	0.003	0.003	0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Dummy Multi-plant firm$_i$	1.911	2.320	2.489	2.354	2.531
	(6.797)	(7.150)	(6.908)	(7.144)	(6.896)
Total firm employment$_i$	-0.132	-0.138	-0.141	-0.136	-0.141
	(0.140)	(0.137)	(0.137)	(0.137)	(0.137)
Foreign-owned MNE$_i$	31.426	31.604	29.274	31.701	29.379
	(17.600)*	(17.091)*	(16.889)*	(17.026)*	(16.847)*
Entrant$_i$	-3.406	-3.104	-3.415	-3.112	-3.325
	(3.347)	(3.318)	(3.323)	(3.339)	(3.346)
Plant employment growth$_i$	-2.153	-2.104	-2.346	-2.117	-2.346
	(1.282)*	(1.269)*	(1.312)*	(1.270)*	(1.312)*
Investment in plant and machinery per worker $_{st-1s}$	75.276	72.882	45.400	73.016	45.325
	(36.468)**	(37.776)*	(38.044)	(37.780)*	(38.052)
Skilled/unskilled worker wage bill ratio$_{st-1s}$	2.494	-13.799	-10.114	136.615	49.675
	(25.422)	(24.528)	(20.838)	(62.874)**	(80.049)
Mean plant age$_{st-1}$	-0.652	-1.873	-1.869	-1.882	-1.851
	(0.973)	(1.646)	(1.643)	(1.655)	(1.652)
Mean employment growth $_{st-1}$	-2.882	22.584	9.856	23.393	9.852
	(21.475)	(23.855)	(23.789)	(23.546)	(23.922)
Dummy highest level Assisted Area$_{rt}$	-0.812	0.227	0.242	0.320	0.234
	(1.466)	(1.960)	(1.924)	(1.976)	(1.930)
Maximum grant rate$_{rt}$	-0.684	-1.527	-1.677	-1.412	-1.483
	(2.438)	(2.314)	(2.195)	(2.268)	(2.143)
Real industry wage$_{srt-1}$	1.037	0.448	0.471	0.453	0.472
	(0.672)	(0.499)	(0.471)	(0.495)	(0.470)
Claimant count rate$_{rt-1}$	-18.509	-18.077	-21.077	-17.769	-21.081
	(5.063)***	(4.830)***	(12.108)*	(4.795)***	(12.103)*
Application year dummies	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	No	Yes	Yes	Yes	Yes
Policy authority dummies	No	No	Yes	No	Yes
Observations	5,953	5,953	5,953	5,953	5,953
R-squared	0.86	0.86	0.86	0.86	0.86

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported).
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

4.3 *Policy capture*

We start by examining Prediction 4, which implies that local policy authorities will be more susceptible to policy capture by locally active firms than national governments. We split the sample into applications dealt with by the national agencies (England, Wales, Scotland), and applications dealt with by the nine individual English sub-regions. In Table 6 we repeat the specifications in the final two columns of Table 5 for each of these two sub-samples, columns (1) and (2) for the national authorities, and columns (3) and (4) for the English regions. Comparison of the two samples reveals that, conditional on other characteristics, on average applicants to the English regions are offered a lower fraction of the value of their application (61 percent in English regions versus 72 percent at the national level).

Table 6. Offers, conditional on application amount: variation by policy authority

Dependent variable: offer amount £1000s	**(1)**	**(2)**	**(3)**	**(4)**
	National Governments	**National Governments**	**English Regions**	**English Regions**
Application amount £1000s	0.716	0.727	0.610	0.609
	(0.035)***	(0.035)***	(0.030)***	(0.030)***
EG index$_{st-1}$	24.385	-912.200	180.467	174.982
	(799.888)	(843.363)	(84.130)**	(85.065)**
Industry peripherality$_{srt-1}$	0.199	-2.104	0.184	0.119
	(2.588)	(2.604)	(0.127)	(0.151)
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$	0.373	10.261	-2.493	-2.512
	(8.222)	(8.688)	(0.899)***	(0.946)***
Offer characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes
Policy authority dummies	No	Yes	No	Yes
Observations	1,684	1,684	4,269	4,269
R-squared	0.85	0.85	0.91	0.91

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 5.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

Interestingly, we find that the negative coefficient on the interaction of central interest, found previously in column (4) of Table 5, is driven by offers made by the English regions, whereas a statistically insignificant effect is observed for applications administered at the national level. This remains the case when we include policy authority dummies for the individual English regions in column (4). We therefore find support for Prediction 4, whereby it is lower-tier governments that are more generous to firms in agglomerated sectors, and in particular when the industry in which the firm operates is more spatially concentrated in the location in which the application is made. Moreover, this result conforms with Prediction 3 and rejects Prediction 2 at the level of English regions, favouring the policy capture model.

Next we explore Prediction 5 in Tables 7 and 8. Prediction 5 implies that it is firms in declining industries and incumbent firms (as opposed to new entrants) that might attract higher per-job subsidies In Table 7 we focus on applications made to the English regions and split the sample into applications that only involve the creation of new jobs and into those that offer to safeguard existing jobs at an established site. We replicate the specification from column (4) of Table 6. In column (1) of Table 7, we consider applications that only involve job creation. In column (2) we consider those that involve only job creation and a combination of job creation and job safeguarding, and in column (3) we consider those that involve only job safeguarding and a combination of job creation and job safeguarding (there are too few applications that only safeguard jobs to consider these alone). From the policy rules, the jobs being supported by the subsidy must be 'marginal' in the sense that in the absence of the public subsidy and new investment they would be lost; hence these incumbent firms can be considered as in decline. We find negative and statistically significant coefficients on the interaction terms between industry peripherality and the EG index in columns (2) and (3) with a stronger relationship in column (3) for those grant applications that all include some component of job safeguarding. These results support Prediction 5, according to which incumbent firms are more successful at attracting subsidies than new entrants.

In Table 8 we cut the sample of applications to English regions according to a measure of average plant employment growth in the industry-TTWA in the year prior to the application being made. The first two columns replicate the specification of column (4) in Table 6 for applications in industry-areas with below median employment growth and the final two columns for applications in industry-areas with above median employment growth. In each case we estimate separately for all applications and the subset which include an element of job-safeguarding. The results suggest that the more generous behaviour on the part of the policy authorities to applicants in more locally agglomerated industries is confined to cases where industry-area employment is in relative decline and is again stronger in the case of applications that propose to safeguard existing jobs, findings which provide further support for Prediction 5.

Table 7. Offers, conditional on application amount, English Regions, job creation and safeguarding

Dependent variable: offer amount £1000s	**(1)**	**(2)**	**(3)**
	Job creation only	**Some job creation**	**Some job safeguarding**
Application amount £1000s	0.595 (0.049)***	0.587 (0.032)***	0.620 (0.037)***
EG index$_{st-1}$	2.967 (37.181)	60.238 (46.153)	300.294 (170.893)*
Industry peripherality$_{srt-1}$	0.018 (0.106)	-0.001 (0.139)	0.262 (0.350)
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$	-0.870 (0.724)	-1.284 (0.581)**	-3.835 (1.876)**
Offer characteristics	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes
Observations	2,694	4,052	1,575
R-squared	0.91	0.91	0.91

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 5.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

Table 8. Offers, conditional on application amount, English regions, low versus high industry-TTWA employment growth

Dependent variable: offer amount £1000s	**(1)**	**(2)**	**(3)**	**(4)**
	Bottom 50% by area industry employment growth		**Top 50% by area industry employment growth**	
	All	**Some job safeguarding**	**All**	**Some job safeguarding**
Application amount £1000s	0.593 (0.038)***	0.595 (0.045)***	0.597 (0.038)***	0.594 (0.052)***
EG index$_{st-1}$	196.765 (63.217)***	281.710 (133.684)**	-83.546 (104.935)	-24.135 (275.586)
Industry peripherality$_{srt-1}$	0.288 (0.170)*	0.397 (0.386)	-0.195 (0.211)	-0.214 (0.606)
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$	-2.689 (0.799)***	-3.710 (1.546)**	0.281 (1.210)	-0.128 (2.873)
Offer characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes
Observations	2,135	794	2,134	781
R-squared	0.92	0.93	0.90	0.91

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 5.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS)

Is the policy capture hypothesis, supported as it is by our estimation results, plausible in the context of British policy institutions? Independent assessment of the application process and receipt of RSA grants has pointed out that subsidies were being awarded repeatedly to the same incumbent firms. The National Audit Office (2003), and independent body which evaluates public spending within England, described the RSA policy as "demand-led", with the scheme being publicised to firms via brochures, and websites.[24] However, they expressed concern about the tendency for some firms to receive multiple grants over time, stating that "between April 1994 and March 2002, of all companies accepting grant offers, 12 percent had received more than one grant, amounting to 31 percent of the total value of offers accepted." (National Audit Office, 2003, p. 21), and suggested that applying for a grant may become a "business skill" potentially biasing the system in favour of previously successful applicants.

Table 9. Offer, conditional on application amount, English regions, industry specialised versus non-specialised areas

Dependent variable: offer amount £1000s	(1)	(2)	(3)	(4)
	Top 50% area industry specialisation		Bottom 50% area industry specialisation	
	All	Some job safeguarding	All	Some job safeguarding
Application amount £1000s	0.596 (0.035)***	0.606 (0.040)***	0.643 (0.061)***	0.637 (0.080)***
EG index$_{st-1}$	211.839 (73.629)***	383.753 (164.768)**	-33.478 (178.941)	-401.071 (665.638)
Industry peripherality$_{srt-1}$	0.268 (0.196)	0.593 (0.442)	-0.574 (0.323)*	-1.409 (0.855)
Industry peripherality$_{srt-1}$ * EG index$_{st-1}$	-2.966 (0.888)***	-5.441 (1.685)***	-0.031 (1.985)	4.752 (6.832)
Offer characteristics	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes
Observations	2,147	876	2,122	699
R-squared	0.91	0.91	0.90	0.91

Note: Robust standard errors, clustered at the 5-digit industry level in parentheses. ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 5.
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

As a final robustness check on both Prediction 4 and Prediction 5, in Table 9 we split the sample of applications to the English regions according to a measure of the extent to

[24] The programme was not actively marketed to firms in specific targeted sectors or geographic areas, as EU rules stipulated that such policies must be available equally across eligible sectors.

which the TTWA in which the application is made is specialised in the respective industry, measured in year t-1.[25] We again consider separately grant applications that involve some job safeguarding and must therefore be made by incumbent plants in decline. The results suggest that the more generous behaviour on the part of the policy authorities is confined to cases where the area is relatively specialised in the industry and is stronger in the case of applications that are to safeguard existing jobs. Hence these results further support Predictions 4 and 5 associated with models of policy capture.

5. Conclusions

We exploit plant-level administrative data on a regional investment subsidy programme in Great Britain to study policy responses to the presence of localisation economies, pitting the predictions of economic geography models against those of models of policy capture. We find that, conditional on the amount applied for by firms, governments offer more generous subsidies in more agglomerated industries in areas with a higher density of industry employment. This phenomenon is most pronounced for sub-national awarding jurisdictions, for applications aimed at safeguarding existing jobs, and for applications in areas where employment in the respective industry is in relative decline. Taken together, these results are in line with theories of policy capture by predominant incumbent local industries, and they run against the "taxable agglomeration rents" result of economic geography models.

On the face of it, our finding that subsidies offered by lower-tier authorities are more generous in areas that host the industry's agglomeration is consistent with another explanation: local jurisdictions could be using subsidies to attract plants that might themselves generate significant agglomeration externalities for the area, and such external benefits could be more pronounced in locations that are already relatively specialised in an applicant's industry (Greenstone *et al.*, 2010; Moretti, 2010). However, we consider this an improbable explanation for the pattern of grant offers we observe. First, agglomeration benefits running from applicant plants to firms in the surrounding area (rather than the other way around) are likely to be an issue only for relatively large projects. This plausibly holds in the case of the "million dollar plants" studied by Greenstone *et al.*, (2010), but not in our

[25] We measure specialisation by: (employment_{srt} / employment_{rt})/ (employment_{st} / employment_{t}), where *s*, *r* and *t* are 5-digit industry, TTWA and year, respectively.

policy setting, where the projects at stake are some two orders of magnitude smaller.[26] Second, we find that these more generous offers are made to incumbent plants applying to safeguard existing jobs but not to entrants creating new jobs. This asymmetric treatment by policy authorities cannot be readily explained by a model with agglomeration effects.

Our results are reminiscent of prior findings whereby subsidy policies ostensibly targeted at growth sectors in fact are geared heavily towards industries and regions in relative decline (Beason and Weinstein, 2005; Martin, Mayer and Mayneris, 2011), and they support the view that the optimal degree of fiscal decentralisation is contingent on the extent to which policy may be subject to capture by dominant entrenched local interests (Bardhan, 2002). To our knowledge, no formal model exists that combines firm-level agglomeration economies with lobbying and fiscal federalism. This could offer a fruitful opening for future research.

[26] The average plant in Greenstone *et al*. (2010, p. 555) accounted for close to three million labour hours, which translates into some 1,600 full-time jobs, whereas in our sample the average grant was associated with an estimated 20 new or 14 safeguarded jobs (see Table 1).

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Appendix: Matching firm-level datasets

We use information provided by the UK Department of Trade and Industry (DTI) to link the RSA and Enterprise Grant applicants to the ARD data. The DTI have matched the grants data to the Inter-Departmental Business Register (IDBR) which is the population underlying the ARD using information including postcodes and company names.

We restrict our analysis to applications to the manufacturing sector between 1985 and 2004 and also to applications which received an offer and were not withdrawn. We therefore begin with data on 21,761 applications. Matching information is provided for 17,815 (or 82%). However, the grants data can be matched into the ARD data at various levels of aggregation; for example directly to single site plants, to establishments (that in principle can comprise more than one plant under common ownership at different locations), or at the firm level, which means that the grant application is matched to all plants within the firm (which can total over 100 sites). In some cases, applications are also matched to multiple plants or establishments, i.e. are not unique. Because the precise location of the site associated with the application is an important factor in our analysis, we restrict our main estimation sample to applicants where the match is at the plant or establishment level (the latter may comprise plants at more than one site, but they should be operating in the same industry, and we use the modal location (TTWA) of plants within the establishment).

This leaves a set of 11,359 potential grant applications over the period 1985 to 2004 to be matched, of which we are able to match around 9,581 (84%) into unique plants or establishments in the ARD data between 1984 and 2006.[27] We then restrict our analysis to matches within three years of the application date leaving 6,377 applications. We are unable to use the 1984 matches in our estimates, as lagged values of our location-specific variables are unavailable. Once missing data, for example on jobs associated with the application or offer, are accounted for, and the top and bottom percent of observations by grant value are eliminated (due to implausible outlier values), our final sample comprises 5,953 applications.

[27] We also ran a probit model to check that there was no systematic relationship between the probability of matching a grant and the value of the EG index for the respective industry. Conditional on two-digit industry, region and year dummies, the coefficient (standard error) on the EG index was -0.380 (0.320). Hence, the probability of a match does not appear to be related in a systematic way to the agglomeration intensity of a sector.

Appendix Tables

Appendix Table A1. Dummy variables for percentiles of EG index top 5%, 10%, 25%, 50%. SUR application and offer

Dependent variable:	**(1)**		**(2)**		**(3)**	
	Application	**Offer**	**Application**	**Offer**	**Application**	**Offer**
EG Top 10%tile	8.712	-4.229				
	(13.053)	(11.598)				
EG Top 25%tile			18.875	12.756		
			(9.879)*	(8.780)		
EG Top 50%tile					28.487	23.825
					(8.920)***	(7.925)***
Application / Offer characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,953	5,953	5,953	5,953	5,953	5,953
R-squared	0.63	0.62	0.63	0.62	0.63	0.62
Test statistics						
Equality of EG Index $_{st-1}$ coefficients	chi2(1) = 1.66		chi2(1) = 0.65		chi2(1) = 0.46	
	Prob > chi2 = 0.1980		Prob > chi2 = 0.4214		Prob > chi2 = 0.4976	

Note: ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 3 specification (2).
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS).

Appendix Table A2. Alternative measures of distance from industry employment: SUR application and offer

Dependent variable:	(1)		(2)		(3)	
	Application	**Offer**	**Application**	**Offer**	**Application**	**Offer**
EG Index$_{st-1}$	125.082	98.496	104.334	59.855	256.297	156.434
	(224.035)	(199.134)	(191.659)	(70.374)	(132.701)*	118.015
Industry peripherality$_{srt-1}$ (50km)	-1.406	-1.155				
	(0.477)***	(0.424)***				
Industry peripherality$_{srt-1}$ (100km)			-1.428	-1.192		
			(0.387)***	(0.344)***		
Distance squared weighted sum of percentage industry employment across TTWAs					-0.0005	-0.0002
					(0.0002)***	(0.0002)
Interaction: EG Index$_{st-1}$* Industry distance measure	-0.394	-0.960	0.265	-0.121	-0.001	-0.001
	(2.923)	(2.598)	(2.712)	(2.411)	(0.002)	(0.002)
Application / Offer characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Industry characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Area characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Application year dummies	Yes	Yes	Yes	Yes	Yes	Yes
2-digit industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Policy authority dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,953	5,953	5,953	5,953	5,953	5,953
R-squared	0.63	0.62	0.63	0.62	0.63	0.62
Test statistics						
Equality of EG Index $_{st-1}$ coefficients	chi2(1) = 0.02		chi2(1) = 0.09		chi2(1) = 0.95	
	Prob > chi2 = 0.8776		Prob > chi2 = 0.7632		Prob > chi2 = 0.3285	
Equality of industry distance measure coefficients	chi2(1) = 0.47		chi2(1) = 0.62		chi2(1) = 7.06	
	Prob > chi2 = 0.4943		Prob > chi2 = 0.4304		Prob > chi2 = 0.0079	
Equality of interaction coefficients	chi2(1) = 0.06		chi2(1) = 0.03		chi2(1) = 0.33	
	Prob > chi2 = 0.8014		Prob > chi2 = 0.8535		Prob > chi2 = 0.5669	

Note: ***, **, * significant at the 1%, 5%, 10% level. All regressions contain a constant (not reported). Offer, Firm, Industry and Area characteristics as in Table 3 specification (4).
Source: authors' calculations using ARD (Source ONS) and RSA, Enterprise Grant data (source BIS)