ONLINE APPENDIX TO[1]
"Some causal effects of an industrial policy" by Chiara Criscuolo, Ralf Martin, Henry G. Overman and John Van Reenen

APPENDIX A: MORE DETAILS OF THE RSA POLICY

During the period of our study, Regional Selective Assistance (RSA) was the main business support scheme in the UK.[2] Since the early 1970s, RSA provided discretionary investment grants to firms in disadvantaged regions typically characterized by relatively low levels of per capita GDP, high unemployment and general labor market weaknesses ("Assisted Areas").[3] It was designed to "create and safeguard employment". Assistance could be provided to establish a new business, to expand, modernize or rationalize an existing business, to set up research and development facilities or to move from development to production.

Because RSA had the potential to distort competition and trade between European countries, it had to comply with European Union (EU) legislation concerning state aid. Except in certain cases European law prohibits this type of assistance. Article 87(3) of the Treaty of Amsterdam (formerly Article 92(3) of the Treaty of Rome) allows for state aid in support of the EU's regional development objectives. The guidelines designate very deprived "Tier 1 Areas" (formerly, "Development Areas") in which higher rates of grant can be offered and somewhat less deprived "Tier 2 Areas" (formerly, "Intermediate Areas") where lower rates of investment subsidy were offered.[4] There is an upper threshold of support called maximum Net Grant Equivalent (NGE)[5] that essentially sets a maximum proportion of the firm's investment that can be subsidized by the government.

Since the main formulae that determine eligibility are decided periodically at the European level, and not at the Member State level, this mitigates concerns of endogeneity of policy decisions to a local area. In addition, although the UK government has latitude to decide the overall amount of the annual budget for RSA, it must stick to the EU rules when deciding which areas are eligible to receive RSA. Thus, changes to area-level eligibility are the key form of identification in our paper.

A.1 Changes in eligibility over time

The map of the areas eligible for RSA changes about once every seven years.[6] The maps were changed in 1984, 1993, 2000 and 2006. In the paper, we focus on the 2000 change because we could not (despite extensive investigation) discover the exact variables used in determining area eligibility in 1984 and previous years. Without this, we could not construct the rules change IV for the 1993 change, although we do show OLS results over the longer 1986-2004 period for manufacturing employment. There were changes in the way that the SAMIS

[1] All notation is consistent within Appendices, but some Greek symbols are used to refer to different objects between Appendices.

[2] We discuss our choice of study period below. According to Harris and Robinson (2005), in 1998/9 RSA represented 19% of the UK's industrial policy spending.

[3] In April 2004, in England, the RSA scheme was rebranded as the "Selective Finance for Investment Scheme" and then "Grants for Business Investment". It is still called RSA in Scotland and Wales. Productivity became an official objective with the move from RSA to Selective Finance for Investment and remains an objective of Grant for Business Investment.

[4] Article 87 of the Treaty of Amsterdam supersedes Article 93 of the Treaty of Rome which had previously governed State Aid. Article 87(3) of the Treaty of Amsterdam defines conditions where State aid may be compatible with EU laws. Article 87(3) (a) allows for "aid to promote the economic development of areas where the standard of living is abnormally low or where there is serious underemployment" [Tier 1 or Development Areas] and Article 87(3) (c) allows for: "aid to facilitate the development of economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest." [Tier 2 or Intermediate Areas] Additional restrictions apply to sectors with over-capacity: motor vehicles, synthetic fibres and yarns, iron and steel, coal, fishery and agricultural products.

[5] The Net Grant Equivalent (NGE) of aid is the benefit accruing to the recipient from the grant after payment of taxes on company profits. RSA grants must be entered in the accounts as income and are made subject to tax. Details for calculations of NGEs are available in the Commission's Official Journal C74/19 10.03.1998.

[6] Note that this happens in conjunction with the periodic revision of the Structural Funds, the EU's main policy for supporting economic development in less prosperous regions. Although the maps are different for RSA and Structural Funds, it is a potentially confounding influence that we consider carefully as discussed in the main text (subsection V.B)

administrative data were gathered after 2004, so we end our sample period in 2004 and cannot easily use the 2006 change. We begin the regression analysis in 1997 for two reasons. First, unemployment data is unavailable on a consistent basis at the ward level before this year. Second, the electronic business register (the IDBR administrative data – see Online Appendix C and main text) was introduced in 1994 and the first few years have reliability concerns. The data is comprehensive since 1997. Nevertheless, our results are broadly robust to beginning the analysis in earlier years than 1997 (for example, see Online Appendix Tables A7 and A11).

The map of the eligible areas is determined by using a series of quantitative indicators. The level of GDP per capita, unemployment and population density are key indicators that have been used in all years. A series of additional indicators is also used, and the EU determines what these are and what years are used for their values – these are detailed in Online Appendix Table A2. The eligibility criteria are outlined in guidelines that are published before the implementation of the map (in our case 1998). The UK government will then gather quantitative information on indicators at the relevant area level and will propose a new map that has to be approved by the EU. The changes before and after 2000 is shown in Figure 1 and Criscuolo et al (2006) shows the map changes at other points in time.

(a) The 1993 change

The assisted area map for RSA was re-drawn in 1993 based on the 1988 guidelines using "Travel to Work Areas" as the underlying spatial units.[7] The Assisted Areas fell into two categories: (a) Development Areas (later called Tier 1) where aid could be granted up to a maximum of 30% NGE (Net Grant Equivalent - see above) and (b) Intermediate Areas (later called Tier 2) where aid was limited to 20% NGE. The new 1993 maps implied a net reduction in the number of assisted areas with Development Areas covering 17%, and Intermediate Areas covering 19%, of the total UK population.

(b) The change in 2000

The EU Commission introduced new guidelines for State Aid in 1998, and the UK responded to that with the introduction of a new Assisted Area map in 2000. The number of indicators rose from eight in 1993 to nine in 2000. The most disadvantaged areas were re-named "Tier 1" - Cornwall and the Isles of Scilly, Merseyside, South Yorkshire and West Wales and the Valleys. The maximum investment subsidy allowed in these areas was 35% NGE. "Tier 2" areas were more scattered and were constructed based on groups of electoral wards.[8] Within Tier 2 areas, the map identified four sub-tier areas eligible for different level of maximum NGE: 30%, 20%, 15% or 10%.

A.2 Formal criteria for receipt of RSA

During our study period (1997-2004), RSA targeted manufacturing sectors. The grants were discretionary, and firms could only apply if the supported project satisfied the following criteria. (a) *Location*: The project had to be undertaken in an Assisted Area. (b) *Investment*: It had to involve capital expenditure on property, plant or machinery; (c) *Jobs*: It should normally have been expected to lead to the creation of new employment or directly protect jobs of existing workers which would otherwise have been lost; (d) *Viability*: The project should be viable and should help the business become more competitive; (e) *Need*: The applicant had to demonstrate that assistance was necessary for the project to proceed as envisaged in terms of nature, scale, timing or location;[9] (f) *Prior Commitments*: As RSA could only be offered when the project could not proceed without it, the Department of Business (BIS) must have completed its appraisal and issued a formal offer of assistance before the applicant entered into any commitment to proceed with the project; (g) *Other Funding*: The greater part of the funding for the project should be met by the applicant or other sources in the private sector. Note that location, which forms the basis for our instrumental variables, is objective, clearly defined and enforceable.

The process for application was as follows. Firms completed an application form, in which they needed to prove additionality, to provide business plans, accounts and reasons for wanting the grant. They then submitted this to the local office of the Department of Business. During the period analyzed, the lag between submission and decision was normally between 35 and 60 days for standard grants, and 100 days or more for grants above £2 million. The lag depended on the amount applied for, the time needed to ensure that all the criteria were met and

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[7] Travel to Work Areas (TTWA) are defined by the UK Office for National Statistics. The fundamental criterion is that, of the resident economically active population, at least 75% work in the area, and that of everyone working in the area; at least 75% live in the area.

[8] The data used for the boundaries come from the 1991 Census of Population. A detailed list of the assisted wards by local authority within regions and the NGEs to which they are eligible is available upon request.

[9] This may be to meet a funding gap, to reduce the risks associated with the project, or to influence the choice of location of a mobile project. It might also be to obtain parent company approval by meeting established investment criteria; or for some other acceptable reason. Each case is considered on its own merits.

on negotiations between the government agency and the firm. If the application was successful, the firm was paid the minimum necessary to get the project going. Additional payments started only after jobs were created/safeguarded and capital expenditure defrayed and were based on agreed targets. The payments were given in instalments – between two and seven and usually spread across more than one financial year. The government agency monitored the project with visits (normally one per year, but more frequently for risky projects).

APPENDIX B: THE ROLE OF CHANGES IN THE CRITERIA IN DETERMINING ELIGIBILITY FOR RSA

As noted in the main text, to deal with the issue that areas may be endogenously selected into being eligible for investment subsidies we use an instrument based on the probability that an area is assigned, based solely on the EU wide rule changes rather than changing area characteristics. There are two practical issues in implementing this IV. First, although the elements of the *X* vector determining eligibility for different subsidy levels are known, the exact policy parameters that determine eligibility are not. A second issue is that the maximum subsidy differs in the eligible areas according to the severity of disadvantage. For example, after 2000 an area could fall into several categories with a maximum support share of 10%, 15%, 20%, 30% or 35% percent. Before 2000, there were two maximum support categories: 20% and 30%.

We proceed by defining a latent variable $s^*_{r,\tau}$ for area r and the two time-periods τ which captures how the European Commission determines how disadvantaged an area is. The threshold cut-offs will determine which of the different maximum support level categories (NGEs) an area is to be placed in. In 2000 and after there are six bins (including zero) and before 2000, there were three bins. We keep to the same notation as in the main text in Section III, even though for simplicity there we discussed this issue in terms of a binary outcome, whereas now we are using the fact that we have multiple categories.

To construct instruments that are only driven by changes in the rules rather than changes in area conditions during the period we run two ordered probit regressions for the pre and post 2000 periods. Our vector of area characteristics $X_{r,93}$ includes all variables that were used by the EU for deciding about support status in the pre-2000 and post-2000 periods. However, we only estimate using values of the *X* variables dated prior to 1993 as used in 1993 rule change (in fact, given the lag structure used by the EU, the most recently date considered is 1991 – see Online Appendix Table A2). This is because using values dated after 1993 could potentially be endogenous (recall equation (5) in the main text). This makes the estimates of the policy rule less precise, but so long as there is sufficient power in the first stage then the instruments will be valid.

Formally, the model is:

$$s^*_{r,\tau} = \theta_\tau X_{r,93} + \varepsilon_{r,\tau} \quad \text{where } \tau = \{93,00\}$$

Where $s^*_{r,\tau}$ are the latent variables of "disadvantage" in area *r* at time τ; and there are threshold parameters, $\mu_{j(\tau),\tau}$ that will determine which subsidy regime *j* an area falls into. For example, in 1993, the ordered probit structure is that the observed $s_{r,93} = 0$ if $s^*_{r,93} \le \mu_{0,93}$, $s_{r,93} = 1$ if $\mu_{0,93} < s^*_{r,93} \le \mu_{1,93}$, and $s_{r,93} = 2$ if $s^*_{r,93} > \mu_{1,93}$. The observed bins correspond to different levels of maximum subsidy, $c_{j,\tau}$ where $j = 1, ..., J$ is an indicator for a bin. So in 1993 $c_{0,93} = 0, c_{1,93} = 0.2$ and $c_{2,93} = 0.3$. Denote the full parameter vector $\theta_\tau = \{\theta_{1,\tau}, \mu_{j,\tau}\}$,which are the "weights" and the "thresholds" respectively.

We report results from the estimation of the ordered probits in Table 3. The signs generally look broadly sensible (with the caveat that these are not marginal effects). For example, areas with higher GDP per person, lower labor force activity rates, lower population densities and higher long-duration unemployment are more likely to be high investment subsidy areas.

From these ordered probit estimates we obtain the predicted probabilities $\hat{P}_{j,r,\tau}$ of falling into each bin in each year for each area given their observables $X_{r,93}$ and the estimated parameters $\hat{\theta}_\tau$. We then create the predicted level of subsidy as:

$$z_{r,\tau} = \begin{cases} \sum_j c_{j,00} \hat{P}_{j,r,00} & if\ \tau = 2000 \\ \sum_j c_{j,93} \hat{P}_{j,r,93} & if\ \tau = 1993 \end{cases}$$

This specification has the advantage that we can interpret reduced form coefficients in a similar way as regressions of the actual support status (NGE). The IV we use in our baseline specifications is the change in this, $\Delta z_{r,\tau}$, the change in the predicted level of the maximum investment subsidy in the area. The distribution of the levels and changes of $z_{r,\tau}$ are in Figures A1 and A2.

We experimented with many other ways of constructing the IV to make sure that nothing hinges on modelling details and our results are robust. For example, in Online Appendix Table A18 we report our main results using instruments constructed from predictions of a linear probability model of the NGE values rather than the ordered probit of NGE categories. We also estimated models using ordered logit as well as simple logit and probit specifications on the binary event of a non-zero NGE value in an area.

APPENDIX C: MORE DETAILS ON DATA, MATCHING AND PRODUCTIVITY CALCULATION

C.1 The Datasets

We use administrative data on RSA program participants (SAMIS) with data from the Interdepartmental Business Register (IDBR), which contains both the names of the businesses and the identification numbers used by the Office for National Statistics (ONS) to conduct the Annual Business Inquiry (ABI).[10] The IDBR is a list of all businesses in the UK, their addresses, type of activity and ownership structure. The list is compiled using a combination of tax records, accounting information (every UK firm must lodge some information at Companies House). The smallest unit in the IDBR is a site that contains name, address and information on the number of employees and industry. We also know the enterprise (firm) that owns the site and whether this is part of a larger group ("enterprise group"). Investigation showed that some of the most micro-units (the sites identifiers) are not reliable over time; we grouped all sites of a firm in a Ward into a single "local unit" which we refer to as a "plant" in the text.

A stratified random sample of enterprises is drawn every year from the IDBR to form the sampling frame for the ABI (Annual Business Inquiry), the mandatory annual survey of UK businesses. Data from the ABI is made available to researchers in the form of the ARD (Annual Respondents Database), which provides information on output, investment, intermediate inputs, employment, wages, etc.[11] The ARD is similar to the US Annual Survey of Manufacturing (ASM) with the caveat it covers all sectors (not just manufacturing) and is at a higher level of aggregation than the plant-level ASM. Not only is the ARD a sub-sample of the population IDBR, but the information is reported at a more aggregated level across the entire firm ("reporting unit"), rather than at the plant ("local unit") level. For example, a firm with two 10 workers plants in two different wards will have only total employment reported in the ARD (20 workers), whereas the IDBR will identify both local units. Note that in about 80% of all cases a firm is single plant and located entirely at a single address.

The upshot is that whereas employment can be matched exactly to an area, so we can analyze at whatever level we like (e.g. plant, firm or ward); the analysis of investment and productivity for a representative sample can only be accurately conducted at the firm level, and not a lower level. Note that the ARD contains the population of larger businesses (those over 100 or 250 employees depending on the exact year) and accounts for around 90% of total UK manufacturing employment.

C2. Matching Datasets

Since the performance data comes from sources unrelated to program participation, several problems arise in matching. The Department of Business uses name and postcodes from its administrative SAMIS data to match a list of participants and applicants to the population IDBR. This matching may occur at the plant-level or the firm level. Often a firm will apply for funding; so that we cannot know for sure whether a plant has benefitted from RSA receipt (although for the 80% of single-firm plants there is never an ambiguity). Thus, one measure of program participation is simply whether a plant was in a firm that received any RSA (which we can always define

[10] The IDBR was introduced between 1994 and 1995. Previously, that sampling was based on a Business Register maintained by the Office of National Statistics.

[11] Stratification is broadly based on industry affiliation, regional location and size. For details, see Criscuolo et al. (2003).

precisely). For a small number of cases, the same SAMIS identifier could match to multiple IDBR firms. In these cases we aggregated the IDBR firms together, but we checked the results were robust to dropping these few cases (they were). The ARD is a strict sub-set of the IDBR, so the issues discussed above apply in the same way to this dataset.

The SAMIS database has information on 54,322 program applications and whether the application was successful. Applicant numbers declined in the 2000s as the total budget for RSA fell. Using name, postcode and CRN numbers, the information in BIS files was linked to the IDBR over the whole period. The matching rate was 82% over the sample period (1997-2004).

There is a variety of reasons for non-matches. The most common reason is that the information on the SAMIS database of RSA participants is inadequately detailed to form a reliable match to the IDBR. It is also possible that the IDBR misses some of the smaller and shorter-lived firms who receive RSA. To check biases arising from matching we conducted a detailed comparison of the characteristics of projects and project participants of firms that BIS matched with IDBR relative to all the projects in the SAMIS database. The analysis shows that the set of "IDBR matches" do not significantly differ from the rest of the projects in the database on observed characteristics, and this is the case for both unsuccessful and successful applications. The variables we considered in the regression were application amounts; headquarter location, a dichotomous variable that is one if the application was handled by the London office of BIS, foreign owned, and a BIS code that seeks to identify "internationally mobile" jobs. More details are available from the authors and in Criscuolo et al (2006).

The area level average subsidy rates used in Table 5 are generated from aggregating up all subsidies granted to plants in ward in the two periods (1997-1999 and 2000-2004) and then dividing by the number of years in each sub-period.

C.3 Firm Size Definition

In some of the analysis, we split by firm size (e.g. Table 10). To mitigate endogeneity concerns we use firm size as measured by employment in a base period, for which we choose 1996, the year before our estimation period. For all plants belonging to a firm who were not alive in 1996 we use the year of birth to determine the size class and exclude data from the first year in our regressions of employment. We also experimented with dropping post-1996 entrants, which led to very similar results.

C.4 TFP (Total Factor Productivity) measures

There are numerous ways to obtain a TFP measure, a subject of ongoing debate in the literature (see inter alia Olley and Pakes, 1996 and Ackerberg et al, 2015). The results in Panel E of Table 11 are based on a simple "factor share" method and relative to an industry by year average. We define $TFP_{it} = \tau_{it} - \bar{\tau}_{I(i)t}$ where $\tau_{it} = r_{it} - \bar{S}_{MI(i)t} m_{it} - \bar{S}_{LI(i)t} l_{it} - \left(1 - \bar{S}_{MI(i)t} - \bar{S}_{LI(i)t}\right) k_{it}$. In this expression r_{it} is ln(firm revenue) for firm i in period t, m_{it} is ln(materials), l_{it} is ln(employment) and k_{it} is ln(capital). $\bar{S}_{MI(i)t}$ is the share of materials in revenues in the four-digit industry and $\bar{S}_{LI(i)t}$ is the share of labor costs in revenues at the industry level. $\bar{\tau}_{I(i)t}$ is the average value for τ_{it} in year t in the four digit industry.

We also considered alternative ways of computing TFP (see Online Appendix Table A16). Firstly, we consider a "regression-based" method where we use ln(revenues) as the dependent variables and include on the right-hand side in addition to treatment controls ln(labor), ln(materials) and ln(capital). Secondly, we consider a more structural production function estimation approach as proposed in Martin (2012) which takes into account firm specific variation in market power when computing TFP. This requires running the following (first stage) regression: $\Xi_{it} = \beta_k k_{it} + \rho(\Xi_{it-1} - \beta_k k_{it-1}) + \nu_{it}$ where $\Xi_{it} = \frac{r_{it} - S_{Mit}(m_{it} - k_{it}) - S_{Lit}(l_{it} - k_{it})}{S_{Mit}}$ and S_{Mit}, S_{Lit} are the variable factor shares at the firm level. From this we can estimate a productivity index as $TFPMUOMEGA = \frac{\Xi_{it} - \hat{\beta}_k k_{it}}{\hat{\beta}_k}$.

APPENDIX D: AGGREGATING ACROSS SPATIAL UNITS

We consider the aggregation from lower (wards) to higher levels area (Travel to Work Areas) as discussed in subsection V.C. For simplicity consider the set-up of a single Travel to Work Area (TTWA, denoted a, consisting of two wards r and r' and consider two periods t = 0 and t = 1. It is straightforward to generalize this to multiple-ward TTWAs (we do this in the empirical application). Suppose we know that as a consequence of the program in period 1, ward r experiences a change of employment of α_r log points whereas ward r' experiences a change of $\alpha_{r'}$ log points; i.e. $\ln L_{r,1} - \ln L_{r,0} = \alpha_r$ and similarly for ward r'.

We are interested in what will be the effect of the policy on total employment at the higher TTWA level. We can write TTWA employment as the sum of the two wards: $L_{a,t} = L_{r,t} + L_{r',t}$. Hence the logarithmic change in employment is:

$$\ln L_{a,1} - \ln L_{a,0} = \ln[e^{\alpha_r} w_r + e^{\alpha_{r'}}(1 - w_r)] \tag{D1}$$

where $w_r = \frac{L_{r,0}}{L_{r,0}+L_{r',0}}$ is the share of employment in Ward 1 in period 0. Re-write equation (D1) as:

$$\ln[e^{\alpha_r} w_r + e^{\alpha_{r'}}(1 - w_r)] = \alpha_{r'} + \ln[(e^{\alpha_r - \alpha_{r'}} - 1)w_r + 1] = \nu_1 + \alpha_{r'} + (e^{\alpha_r - \alpha_{r'}} - 1)w_r$$

Where ν_1 is an approximation error that is small for values of $(e^{\alpha_r - \alpha_{r'}} - 1)w_r$ close to zero. Similarly note that $(e^{\alpha_r - \alpha_{r'}} - 1) = \nu_2 + \ln[(e^{\alpha_r - \alpha_r'} - 1) + 1] = \nu_2 + \alpha_r - \alpha_{r'}$ for $(e^{\alpha_r - \alpha_{r'}} - 1)$ close to zero and where ν_2 is another approximation error.[12] Consequently, we can write the change in TTWA employment as:

$$\ln L_{a,1} - \ln L_{a,1} \approx \alpha_{r'} + (\alpha_r - \alpha_{r'})w_r = w_r \alpha_r + (1 - w_r)\alpha_{r'} \tag{D2}$$

In other words: the percentage TTWA level change is approximately the percentage change in each ward weighed with the employment share of each ward.

This allows us to examine the case of negative spillovers as well. Suppose region r experiences an increase in support $\Delta NGE_r > 0$ but there is no change in ward r'. This leads to a positive effect of $\alpha_r = \beta \Delta NGE_r$ in region r at the expense of a possible negative spillover of $\alpha_r = -\chi \Delta NGE_r$ in region r'. For the aggregate TTWA we would consequently expect the effect on employment to be:

$$\alpha_a = w_r \lambda_1 \Delta NGE_r - (1 - w_r)\chi \Delta NGE_r$$

Indeed, in the case where the policy simply shifts jobs from one ward region to the other we would expect

$$\chi = \lambda_1 \frac{w_r}{1 - w_r}$$

i.e. if r' is smaller than r, χ would be bigger than β. On the other hand, if we assume that there are no spillovers equation (D2) becomes

$$\ln L_{a,1} - \ln L_{a,0} \approx \alpha_a = \lambda_1 \Delta NGE_a \tag{D3}$$

where $NGE_a = \sum_r w_r NGE_r$. This implies that if we regress (changes) in TTWA ln(employment) on the employment weighted share of area level NGE changes we would expect to recover comparable impact estimates as we did when running ward level regressions on (changes) in NGE. By contrast, if there are negative spillovers we expect a coefficient smaller than λ_1 when running a regression as implied in equation (D3). We would also expect some bias towards zero because of the approximation error implied in equation (D3). In our empirical estimates at the TTWA level in Table 8, we find treatment effects that look (if anything) larger than the ward level β estimates in Table 4. This leads us to the conclusion that negative spillovers are not a major issue of concern in our application.

APPENDIX E: OTHER PLACE-BASED POLICIES

Our identification strategy uses exogenous policy rule changes that determine which wards are "randomized in" to be eligible (or ineligible) for RSA support. The exogenous policy rule change that we use stems from the change in the UK assisted area map drawn up to comply with revised EU regulation. One potential threat to identification is the existence of other regional policies that use geographical areas to determine eligibility and experience similar changes in eligibility at around the same time as the rules for RSA eligibility change. If such policies exist, then they may cause us to over-estimate the effect of RSA eligibility if these other policies positively affect RSA-

[12] Note that the two errors go in opposite directions with the first one overestimating and the second one underestimating the true figure. The second error is also likely larger so that on net we are underestimating the true figure. Simulations of the errors suggest that these are under 5%.

eligible areas. In this Appendix, we consider a wide range of place-based policies and discuss whether they raise concerns and, if so, how we address these in the paper. Broadly, there appears to be only one policy – the Regional Development Fund aspects of EU Structural Funds – that is potentially problematic as it has both cross-area variation and rules that changed at the same time as RSA.[13]

E.I EU Structural Funds (SF)

The change in the Assisted Areas map for RSA in 2000 coincides with several changes to the EU "Structural Funds (SF)." SF are important instruments for delivering EU regional policy mainly through infrastructure spending. Total SF spending is higher than RSA, although the direct SF grants to business are an order of magnitude smaller than RSA. For example, in 1997 the total amount of RSA grants accepted was £158.3 million while the total amount of SF Regional Development was £621 million (House of Commons, 2000), only £15.6 million of this were Funds for business grants (1997 Annual Report of the Industrial Development Act).

Our data cover two program periods 1997-1999 and 2000-2004. In the earlier period, the EU Structural Funds were organized around "objectives." Broadly, only Objectives 1 and 2 really matter for us.[14] Objective 1 is targeted at the poorest regions. Objective 2 regions are less poor but suffer from high unemployment and/or have high shares of employment in declining industries. Objective 1 accounts for about 70% of all SF spending, whereas Objective 2 accounts for only 11%.

The rules for eligibility for Objective 1 were very similar in both periods - a region must have a GDP per capita that is below 75% of the EU average.[15] Objective 1 is defined on the NUTS2 geographical areas whereas Objective 2 is defined on smaller units. [16] A number of criteria were used to determine eligibility for Objective 2 that were similar to RSA such as the unemployment rate, the percentage share of manufacturing jobs; falls in employment and the fraction of skilled workers. The reference year for which these were taken were sometimes different from RSA, however.[17] One factor determining eligibility for Objective 2 SF that did not determine RSA were local crime rates, and we include these variables (robberies, burglaries and drug crimes) when predicting which areas were eligible for SF.

Since the maps for SF and RSA eligibility change at the same time and both are aimed at disadvantaged areas, a concern is that the RSA effect may be confounded by the effects of SF. We can observe the maps of eligibility for SF and RSA and, in fact there are many differences. There are several reasons for these differences. First, the exact weights given to different variables in the policy rule are not the same for RSA and SF. Second, the "reference year" used to define the variables is different. Third, the level of aggregation used to determine eligibility also differs. Fourth, and perhaps most importantly, the variables that enter the policy rules for RSA and SF are not all the same. Crime rates enter the policy rule for SF but not RSA. Similarly, although the structural unemployment, the activity rate, the long-term unemployment rate and the start-up rate of new businesses affect whether an area is eligible for RSA at various points of time, they are never in the list of variables that determine SF eligibility.

For example, GDP per capita is a key component for eligibility to Objective 1 SF support and the highest investment subsidy rates of RSA (i.e. a "Development Area" or Tier 1 area). Indeed, the maps for eligibility are identical 2000-2006 (NUTS2 areas of Cornwall and the Isles of Scilly; Merseyside; South Yorkshire; West Wales and the Welsh Valleys). However, in the 1993-99 period the two maps differ significantly. The RSA Development Areas comprise 123 Travel-To-Work Areas (TTWAs) or parts of such areas. In addition, the only two regions eligible to Objective 1 support over this period were Merseyside and the Highlands and Islands.[18] This is mainly because of a different level of aggregation used to determine RSA compared to SF.

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[13] The bulk of EU transfers to the UK are towards agriculture via the Common Agricultural Policy. Structural Funds also include an Agricultural Guidance Fund and a Social Fund (that does not have an explicit regional component). Since these are not very relevant for a place-based industrial policy like RSA, we simply refer to the Regional Development Fund aspect of SF as "Structural Funds" for brevity in what follows.

[14] Objectives 3 and 4 were not spatially targeted at particular types of region so are not a threat to identification of RSA. Objective 5 was subsumed into Objective 2 after 2000.

[15] Calculations are based on three-year averages: 1989-1991 for the early period and 1994-1996 for the post-2000 period.

[16] To give a better idea of the size of these territorial units consider that in the UK there are 37 NUTS 2, each covering between 800,000 and 3,000,000 inhabitants and 133 NUTS 3, each covering between 150,000 and 800,000 inhabitants. The equivalent in the US could be municipalities or city/county/authorities. Note that the geography used for eligibility to RSA are "wards" (NUTS 5) with an average population of about 6,600 people.

[17] For example, for manufacturing share the reference year was 1975 for the 1993-1999 period and 1985 for the 2000-2006 period.

[18] For example, while Cornwall was not eligible to Objective 1 status; TTWAs such as Penzance and St. Ives or Newquay were Development Areas. Similarly, no part of Wales was eligible to Objective 1 aside from part of Blaenau Gwent and Abergavenny; Thanet and South Pembrokeshire are Development Areas.

Online Appendix Table A3 presents the degree of overlap in eligibility for RSA and SF over time to illustrate the amounts of non-overlap. Row 1 shows that out of 10,737 wards, 2,424 (22.6%) were eligible for both SF and RSA over the 1993-99 period. Of these, 1,743 (71.9%) continued to be eligible for both policies after 2000. 681 wards (28.1%) lost eligibility for RSA but maintained eligibility for SF (none of these wards lost eligibility for SF or lost eligibility for both types of support). Similarly, rows 2 and 3 look at changes in eligibility over time of wards that pre-2000 were eligible for only one type of support (RSA in row 2 and SF in row 3). The last row shows that most wards (6,602 or 61.5% of the population) were ineligible for both policies pre-2000. Of these 3% subsequently became eligible for both types of support; and 2% for RSA only with the majority (95%) remaining ineligible for both.

Since there may be unobservables that determine whether an area becomes eligible for SF this can create endogeneity issues. We can exploit the same identification strategies we use for RSA for SF to deal with this problem. Although some of the criteria determining SF are the same as RSA, many are different. For example, crime variables affect whether an area is eligible for SF, they do not appear in the criteria determining RSA eligibility. Similarly, structural unemployment, the activity rate, the long-term unemployment rate and the start-up rate of new businesses affect whether an area is eligible for RSA, they are not in the list of variables that determine SF eligibility. Hence, analogously to Table 3 we estimate a model where the dependent variable is whether an area is eligible for SF in Online Appendix Table A4 separately for the earlier period (1993) and later period (2000). The coefficients generally look sensibly signed: areas with lower GDP per capita, less population density, more manufacturing and worse job markets are more likely to be eligible for SF. Additionally, five of the six crime coefficients suggest that places with more crime are significantly more likely to be eligible for structural funds (the only exception is drug crime in 1993).

Analogously to our strategy for RSA, we use the estimates in Online Appendix Table A4 to build up a "SF rules change IV" and enter this alongside our standard specifications in Table 6. We show there that although there is a little evidence of beneficial effects of structural funds on unemployment in the reduced forms, the SF treatment variable is not significant at the 5% level in the IV specifications for either employment or unemployment. More importantly for our purposes, the effect of the RSA policy is robust to inclusion of the SF variable (see discussion in subsection V.B in main text).

E.2 Enterprise Grant (EG) Scheme

Another change that happened in 2000 was a revision in the way Regional Selective Assistance was administered to small and medium sized enterprises (SMEs) and for smaller projects. These smaller grants were renamed as "Enterprise Grants" (EG). In England and Scotland, EG's began in January 2000. They were a simplified scheme for SMEs in RSA eligible areas. The scheme replaced small-scale RSA grants and provided funding up to a maximum of 15% of investment.

In England (but not Scotland) EGs also became available in "Tier 3" areas (see Figure 4 in http://www.tandfonline.com/doi/pdf/10.1080/00343400123609). These Tier 3 areas were outside those eligible for assistance under RSA. Small firms (under 50 employees) could receive up to 15% investment subsidies and medium sized firms (between 50 and 249 employees) could receive up to 7.5% in Tier 3. In Wales, EGs were not introduced until 2002 and then were available throughout the country.

The aggregate spending on EGs was low compared to RSA. For example, in Scotland in 2001 only £3m was spent on EGs, under 3% of the total RSA budget.

Following our strategy for other area-based policies (see next subsection) we can include a dummy variable equal to one when an area becomes eligible for EGs. Although these are generally the same as RSA, the introduction of Tier 3 in England in 2000 and the delayed introduction until 2002 in Wales, enables us to separately identify their effect.[19]

This does, however, raise the concern that the larger effect of RSA on plants belonging to small firms could be due to EGs. The results in Online Appendix Table A14 cast doubt on this. Here we use the actual subsidy amounts (effectively RSA plus EG) and do not find that the results are due to smaller firms receiving relatively large grants. However, a data issue is that the Scottish and Welsh (after 2002) subsidies exclude EG, so could be generating this effect. To check this, we allowed the coefficient on the RSA treatment effect to be different in England from in the rest of the sample (Wales and Scotland). If the result were driven by measurement error in the subsidy amount, we would expect that the coefficient should be significantly different. We found that the interaction terms were not significant (-0.402 with a standard error of 0.625) suggesting that this is not a first order issue.

[19] Note that we have access to the subsidy amounts of EG in England, but not in Scotland or Wales. Since EGs were effectively part of the RSA treatment before and after 2000 we consider the reduced form estimates a reflection of the "RSA and EG bundle." However, since we showed in Table 7 that EG had no effect on the RSA policy effect; that the EG coefficient itself is small and considering also the aggregate amount spend on EG was also relatively small, it is reasonable to assume that our overall estimates are due to RSA.

E.3 Other Area Policies

Online Appendix Table A19 considers many regional and active labor market policies that operated during our estimation period. The Table provides information on the timing of the policy and basic information on area eligibility. The clear majority of policies (10 out of 14) are purely national in nature and do not have specific local area eligibility.[20] Thus, the time dummies will control for them.

Apart from Structural Funds and Enterprise Grants discussed above, there are five other potential policies with a geographical area component: Employment Zones, Coalfields Regeneration Trust, New Deal for Communities and Regional Venture Capital Funds.

(a) *Employment Zones* were designated areas of high long-term unemployment where a package of policies was delivered aimed at improving the chances of those on long-term unemployment insurance getting back into work. The Job Center assessed whether extra training, job subsidies, more intense work search, etc. were needed and delivered these with the threat of benefit sanctions. These started in April 2000 and we code the 15 designated areas with a dummy equal 1 after 2000 and zero otherwise. The areas are: Birmingham, Brent, Brighton and Hove, Doncaster, Glasgow, Haringey, Liverpool and Sefton, Merthyr Tydfil (including Caerphilly and Blaenau Gwent), Middlesbrough (including Redcar and Cleveland), Newham, North West Wales (Conwy, Denbighshire, Anglesey, Wrexham, Caernarfonshire and Merionethshire), Nottingham, Plymouth, Southwark and Tower Hamlets.

(b) *The Coalfields Regeneration Trust* (http://www.coalfields-regen.org.uk/) contains a set of initiatives designed to support areas historically dependent on Coalfields. This includes help on skills, setting up new businesses and finding new jobs. This program began in 1999, so the affected areas were coded to be 1 from 2000 onwards and zero otherwise. The coal-field districts were: Allerdale, Alnwick, Amber Valley, Ashfield, Bassetlaw Barnsley, Blaenau Gwent, Blyth Valley, Bolsover, Broxtowe, Caerphilly, Cannock Chase, Canterbury, Castle Morpeth, Chesterfield, Chester-le-Street, Clackmannanshire, Copeland, Derwentside, Doncaster, Dover, Durham, East Ayrshire, Easington ,Erewash, Fife, Forest of Dean, Gedling, Hinckley and Bosworth, Kirklees, Knowsley, Leeds, Lichfield, Mansfield, Melton, Merthyr Tydfil, Midlothian, Moorlands, North Lanarkshire, North Warwickshire, North-East Derbyshire, Neath PT, Newark and Sherwood, Newcastle-under-Lyme, North Tyneside, Nottingham, Nuneaton and Bedworth, NW Leicestershire, Rhondda CT, Rotherham, Rushcliffe, South Derbyshire, South Lanarkshire, Salford, Sedgefield, Selby, Sheffield, South Staffordshire, South Tyneside, St Helens, Staffordshire, Stoke-on-Trent, Sunderland, Tamworth, Torfaen, Wakefield, Wansbeck, Wear Valley and Wigan.

(c) *The New Deal for Communities* was targeted at the most deprived areas of England. These were usually very small localities, generally on public housing projects, suffering from low employment, high crime and health problems. Local public services across different agencies (welfare benefits, housing, health and social care) tried to offer "joined up" interventions. The program started in 1998 in 17 areas (ending in 2008), and then another 22 were added in 1999 (ending in 2011). As usual, we have a dummy that turns on in these years for the relevant areas. The communities targeted in round 1 (1998) include:

Local authority Area	*wards/estates/communities*
Birmingham	Kings Norton
Bradford	Little Horton, Marshfield and West Bowling
Brighton	East Brighton
Bristol	Barton Hill
Hackney	Shoreditch
Hull	Preston Road
Leicester	Braunstone
Liverpool	Kensington
Manchester	Beswick and Openshaw
Middlesbrough	West Middlesbrough
Newcastle Upon Tyne	Arthur's Hill, Cruddas Park, Rye Hill and Elswick
Newham	West Ham and Plaistow
Norwich	North Earlham, Larkman and Marlpit
Nottingham	Radford and Hyson Green

[20] Some of the policies have small local area pilot schemes. See, for example, Blundell et al (2004) on the New Deal for Young People or Koenig et al (2018) on Job Centre Plus.

Sandwell	Greets Green
Southwark	Aylesbury Estate)
Tower Hamlets	Ocean Estate

In Round 2 (1998) the following communities were targeted:

Local authority Area	*wards/estates/communities*
Birmingham	Aston
Brent	South Kilburn
Coventry	Wood End, Henley Green and Manor Farm
Derby	Derwent
Doncaster	Central Doncaster
Hammersmith and Fulham	North Fulham
Haringey	Seven Sisters
Hartlepool	West Central Hartlepool
Islington	Finsbury
Knowsley	Huyton
Lambeth	Clapham Park
Lewisham	New Cross Gate
Luton	Marsh Farm
Oldham	Hathershaw and Fitton Hill
Plymouth	Devonport
Rochdale	Heywood
Salford	Charlestown and Lower Kersal
Sheffield	Burngreave
Southampton	Thornhill
Sunderland	East End and Hendon
Walsall	Blakenhall
Wolverhampton	All Saints and Blakenhall Community Development

(d) *Regional Venture Capital Funds* was national from 2003 but affected two regions (West Midlands and East of England) from 2002. The program provided small-scale equity (under £500,000) to firms with "growth potential". We included a dummy which switches on for these two regions in 2002 (the national program is in the time dummies).

(e) *Devolution to Scotland and Wales.* Following successful Referenda, in 1999 greater powers were delegated from central government in London to Wales (Government of Wales Act 1998) and Scotland (Scotland Act 1998). Although the budget allocated to RSA and the administration of the scheme was (partially) decentralized, the EU driven determination of eligible and ineligible areas was not changed, so the identification scheme we are using is unaffected by these changes. Nevertheless, we included a dummy for Wales and Scotland in 1999 and thereafter to control for any effects.[21]

E.4 Summary on "Other Policies"

Table 7 (where the dependent variable is manufacturing employment) and Online Appendix Table A5 (where the dependent variable is unemployment) in the main text shows that our RSA effects are robust to all these "other policy" controls (including adding in Structural Funds).

[21] Note that in 1999 there were also greater powers to the nine Regional Development Agencies that covered contiguous areas in England (Statutory Instrument 1999/672). Any effect from this would be captured by the time dummies in the regression with post 1999 Scotland and Wales controls.

APPENDIX F: FURTHER RESULTS

F.1 Spatial Clustering of the Standard Errors

Our main results rely on clustering the standard errors at the ward-level because this is the level where NGE eligibility is determined. In the language of Abadie et al (2017) our experimental design delivers quasi-random variation at the ward-level, so this is ex ante the appropriate level for clustering. The data underlying the policy variables are at a mixture of levels of aggregation (some at the wide NUTS2 level, but others as low as the ward level).

If treatment eligibility was determined solely by factors at a geographically higher level than the ward level our approach could underestimate the correct standard errors. In this section, we explore several more conservative clustering approaches. These include:

1. Clusters based on TTWAs (Travel to Work Area)
2. Clusters based on contiguous neighboring wards receiving identical support levels.
3. Clusters based on "close" neighboring wards receiving identical support levels
4. NUTS-2 level clustering

Online Appendix Table A20 reports versions of our main results in Table 4 with errors clustered at these different levels. Irrespective of the precise level of clustering we find that our treatment effects are significant at 5% level or greater for the employment regressions. For unemployment, we lose significance at conventional levels only when clustering at the extremely conservative NUTS-2 level (34 clusters).

In Panel A of Online Appendix Table A20 we simply cluster at the level of the TTWA (322 clusters), the least conservative approach in the Table (but more conservative than in Table 4 where clustering is at the ward level). In Panel D we cluster at the level of the NUTS2 region (34 clusters), the most conservative approach. We also investigated more sophisticated approaches where we created clusters of areas that were "close" to each other and had the same level of NGE support in both the pre and post 2000 period. We tried several alternatives, two of which we report in the paper. The first of these defined "close" as contiguous wards – i.e. we aggregated all wards having a shared boundary and the same level of NGE support in the two periods. We use NUTS 2 boundaries to define clusters for wards that receive no support. This gave us 102 clusters in total: 70 clusters of wards with positive NGE and another 32 clusters with zero NGE (i.e. no support). Our second approach defined "close" as being within 1km of another ward (rather than strictly contiguous) with the same NGE. Once again, we used NUTS 2 boundaries to define clusters for wards that receive no support. This gave us 80 clusters in total: 48 clusters of wards with positive NGE and another 32 with zero NGE. Both approaches are illustrated in Online Appendix Figure A3. Regression results are reported in Panels B and C of Online Appendix Table A20.

In short, our core results appear broadly robust to various ways of dealing with spatial autocorrelation.

F.2 Relationship of Regression Discontinuity Designs to our baseline IV approach

We explore the impact of different levels of support (NGE) on various area *r* level outcomes at time *t*. Recall our basic model is:

$$y_{r,t} = \lambda_1 \, NGE_{r,t} + \epsilon_{r,t}$$

where $\epsilon_{r,t} = \eta_r + \nu_{r,t}$. To deal with area fixed effects that are potentially correlated with treatment our basic approach involves identifying λ_1 from differences

$$\Delta y_{r,t} = \lambda_1 \Delta NGE_{r,t} + \Delta \nu_{r,t} \tag{F1}$$

Where $\Delta y_{r,t} = y_{r,t} - y_{r,1997}$ and there was a change in NGE after 2000.

While differencing eliminates the fixed effect there is concern that differential trends in the outcome variables could affect treatment so that $E\{\Delta\nu_{r,t} | \Delta NGE_{r,t}\} \neq 0$. This could be because an area that does more poorly in the period leading up to 2000 would be more likely considered in need of support so that $E\{\Delta\nu_{r,t} | \Delta NGE_{r,t}\} < 0$. Indeed, the mechanism that leads to this is that the European Commission deems areas as disadvantaged and therefore in need of support based on a set of area level characteristics at certain points in time. This rule can be described as:

$$NGE_{it} = \begin{cases} f_{93}(X_{r,93}) \text{ if } t < 2000 \\ f_{00}(X_{r,00}) \text{if } t \geq 2000 \end{cases}$$

(F2)

where X is a vector of area characteristics, i.e. support levels of NGE are a mapping of local area characteristics. For the period between 1993 and 2000 the area characteristics are based on some point in time before 1993, for the period from 2000 onwards NGE is based on area characteristics at some point between 1993 and 2000 (see Online Appendix Table A2). These include weightings of the different characteristics (including a weight of zero for some characteristics in some periods) as well as a variety of thresholds.

As consequence of this,

$$E\{\nu_{r,t}|X_{r,93}, NGE_{r,t}\} = E\{\nu_{r,t}|X_{r,93}\} \text{ for } t < 2000$$

(F3a)

and

$$E\{\nu_{r,t}|X_{r,00}, NGE_{r,t}\} = E\{\nu_{r,t}|X_{r,00}\} \text{ for } t \geq 2000$$

(F3b)

i.e. NGE is correlated with the error term only because it is in part driven by $X_{r,00}$ and $X_{r,93}$.

This in turn implies that if we could observe $E\{\nu_{r,t}|X_{r,p}\}$ – where period $p \in \{93,00\}$ – we could obtain an unbiased estimate of λ from a regression of

$$\Delta y_{r,t} = \lambda_1 \Delta NGE_{r,t} + E\{\Delta\nu_{r,t}|X_{r,00}, X_{r,93}\} + \Delta\xi_{r,t}$$

where $\Delta\xi_{rt} = \Delta\nu_{r,t} - E\{\Delta\nu_{r,t}|X_{r,00}, X_{r,93}\}$

Of course, we have no way of observing $E\{\Delta\nu_{r,t}|X_{r,00}, X_{r,93}\}$, directly but since it is driven entirely by observables we can use a non-parametric approach to estimate it; i.e. we can run a regression of

$$\Delta y_{r,t} = \lambda_1 \Delta NGE_{r,t} + \phi(X_{r,00}, X_{r,93}) + \Delta\xi_{r,t}$$

(F4)

where $\phi(X_{r,00}, X_{r,93})$ is approximated by a series expansion or similar non-parametric method. Note that λ_1 and $\phi(X_{r,00}, X_{r,93})$ are separately identifiable because ΔNGE is determined by both X variables *and* EU rules that change over time. This is very similar to a regression discontinuity approach where we control for the (unknown) running variable $\phi(X_{r,00}, X_{r,93})$.

We provide results using this approach in Online Appendix Table A10 for both employment and unemployment. The estimates are significant and larger in absolute magnitude than the OLS estimates in Table 4 column (1). However, they are *smaller* than our preferred IV results in column (4) of Table 4.

One reason for this difference could be measurement error in the running variable in equation (F4). The measurement error could be simply that the variables we use are not exactly the ones used to determine eligibility of an area, because for example at the time the information might have come from an older vintage of data than the ones that we are using.

As is well-known even classical measurement error can create serious biases in RD Designs. This is because continuous measurement error smooths over the discontinuity (see Battistin et al, 2009). In many non-RD design approaches like matching, estimators do converge at a standard rate to a biased value with classical measurement error (e.g. Battistin and Cheshire, 2014) and will be negligible for sufficiently small variance of the measurement error. By contrast, Davezies and Le Barbanchon (2017) show that in RD Designs even a small amount of classical measurement error results in inconsistency of the usual estimator. They show that this seems to be important not just in theory, but also in their Monte Carlo evidence and empirical application. The standard methods to deal with measurement error in the running variable are not applicable to our context where we know neither the true value of the running variable (even for a subset of the data) nor the cut-off (e.g. Battistin et al, 2009; Porter and Yu, 2015).

The advantage of the IV strategy we pursue in the main part of the paper is that the instrument may contain classical measurement error, but it will not cause bias so long as the instruments are not weak. And we showed the strength of instruments through standard techniques such as F-statistic in the first stage.

F.3 A RD Design in Levels?

Although we have described a potential RD Design in terms of differences in equation (F4), one could also imagine an RD Design using levels of the variables as in equation (F2). Consider the model in the period before the 2000 policy change (the same issues arise for post-2000):

$$y_{r,t} = \lambda_1 NGE_{r,t} + f\left(X_{r,93}\right) + v_{r,t}$$

Moment condition (F3a) implies that we can consistently identify λ under the usual RD assumptions. If we considered NGE as a discrete dummy (eligibility vs. non-eligibility), then the RD is considering areas "just above" the surface $f\left(X_{r,93}\right)$ where an area becomes eligible to areas "just below" the surface. The problem however is that we observe neither the running variable nor the cut-off. But we do observe all the elements of the running variable $X_{r,93}$. Thus, one might think the cut-off for the surface could be identified empirically from the data.

Unfortunately, the complexity of the rules (plus potentially measurement error in the X's) did not enable us to do this in a convincing way. The basic issue is that there are many indicators underlying the running variable (8 before 2000 and 9 afterwards) and these could be combined in a huge number of non-linear combinations. In addition, there are multiple NGE levels, so we are not just looking along the eligibility/non-ineligibility boundary, but also at different levels of NGE. The only aspect of the rules where we could identify a clear difference was by using ex ante information for the cut-off for GDP per capita (see below). Here we were able to implement an RD design in levels, and although the results are qualitatively similar to our main results they are noisy.

We also considered applying spatial discontinuity methods as first used in the paper by Dell (2010). Here the running variable is a function of geography (such as latitude and longitude). Unlike our context, however, the cut-off is known (it's when you cross the boundary) and the number of dimensions underlying the running variable is smaller (two compared to 8 or 9).

F.4 An RD Design in levels using a known cut-off for one of the elements of RSA rules

While we know which area level statistics have been used to determine if an area is eligible for treatment, we do not know the exact threshold(s) that were used to classify areas. One exception is the GDP per capita relative to the EU wide average criteria. Only areas with a relative per capita GDP of below 75% are eligible for the maximum amount of support ("Tier 1" status).

We consider using this threshold to generate a fuzzy Regression Discontinuity (RD) design. Note that in our main results we exploit many other criteria for eligibility that are based on the ward level. The 75% threshold, by contrast is based on the NUTS2 level of aggregation. There are over 10,000 wards but only 34 NUTS2 levels in Great Britain, which severely reduces the variation in the source of identification. Furthermore, only four NUTS2 areas are below the 75% over the 1997 to 2004 period.

This caveat notwithstanding Online Appendix Table A9 details the RD results. We estimate $lnY = \beta_1 D + \beta_2(R - 75) + \beta_3\ [D \times (R - 75)] + \epsilon_{RF}$ where R is the running variable (i.e. GDP per capital relative to EU average of the NUTS 2 region), D is a dummy variable equal to 1 if an area's running variable is below 75% and ϵ_{RF} is the error term. Similarly, our IV estimates are $lnY = \beta_{1,NGE} NGE + \beta_{2,NGE}(R - 75) + \beta_{3,NGE}\ [D * (R - 75)] + \epsilon_{NGE}$ where we instrument NGE by D.

In column (1) of Online Appendix Table A9 the dependent variable is simply the value of NGE. The coefficient on the threshold in this "first stage" is positive and significant, suggesting a 9 percentage point increase in NGE from crossing the threshold. This is consistent with an increased level of NGE from 18% to 27% when crossing the threshold on average. In column (2) we present the reduced form for employment and in column (3) we present the IV result. In both cases the effect of the policy appears to be positive. Similarly, both reduced form and IV for unemployment (columns (4) and (5)) suggest that the policy reduces unemployment. Using the IV estimates a 10 percentage point in NGE causes a 19% increase in employment and a 14% reduction in unemployment. These are larger than our main estimates in the text.

Although these implied effects are larger than our baseline estimates, they are very imprecisely estimated: neither is significant at conventional levels. This is unsurprising given the fuzziness of the design: the corresponding F-statistic on the first stage is only 7.3. The fuzziness of the RD design can also be seen in Online Appendix Figure A2. The break at the threshold is hard to see clearly due to the small number of observations. It is most visible for the NGE first stage but is much noisier for the labor market outcomes.

We also looked at empirically identifying cut-offs for all other variables in Online Appendix A2 that made up the policy rules as well as combinations of them. Although sometimes thresholds could be seen in the data for NGE and these policy variables (like GDP per capita), they were quite noisy. When using these thresholds in a RD Design like that for GDP per capita, we generally found that the point estimates suggested improved labor market outcomes, but with statistically insignificant effects (like Online Appendix Table A9).

Hence, although it is reassuring that the RD design delivers point estimates that are not very different from our main results, they are imprecise. Our baseline IV approach that use the other criteria does help us obtain more precision in the results albeit at the expense of a more parametric specification.

F.5 Other General Robustness tests: GE effects; longer time-period and matching

We have conducted many other robustness tests, especially on the core baseline results of Table 4.

First, we look to see if there are general equilibrium effects on wages by using average ln(wages) as an outcome variable in equivalent specifications to Tables 4 and 6. As argued in subsection II.C it is unlikely that there are substantive GE effects from the RSA policy given the magnitude of the sums spent and the nature of the policy. As expected, we never found significant effects (e.g. in the equivalent of column (4), Panel A of Table 4 NGE has a coefficient of 0.287 with a standard error of 0.877). Although the RSA policy also has no significant effect on wages in Table 6, we *did* find evidence of some equilibrium effects of SF. In the equivalent of column (5) of Table 6 SF has a coefficient (standard error) of 0.933(0.333). So, there may be some impact of this wider policy, even though we have shown it does not confound the RSA impact we identify.

Second, we estimated the regressions over a longer time-period (from 1986 to 2004) which includes the policy change in 1993 as well as the one we use in 2000. Unfortunately, detailed information on the construction of the policy rules for the period before 1993 is not available so we cannot construct the rule change instruments. Hence, we only run regressions of outcome variables on *actual* NGE support levels.[22] As noted above, data on unemployment and non-manufacturing employment is not available on a consistent basis pre-1997 (and even the manufacturing series has some concerns in these earlier years). Nevertheless, putting these concerns aside, we find coefficients implying that an increase of support intensity by 10 percentage points leads to a growth of 2.8% more jobs (see Online Appendix Table A11, column (2)). This is somewhat higher, but not significantly different from the results in column (1) which just uses the 1997-2004 period.

Third, we examined trimming the sample on a common support; i.e. we exclude observations that fall into the extremes of the distribution of employment and unemployment across wards. We successively drop larger bands from the edges of the distribution (1%, 5%, and 10%). None of this has much effect on the estimates (see last six columns of Online Appendix Table A11).

APPENDIX G: RSA COSTS PER JOB AND A COMPARISON WITH OTHER ESTIMATES IN THE LITERATURE

G.1 Calculating additional jobs in our study

We work out the cost per job by looking at the reduction in jobs that would arise if, instead of redrawing the map in 2000, the government had abolished the policy, i.e. had set NGE to zero in all areas. Note that while our model is specified using logs of employment we cannot use the approximation that the resulting estimates represent percentage changes because this only holds for relatively small changes. However, in our case we have changes in NGE which can be up to 35%. Hence, we calculate counterfactual employment levels when support is withdrawn in an area *r* as:

$$\ln EMP_r^{CF} = \ln EMP_r - \hat{\lambda}_1 NGE_r$$

Where EMP_r^{CF} is the counterfactual employment level in the absence of the policy, EMP_r is the current level of employment and β is the estimated coefficient on NGE. Consequently, the reduction in jobs in area *r* becomes

$$\Delta EMP_r^{CF} \equiv \quad EMP_r^{CF} - \quad EMP_r \quad = \left(\frac{1}{\exp(\hat{\beta} NGE_r)} - 1\right) EMP_r$$

We calculate this counterfactual employment for each area using the area average level of employment from 2000-2004 (to smooth out any yearly variation) and the area level of NGE pre-2000.

In the main text, we do this calculation using the area level IV coefficient of 0.953. Using this coefficient we estimate that 156,000 jobs would have been lost if the policy had been abolished in 2000. With costs of £288 million, calculated as reported in the text, this gives us a cost per job of £1,846. Taking the more conservative OLS coefficients of 0.124 we get smaller job effects of just under 22,400 and a correspondingly higher cost per job of £12,857, again as reported in the text.

[22] Another limitation is that there is no consistent series of ward level unemployment for the period before 1996 so we just focus on employment.

For the purposes of comparing to other studies, it is also useful to have an estimate from the firm level regressions. As the effect on large firms is insignificant from zero, we use the IV coefficient for small firms of 0.441 and calculate as before, but now using area level employment in supported small firms as the basis for the area level calculation. This gives an estimate of 20,790 jobs and a cost per job of £13,852.

G.2 Comparing the magnitude of our effects with other Place-Based Policies

We provide information on several other cost-per job estimates that have been published for similar area-based policies. To identify these studies, we started with the What Works Centre for Local Economic Growth (2016a, b) reviews which report results from a systematic review of the evaluation evidence. Systematic search terms were developed and applied on multiple platforms covering published research, working papers and government reports (e.g. EconPapers, Google Scholar, Gov.co.uk and OECD.org). The results were sifted based on relevance (area-based policy evaluations, OECD focus, and English language reports) and robustness of method according to the Maryland Scientific Methods Scale (Sherman et al. 1998). The What Works Centre uses a methodological cut-off point which requires a before and after comparison for treated and a suitable control group.[23] The review reports that the initial search found more than 2,100 policy evaluations and that sifting left 58 evaluations that met this minimum criterion. From these, we took the three studies that provided cost per job estimates.

We supplemented these three studies with additional cost per job estimates from more recently published evaluations of area-based policies identified using additional searches on Google Scholar. These additional searches mainly focused on identifying evaluations of area-based policies (although we also included one study that provided loans rather than grants to small businesses) published in the leading peer reviewed journals and other journals in the relevant field (which we judged to be "Urban Economics" given the nature of the intervention).

Ultimately, we found six cost-per job estimates for area-based policies that are reported in Online Appendix Table A21 (these are drawn from eight separate papers and we include our own estimates in this paper for comparison). We report the name of the program (column (1)), the country where the program was implemented (column (2)), a brief description of the intervention (column (3)), the econometric methodology (column (4)), the unit of analysis (column (5)), the cost per job estimate (column (6)) in 2010 US$, and the source articles (column (7)). We converted to US dollars using the original currency to dollar exchange rate in the price base year for reported costs. For example, if program costs were originally reported in £2003, then the £-$ exchange rate for 2003 would have been used. Historical yearly average exchange rates were taken from www.ofx.com. Finally, we adjusted to 2010 constant prices using a consumer price index for the US taken from the World Bank at https://data.worldbank.org/.

This exercise also identified several studies which provided less direct estimates of the cost per job – either modelling these from evaluations for other outputs (e.g. productivity), undertaking calculations using additional ad-hoc assumptions (e.g. imposing additionality or multiplier assumptions), or reporting ex-ante appraisal estimates. Figures for these studies are available on request. The range of costs is similar to those reported in Online Appendix Table A21.

Our own cost per job estimates of RSA in row 1 of Online Appendix Table A21 of $3,541 looks much lower than those reported in the other studies. Two methodological differences help explain our lower cost per job numbers. First, two of the three area-based studies reported in rows 4 and 5 use OLS rather than IV. If we use our OLS coefficients we derive a cost per job of $24,662 (reported in row 2), which is within the range of these two studies ($18,295 and $63,100).

Second, results for the three firm-based studies (rows 7 through 9 of Online Appendix Table A21) should be based on cost per job estimates derived using coefficients from our firm-level regressions. Here, we need to account for the fact that the effect of RSA on large firms is zero. Doing this by using data on small firms and the coefficient from the small firm only regressions gives a cost per job of $26,572 (row 3). This is higher than the US figure (row 7), but lower than the two Italian studies (rows 8 and 9). This suggest that ignoring (in our case positive) area level multipliers over-estimates the cost per job. It is also important to restrict job calculations to those firms for whom estimated effects are positive (in our case, small firms).

The comparisons in Online Appendix Table A21 highlight two ways in which our cost per job estimates improve on existing studies. But it is also important to note that aspects of RSA policy design also help explain some of the differences that persist even after making these methodological adjustments. RSA is selective and targeted at manufacturing firms who can provide evidence that they require support and that they do not serve just the local geographical market. By contrast, most of the area-based policies in Online Appendix Table A19 are non-selective providing support to all firms within the target area regardless of whether they can provide evidence

[23] In practice, this means any study that uses an identification strategy based on a minimum Conditional Independence Assumption on observables such as propensity score matching or regression.

that the subsidies are likely to create additional jobs. To the extent that RSA procedures better identify firms generating additionality we would expect less deadweight for RSA than for these other non-selective schemes (see the model discussion in Section II in the main text).

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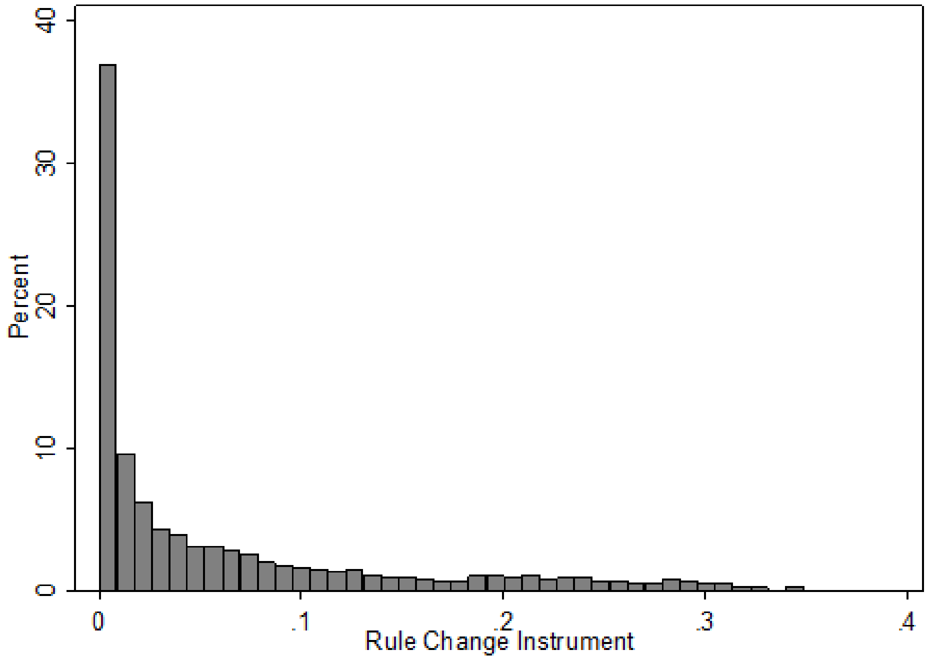
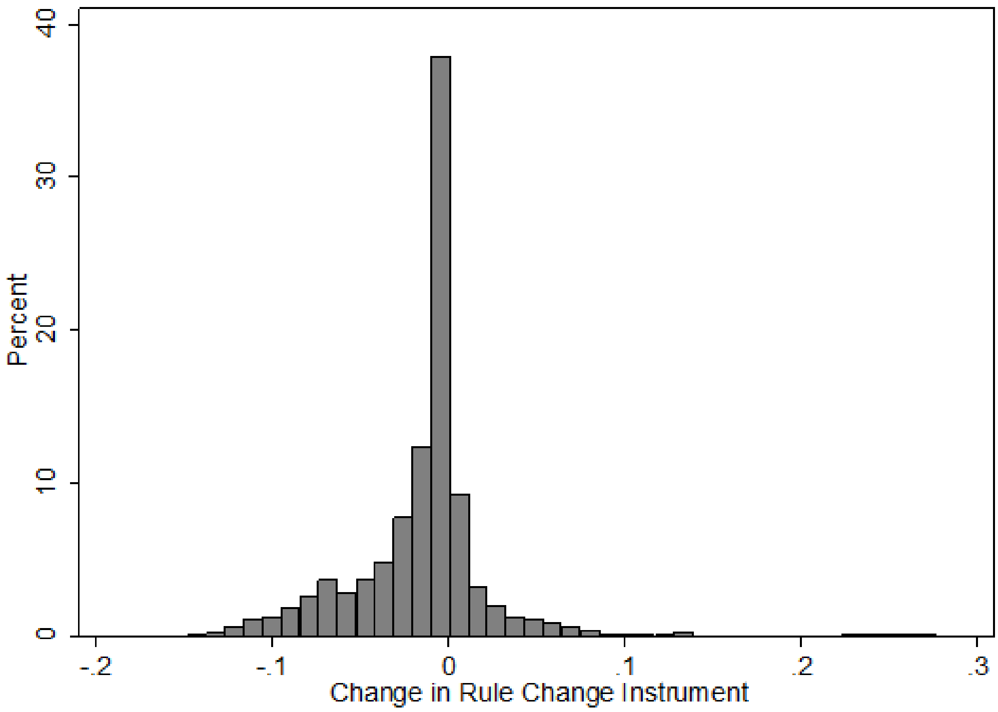
Figure A1: Distribution of the level of the policy rule instrumental variable

Panel A: Level of the instrument

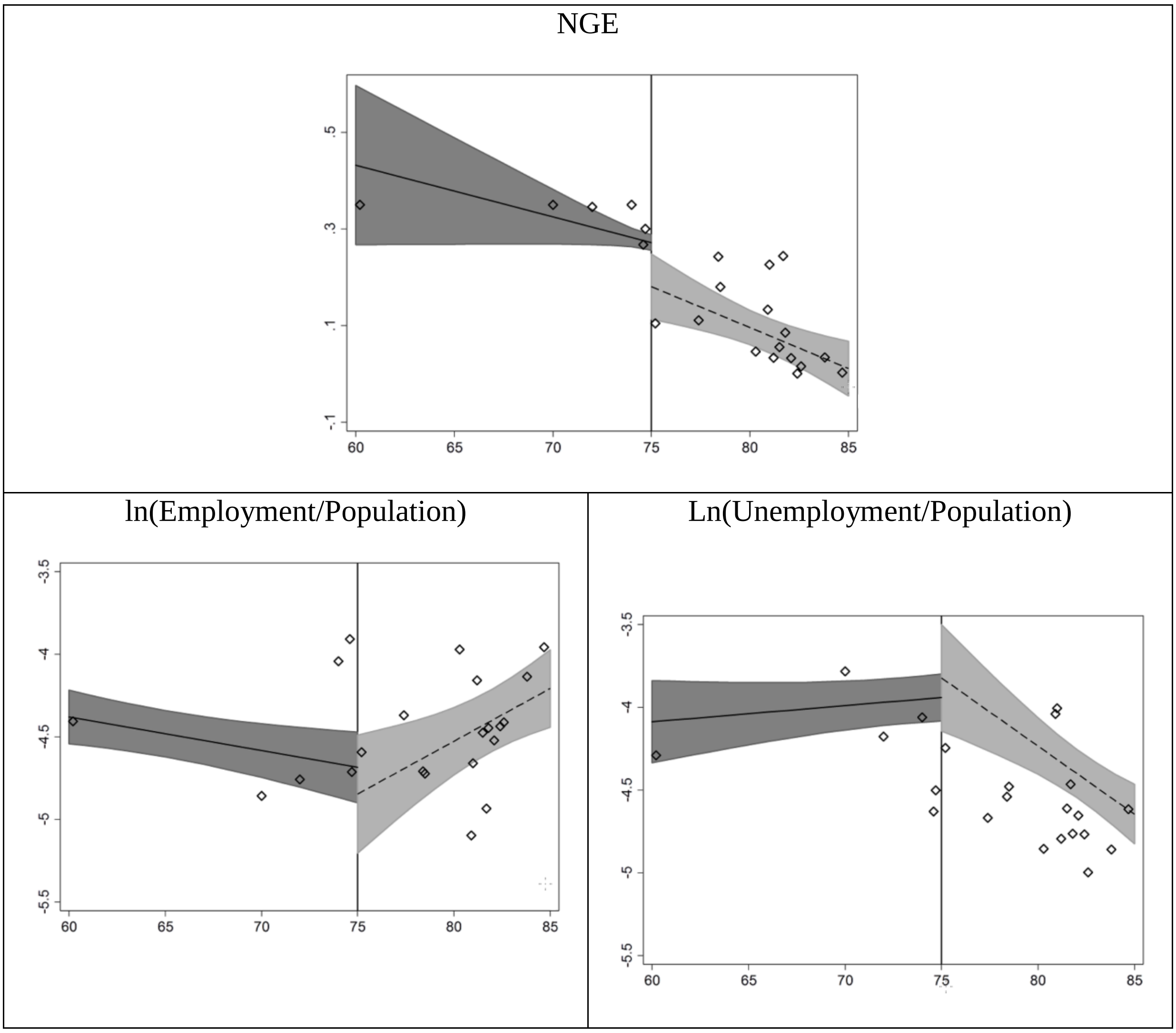


Panel B: Change in the value of the instrumental variable



Notes: Histograms of the policy rule instrument based on 10,737 wards. Panel B is $\Delta z_{r,t}$ which is the actual IV used and Panel A is $z_{r,t}$ constructed from the expected probability of being in each subsidy regime multiplied by the level of subsidy in that regime. It is constructed form the ordered probits in Table 3 from which we can calculate the probability that an area falls into a subsidy regime in all years and the actual level of NGE. See Appendix B for further details.

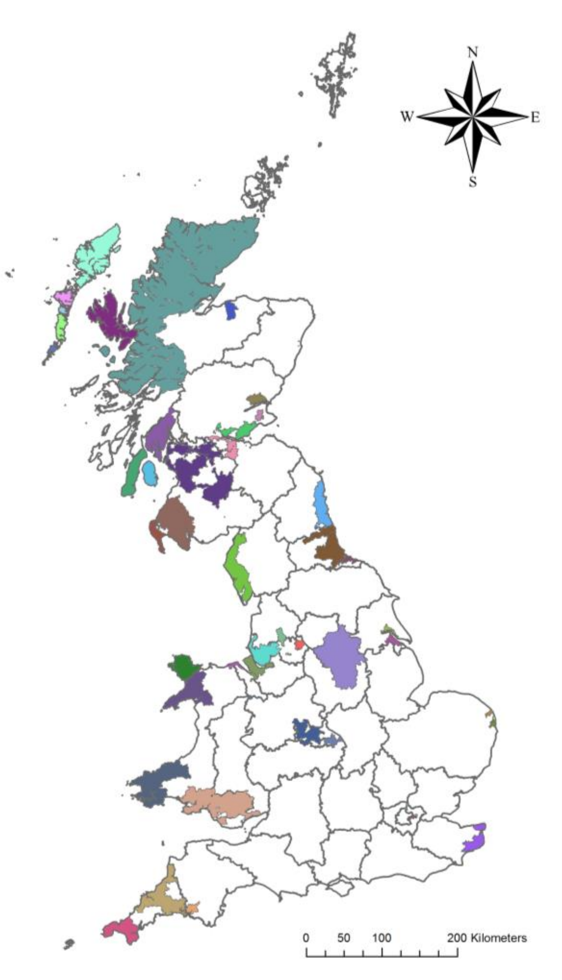
Figure A2: Regression discontinuity at 75% GDP per capita relative to EU average threshold

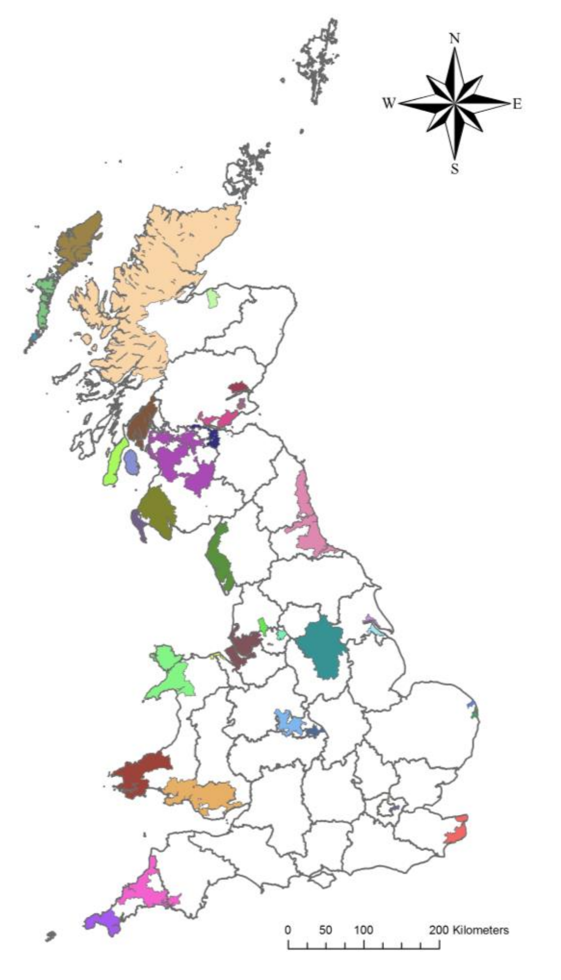


Notes: The running variable on the horizontal axis is GDP per capita of the NUTS2 area relative to the EU wide average level. The diamonds show the mean value (across wards) of the dependent variable at a particular value of the running variable. Shaded areas are 95% confidence intervals.

Figure A3: Alternative approaches to spatial clustering

Immediate neighbors	Close Neighbors





Notes: The Figure illustrates our two spatial clustering approaches based on similar support levels in neighboring clusters. The colored areas show common clusters based on the same support level in both the pre and post 2000 period for neighboring areas (wards). Non-treated wards are grouped based on NUTS2 areas shown in white. On the left, neighboring is defined as two wards having a common contiguous border leading to 70 treated and 32 non-treated clusters. On the right, neighboring it is defined as being no further than 1km away leading to 48 treated and 32 non-treated clusters. The corresponding regression results are reported in Online Appendix Table A20 Panels B and C, respectively.

Table A1: Descriptive statistics across areas (Wards), Manufacturing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Aggregate expenditure on RSA (£m)	**Average NGE (maximum investment subsidy) rate in eligible wards**	**Eligible Wards (as % of all Wards)**	**Jobs in eligible areas (millions)**	**Plants in Eligible Areas**	**Jobs in eligible areas (as % of all jobs)**	**% plants in eligible areas**	**% plants in eligible areas receiving support**
1997	158.27	0.241	31.9	1.230	44,755	42.1	32.4	4.4
1998	115.32	0.241	31.9	1.211	43,575	41.9	32.3	3.1
1999	91.76	0.241	31.9	1.168	43,101	41.7	32.3	2.8
2000	185.68	0.237	26.1	1.041	36,557	38.6	28.0	3.4
2001	219.69	0.237	26.1	1.002	35,837	37.9	28.0	3.1
2002	192.71	0.237	26.1	0.939	35,274	37.6	28.0	3.0
2003	197.26	0.237	26.1	0.900	34,797	37.7	28.1	3.1
2004	148.58	0.237	26.1	0.866	34,437	37.9	28.0	3.0
Average	163.66	0.238	28.3	1.045	38,542	39.4	29.6	3.1

Notes: Column (1) is total expenditure on RSA. Column (2) is the average NGE across eligible wards. Column (3) is the share of wards that are eligible for RSA. Column (4) are the number of jobs in eligible areas. Column (5) is the number of plants in eligible areas. Column (6) reports the jobs in eligible areas as a fraction of all jobs. Column (7) reports the plants in eligible areas as a fraction of all plants. Column (8) is the fraction of plants in eligible areas that receive support. All data refer to manufacturing sector.

Source: Industrial Development Reports (various years) and authors' calculation using the IDBR, ARD and SAMIS matched data.

Table A2 - Variables that define Rules for eligibility

Variable	**Definition**	**Timing of data used by EU for eligibility**	**Source**	**Used in which years for rules**
GDP per capita	Value added in the area per person (NUTS2)	1991 (for 1993); 1994-96 average (for 2000)	Eurostat	1993 and 2000
Population Density	Number of inhabitants per square km (district)	1981 (for 1993) 1991 (for 2000)	Census	1993 and 2000
Share of high Skilled workers	Share of working residents aged over 16 in high skilled (SOC Groups 1 to 3) occupation (ward)	1991 (for both)	Census	1993 and 2000
Start-Up rate	Annualized net percentage rate of growth of company VAT registrations (except retail and agriculture); i.e. total registrations minus de-registrations (district)	1987-1991	ONS Business Register	1993
Structural Unemployment rate	Average annual unemployment (based on ILO definition) rate 5-year average (district)	1986-90 (for 1993); 1992-96 (for 2000)	ONS	1993 and 2000
Activity rate	Fraction of working age population who are economically active. For men: 16-64; for women: 16-59. (ward)	1991 (for both)	Census	1993 and 2000
Employment Rate	Residents in employment divided by population of working age (district)	1992	Labor Force Survey	2000
Current Unemployment rate (Claimant Count)	Average monthly unemployment rate over year. Based on residents claiming unemployment insurance divided by labor force (district)	1991 (for 1993); 1998 (for 2000)	ONS	1993 and 2000
ILO Unemployment Rate	Proportion of residential labor force who are "ILO" unemployed (district)	1992	Labor Force Survey	2000
Long-duration Unemployment rate	Number claiming unemployed insurance for more than a year as a fraction of the labor force (ward)	1991	Census	1993
Share of manufacturing workers	Number of manufacturing employee jobs divided by total jobs (ward)	1991	Census	2000

Notes: These are the definitions of variables used by the EU to determine whether an area is eligible for RSA and if so, at what level of support. The definitions column also gives the level of aggregation that the data is defined at (in parentheses). ILO unemployed are defined as individuals who are (i) without a job, want a job, have actively sought work in the last four weeks and are available to start work in the next two weeks, or (ii) are out of work, have found a job and are waiting to start it in the next two weeks. People who are not claimants can appear among ILO unemployed if they are not entitled to unemployment related benefits. Similarly, unemployment claimants may not appear in the LFS measure of unemployment if they state that they are not seeking, or are not available, to start work. The average district in our data contains 25 wards and the average NUT2 contains 15 districts.
Source: Official Journal of the European Communities (1998), OJ C 74, 10.3; and OJ C 88/C 212/02, 12.8.1988; Department of Trade and Industry (1999) "The UK Government's proposals for new Objective 2 areas" Official letter SG(2000) D/ 106293; Department of Trade and Industry (1993), "Review of the assisted areas of Great Britain. Background document on the new assisted areas map."

Table A3: Changes in area eligibility for Structural Funds (SF) and RSA before and after 2000

	(1)	(2)	(3)	(4)	(5)
	Total	**Eligible for RSA and eligible for SF in 2000 onwards**	**Eligible for RSA and not eligible for SF 2000 onwards**	**Non-eligible for RSA and eligible for SF 2000 onwards**	**Non-eligible for RSA and non-eligible for SF 2000 onwards**
1. Eligible for RSA and eligible for SF in 1993-99	2,424 (22.58% of total wards)	1,743	0	681	0
% of row	*100%*	*71.91%*	*0.00%*	*28.09%*	*0.00%*
2. Eligible for RSA and not eligible for SF in 1993-99	1,004 (9.35% of total wards)	384	195	0	425
% of row	*100%*	*38.25%*	*19.42%*	*0.00%*	*42.33%*
3. Non-eligible for RSA and eligible for SF in 1993-99	703 (6.55% of total wards)	175	0	528	0
% of row	*100%*	*24.89%*	*0.00%*	*75.11%*	*0.00%*
4. Non-eligible for RSA and non-eligible for SF in 1993-99	6,606 (61.53% of total wards)	177	134	0	6,295
% of row	*100%*	*2.68%*	*2.03%*	*0.00%*	*95.29%*
Total	**10,737**	**2,479**	**329**	**1,209**	**6,720**

Notes: This is the transition matrix showing numbers of wards before and after the policy change in 2000 (for RSA and SF). For example, column (1) of the first row details that there were 2,424 areas eligible for both RSA and SF pre-2000 (22.58% of total wards as noted in parentheses below the figure). The next 4 rows show how these rows transitioned into different RSA and SF regimes. For example, column (2) shows 1,743 (*71.91*%) remained eligible for both RSA and SF after 2000 whereas column (4) shows 681 (*28.09%*) lost access to RSA but not SF.

Table A4: Estimates of parameters on eligibility rule changes for Structural Fund (SF) IV

Year	1993	2000
Dependent Variable: Eligibility for Structural Funds		
GDP per capita	-0.046	-0.057
	(0.002)	(0.002)
Population density	-0.029	-0.046
	(0.002)	(0.003)
Share of high skilled workers	-0.501	-0.406
	(0.149)	(0.155)
Employment rate	-2.955	-6.703
	(0.376)	(0.524)
Current unemployment rate	33.835	52.296
(claimant count)	(2.479)	(2.600)
ILO unemployment rate	4.274	0.162
	(0.793)	(0.912)
Share of manufacturing workers	3.028	2.127
	(0.215)	(0.218)
Robberies	263.371	265.231
	(19.781)	(21.382)
Drug Crimes	-87.770	12.598
	(6.250)	(2.013)
Burglaries	35.245	7.093
	(0.046)	(0.057)
Log Likelihood	-4,261.914	-3,900.468
Number of areas (wards)	10,737	10,737

Notes: denotes significance at the 1% level, 5% level and 10% level. The table reports the regressions we perform to derive instruments for structural fund eligibility of an area. For that we regress in column (1) a dummy indicating structural fund eligibility pre-2000 on various area level statistics evaluated before 1993. The second column performs the same regression on a dummy indicating SF eligibility post-2000 (with the same control variables). Standard errors (in parentheses below coefficients) are clustered at the area (ward) level.

Table A5: Controlling for Other policies – Unemployment as an outcome

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable: Ln(Unemployment)								
A. Reduced Form								
Rule change IV	-0.336	-0.367	-0.363	-0.399	-0.350	-0.346	-0.292	-0.253
	(0.069)	(0.069)	(0.069)	(0.069)	(0.069)	(0.068)	(0.069)	(0.069)
Employment Zones	-0.017						-0.032	-0.028
	(0.008)						(0.008)	(0.008)
Coalfield Regeneration Trust		-0.009					0.004	0.004
		(0.006)					(0.006)	(0.006)
Regional Venture Capital Funds			0.036				0.041	0.039
			(0.008)				(0.008)	(0.008)
Enterprise Grants				-0.066			-0.053	-0.050
				(0.006)			(0.007)	(0.007)
New Deal for Communities					0.025		0.050	0.045
					(0.007)		(0.007)	(0.007)
Devolution to Wales and Scotland						0.068	0.062	0.073
						(0.007)	(0.007)	(0.007)
Structural Fund IV								-0.108
								(0.023)
B. IV								
NGE	-0.407	-0.420	-0.413	-0.463	-0.394	-0.388	-0.346	-0.234
	(0.084)	(0.079)	(0.078)	(0.081)	(0.078)	(0.076)	(0.082)	(0.096)
Employment Zones	-0.004						-0.024	-0.016
	(0.009)						(0.009)	(0.009)
Coalfield Regeneration Trust		-0.019					-0.002	-0.001
		(0.006)					(0.006)	(0.006)
Regional Venture Capital Funds			0.031				0.038	0.036
			(0.008)				(0.008)	(0.008)
Enterprise Grants				-0.083			-0.062	-0.064
				(0.007)			(0.007)	(0.007)
New Deal for Communities					0.031		0.058	0.054
					(0.007)		(0.007)	(0.007)
Devolution to Wales and Scotland						0.086	0.074	0.077
						(0.007)	(0.007)	(0.007)
Structural Fund								-0.087
								(0.026)
Number of areas (wards)	10,737	10,737	10,737	10,737	10,737	10,737	10,737	
Observations	85,896	85,896	85,896	85,896	85,896	85,896	85,896	

Notes: denotes significance at the 1% level, 5% level and 10% level. This is the same specification as Table 7 except with ln(unemployment) instead of ln(manufacturing employment) as the dependent variable. Standard errors (in parentheses below coefficients) are clustered at the area (ward) level. NGE ("Net Grant Equivalent") is the level of the maximum investment subsidy in the area. The time-period is 1997-2004. Rule Change IV is described in text. Panel A has a specification identical to column (2) in Panel A of Table 4 except additional policy variables have been included (see text). Panel B has a specification identical to column (4) in Panel A of Table 4 except additional policy variables have been included (see text).

Table A6: Alternative ways of controlling for initial conditions in area regressions

Method	(1) OLS	(2) Reduced Form	(3) First Stage	(4) IV
A. Dependent variable: ln(Manufacturing Employment); No initial lagged values				
Maximum investment subsidy	0.218			1.140
NGE	(0.071)			(0.244)
Policy Rule Instrument		1.007	0.883	
		(0.215)	(0.032)	
B. Dependent variable: ln(Unemployment); No initial lagged values				
Maximum investment subsidy	-0.226			-0.583
NGE	(0.025)			(0.076)
Policy Rule Instrument		-0.515	0.883	
		(0.067)	(0.032)	
C. Dependent variable: ln(Manufacturing Employment); Second order polynomial in all lagged characteristics				
Maximum investment subsidy	0.095			1.110
NGE	(0.071)			(0.247)
Policy Rule Instrument		0.930	0.837	
		(0.204)	(0.034)	
D. Dependent variable: ln(Unemployment); Second order polynomial in all lagged characteristics				
Maximum investment subsidy	-0.139			-0.671
NGE	(0.024)			(0.079)
Policy Rule Instrument		-0.562	0.837	
		(0.064)	(0.034)	
E. Dependent variable: ln(Manufacturing Employment); Including predicted probabilities				
Maximum investment subsidy	0.139			0.887
NGE	(0.070)			(0.256)
Policy Rule Instrument		0.786	0.886	
		(0.227)	(0.033)	
F. Dependent variable: ln(Unemployment); Including predicted probabilities				
Maximum investment subsidy	-0.127			-0.334
NGE	(0.024)			(0.078)
Policy Rule Instrument		-0.296	0.886	
		(0.069)	(0.033)	
Number of areas (wards)	10,737	10,737	10,737	10,737
Observations	85,896	85,896	85,896	85,896

Notes: denotes significance at the 1% level, 5% level and 10% level. Standard errors (in parentheses below coefficients) are clustered at the area (ward) level. NGE ("Net Grant Equivalent") is the level of the maximum investment subsidy in the area. The time-period is 1997-2004. These specifications are the same as Table 4 except instead of including lagged linear controls used to define eligibility in 1993 ($X_{r,93}$), Panels A and B exclude them, while Panels C and D include both linear controls and a second order polynomial in these terms (all cross products and quadratic terms). Panels E and F include the predicted probabilities of receiving a particular level of support as additional controls. These are derived from the multinomial regression of support level state on long lagged area level statistics, which we use to construct our instruments. (Table 3 columns (1) and (2)).

Table A7: Area Level regressions – Placebo regressions 1995-1999

	(1)	(2)
Dependent Variable: ln(employment)		
Specification	Baseline: 2000	Placebo: 1997
Years	1997-2004	1995-1999
Policy Rule Instrument	0.839	0.162
	(0.228)	(0.163)
Number of areas (wards)	10,737	10,737
Observations	85,896	53,685

Notes: denotes significance at the 1% level, 5% level and 10% level. Column (1) is the same specification as the reduced form employment equation of Table 4 Panel A using the baseline in 2000 when actual policy rule change took place. The placebo in column (2) uses employment changes as if the policy change happened in 1997 in column (2).

Table A8: Area level - Bootstrapped standard errors to account for generated regressors

Dependent Variable:	**Ln(Employment)**	**Ln(Unemployment)**
Policy Rule Instrument	0.839	-0.365
	(0.215)	(0.072)
Number of areas (wards)	10,737	10,737
Observations	85,896	85,896

Notes: denotes significance at the 1% level, 5% level and 10% level. The standard errors in most of our tables ignore the fact that our policy rule instrument emerges after regressing support status on various area level statistics taken into account by EU rules; i.e. as reported in Table 3. Here we provide bootstrapped results (clustered at the ward level, 200 replications). This shows standard errors very similar to those simpler ones found in column (2) of Table 4.

Table A9: Regression Discontinuity Design approach using only GDP per capita policy variable

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	**NGE**	**ln(Employment)**		**Ln(Unemployment)**	
	First Stage	**Reduced Form**	**IV**	**Reduced Form**	**IV**
D (Threshold)	0.091	0.161		-0.119	
	(0.034)	(0.188)		(0.161)	
NGE			1.7665		-1.299
			(2.339)		(1.962)
Running variable	-0.017	0.064	0.094	-0.082	-0.104
	(0.005)	(0.021)	(0.060)	(0.018)	(0.05)
Running	0.006	-0.084	-0.095	0.092	0.100
Variable Threshold	(0.006)	(0.024)	(0.037)	(0.020)	(0.032)
Observations	27,562	27,562	27,562	27,562	27,562
Wards	4,079	4,079	4,079	4,079	4,079
# of NUTS2 clusters	14	14	14	14	14

Notes: denotes significance at the 1% level, 5% level and 10% level. Coefficients are from OLS regressions, with standard errors below clustered by NUTS2. An observation is a ward-year. All regressions include ln(population in the ward). Bandwidth is (wards in) NUTS2 areas between 60% to 95% GDP per capita of EU average. See text for exact specifications. The dependent variables in columns (2) through (4) are normalized on area population.

Table A10: Alternative RD Design

	(1)	(2)
Dependent Variable:	Employment	Unemployment
Maximum investment subsidy (NGE)	0.160	-0.210
	(0.070)	(0.024)
Area statistics defining support eligibility pre-2000	Yes	Yes
Area statistics defining support eligibility post-2000	Yes	Yes
Number of areas (wards)	10,737	10,737
Observations	85,896	85,896

Notes: denotes significance at the 1% level, 5% level and 10% level. Coefficients are from OLS regressions, with standard errors below clustered by ward. NGE ("Net Grant Equivalent") is the level of the maximum investment subsidy in the area. All columns include a full set of linear (lagged) characteristics used to define eligibility in the pre and post-2000 period. The time-period is 1997-2004. Dependent variables are in differences of relative to the base year of 1997.

Table A11: Robustness of Ward Level regressions – Long time horizon (1986-2004) and Common Support

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var:	**ln(Employment)**		**Ln(Employment)**			**Ln(Unemployment)**		
Years	1997-2004	1986-2004	1997-2004	1997-2004	1997-2004	1997-2004	1997-2004	1997-2004
Trimming:	None	None	1%	5%	10%	1%	5%	10%
NGE	0.169	0.280						
	(0.057)	(0.071)						
Rules Change IV			0.895	0.856	0.958	-0.419	-0.322	-0.313
			(0.234)	(0.269)	(0.303)	(0.068)	(0.073)	(0.079)
# of areas(wards)	10,737	10,737	10,322	8,755	6,985	10,322	8,755	6,985
Observations	85,896	204,003	82,576	70,040	55,880	82,576	70,040	55,880

Notes: denotes significance at the 1% level, 5% level and 10% level. Each cell is from a different regression and each of the eight panels is a different sample and measure of the treatment effect. Columns (1) and (2) are by OLS (as we do not know pre-1993 policy rules to construct IVs) and include a full set of area fixed effects and time dummies (so within groups rather than the standard long-differences regressions as it is unclear which year to use as baseline). Standard errors below coefficients are clustered by area (ward level) in all columns. The time-period is 1986-2004 in columns (1) and (2) and 1997-2004 in the other columns. NGE is maximum investment grant subsidy. Columns (3)-(8) trim the sample to get a closer common support and re-run the reduced form of Table 3 Panel A column (2). "1%" trims the sample at the lowest and top percentiles, "2%" trims from 2nd to 98th percentile, etc.

Table A12: Alternative Firm Size cut-offs, Plant-level employment regressions

	(1) **OLS**	(2) **Reduced Form**	(3) **First Stage**	(4) **IV**
Panel A. Small Firm employment less than 40 in 1996 (583,259 observations; 86,109 firms; 9,874 areas)				
NGE	-0.002			0.429
	(0.027)			(0.096)
Policy Rule		0.292	0.680	
Instrument		(0.064)	(0.040)	
Panel B. Large Firm employment greater than 40 in 1996 (70,126 observations; 10,659 firms; 4,008 areas)				
NGE	0.065			0.200
	(0.052)			(0.191)
Policy Rule		0.126	0.629	
instrument		(0.120)	(0.052)	
Panel C. Small Firm employment less than 60 in 1996 (601,976 observations; 88,837 firms 9,893 areas)				
NGE	0.004			0.431
	(0.026)			(0.094)
Policy Rule		0.292	0.679	
instrument		(0.062)	(0.040)	
Panel D. Large Firm employment greater than 60 in 1996 (51,409 observations; 7,931 firms; 3,466 areas)				
NGE	0.055			0.174
	(0.059)			(0.221)
Policy Rule		0.11	0.632	
Instrument		(0.140)	(0.052)	

Notes: denotes significance at the 1% level, 5% level and 10% level. Standard errors (in parentheses below coefficients) are clustered at the area (ward) level. These are all plant-level regressions splitting the samples by firm size in 1996 (or the year the plant enters the sample). Each cell is from a different regression. All columns include a full set of area fixed effects time dummies. Standard errors below coefficients are clustered by area (ward level) in all columns. The time-period is 1997-2004. Policy Rule instrument is described in text.

Table A13: Do small firms respond to treatment more because they are younger?

	(1)	(2)	(3)	(4)	(5)
Dependent variable: ln(employment)					
Young = Alive for no more than:		**3 years**	**4 years**	**5 years**	**6 years**
NGE	0.034	0.043	0.067	0.047	0.071
	(0.184)	(0.184)	(0.185)	(0.186)	(0.187)
NGE × Small Firm	0.407	0.408	0.430	0.429	0.442
	(0.200)	(0.201)	(0.201)	(0.203)	(0.202)
NGE × Young firms		-0.187	-0.396	-0.108	-0.162
		(0.315)	(0.225)	(0.170)	(0.160)
Observations	653,385	653,385	653,385	653,385	653,385
Firms	96,768	96,768	96,768	96,768	96,768
Number of Areas (wards)	9,975	9,975	9,975	9,975	9,975

Notes: denotes significance at the 1% level, 5% level and 10% level. These are specifications equivalent to Table 10 Panel A column (4) except that we include additional interactions as specified. Column (1) includes an interaction with “small” - defined as firms with less than 50 employees (as in Table 10) only. Columns (2) to (5) are based on different definitions of a “young” firm. Column (2) defines young to be a firm that is one year old or younger; in column (3) young = 2 years old or less, etc. All treatment variables are instrumented using the equivalent interactions between the policy rule instrument and the respective indicators for “small” and “young”.

Table A14: Is absence of policy effect on plants in large firms because they receive less subsidies?

Method	(1) OLS	(2) First Stage	(3) IV
Sample: Pooled across all plants, 653,385 observations on 96,768 plants, 9,975 wards			
A. Pooled, Dummy for subsidy receipt			
Receiving any subsidy?	-0.004		1.658
RSA>0	(0.011)		(0.464)
Policy Rule Instrument		0.188	
		(0.040)	
B. Pooled, subsidy amount			
ln(subsidy)	0.001		0.276
RSA	(0.001)		(0.112)
Policy Rule Instrument		1.132	
		(0.418)	
Sample: Small (Plants in Firm with under 50 employees) 594,356 observations on 87,728 plants, 9,880 wards			
C. Small, Dummy for subsidy receipt			
Receiving any subsidy?	-0.02		1.891
RSA>0	(0.013)		(0.607)
Policy Rule Instrument		0.158	
		(0.037)	
D. Small, subsidy amount			
Ln(subsidy)	0.000		0.329
RSA	(0.001)		(0.160)
Policy Rule Instrument		0.908	
		(0.401)	
Sample: Large (Plants in Firm with over 50 employees), 59,029 observations on 9,040 plants, 3,708 wards			
E. Large, Dummy for subsidy receipt			
Receiving any subsidy?	0.022		0.120
RSA>0	(0.018)		(0.345)
Policy Rule Instrument		0.375	
		(0.139)	
F. Large, subsidy amount			
ln(subsidy)	0.002		0.019
RSA	(0.002)		(0.055)
Policy Rule Instrument		2.384	
		(1.569)	

Notes: denotes significance at the 1% level, 5% level and 10% level. Each cell is from a different regression and each of the six panels is a different sample and measure of the treatment effect. Standard errors below coefficients are clustered by area (ward level) in all columns. The time-period is 1997-2004. Policy Rule instrument is described in text. "Receiving any subsidy" (RSA>0) is a dummy switched on when the firm begins receiving an investment subsidy and ln(subsidy), RSA, is the log of (1+the amount of subsidy received). All columns include a full set of long memory area statistics. All variables are in differences of ln(1+Y) relative to the base year 1997, where Y is the raw value of the variable.

Table A15: RSA Impact in large vs small firms

	(1) **Average Subsidy amount (£1,000s)**	(2) **Average number of employees**	(3) **Elasticity between employment and subsidies**	(4) **Marginal Impact of subsidy**
Small Firm (under 50)	29.45	18	0.329	0.201
Large Firm (over 50)	107.19	211	0.012	0.024

Notes: The Table calculates the marginal effect of £1,000 of subsidy on the number of jobs, split by large and small firms. Column (1) is the average subsidy received and column (2) is the average plant size from our data 1997-99. In column (3) we report the elasticity between jobs and subsidies received (γ) as estimated in column (3) of Online Appendix Table A14 for small firms (Panel D) and large firms (Panel F). Since $\gamma = \frac{\partial \ln L}{\partial \ln \phi}$ where L = employment and ϕ = subsidy, the marginal effect of a $ of subsidy on the number of jobs is: $\frac{\partial L}{\partial \phi} = \gamma \frac{L}{\phi}$. This is given in column (4). It shows that the marginal impact of subsidies on jobs is over eight times (= 0.201/0.024) bigger in plants belonging to small firms rather than large firms.

Table A16: Alternative ways of measuring firm-level productivity

	(1)	(2)	(3)
Method of measuring TFP:	**Factor Share**	**Regression**	**MU OMEGA**
Policy Rule instrument	-0.034	-0.017	0.336
	(0.043)	(0.065)	(3.206)
Observations	45,511	45,511	18,999
Firms	21,389	21,389	9,139

Notes: denotes significance at the 1% level, 5% level and 10% level. These are reduced form specifications corresponding to column (2) of Panel E in Table 11. **"**Factor Share" method in column (1) reproduces the results reported in Panel E of Table 11 for reference; i.e. TFP is computed using a "factor share" method and relative to an industry by year average "Regression" method in column (2) includes (the log of) labor, materials and capital as additional control variables in a specification where the dependent variable is ln(revenue). "MU OMEGA" in column (3) implements the structural production function framework proposed in Martin (2012) which takes into account firm specific variation in market power when computing TFP. The exact method of construction is in the final subsection of Appendix C.

Table A17: Firm level regressions with capital intensity interactions

Dependent variable: ln(employment)		
Policy Rule Instrument	0.519	0.247
	(0.112)	(0.137)
Policy Rule Instrument × High Capital Intensity		0.525
		(0.200)
Observations	72,902	72,902
Firms	12,242	12,242

Notes: denotes significance at the 1% level, 5% level and 10% level. These are specifications equivalent to column (2) of Table 11 Panel B. Standard errors (in parentheses below coefficients) are clustered at the area (ward) level. Capital intensity is firm level average capital to labor ratio before 2000. "High capital intensity" is a dummy equal to one if capital intensity is above the sample median and zero otherwise. Sample is smaller than in other firm level results because firms without valid observations for pre-2000 capital intensity are excluded.

Table A18: Instrumenting NGE with Policy Rule Instrument (but using linear probability model instead of ordered probit for Table 3)

Method	(1) OLS	(2) Reduced Form	(3) First Stage	(4) IV
A. Dependent variable: ln(Employment)				
Maximum investment subsidy	0.124			1.509
NGE	(0.070)			(0.255)
Policy Rule Instrument		1.266	0.839	
		(0.208)	(0.036)	
B. Dependent variable: ln(Unemployment)				
Maximum investment subsidy	-0.137			-0.767
NGE	(0.024)			(0.099)
Policy Rule Instrument		-0.644	0.839	
		(0.079)	(0.036)	
Number of areas (wards)	10,737	10,737	10,737	10,737
Observations	85,896	85,896	85,896	85,896

Notes: denotes significance at the 1% level, 5% level and 10% level. NGE ("Net Grant Equivalent") is the level of the maximum investment subsidy in the area. All columns include a full set of area fixed effects time dummies. Standard errors below coefficients are clustered by area (ward level) in all columns. The time-period is 1997-2004. This Table corresponds to Table 4, however, we use a slightly different version of the policy rule instrument. Instead of the ordered probit reported in Table 3, the instrument here is based on a binary Probit of the event "NGE>0".

Table A19: Other policies (introduced between 1997 and 2004)

Policy	Aim	When Introduced?	Area Eligibility
New Deal for the Long Term Unemployed	Helping long-term unemployed (over 25 years old) into work. Mandatory work search, training or wage subsidy.	July 1999	National
Employment Zones (EZ)	To improve the employability of the long-term unemployed through skill acquisition, fast-track job services and removal of restrictions to getting jobs.	April 2000	In 15 disadvantaged areas EZ provision replaced New Deal for Long-Term Unemployed.
Coalfields Regeneration Trust	To support areas historically dependent on Coalfields.	1999	Coalfields
New Deal for Communities	To tackle multiple deprivation in the poorest areas.	1998-2008	17 areas 1998-2010; 22 areas 1999-2011 (10 in London and others throughout England). 9,900 people per area on average
New Deal for 18 - 24 year old unemployed people	To help young unemployed people find work. Mandatory work search, training or wage subsidy.	July 1999	National
New deal for Lone Parents	To encourage lone parents into work.	April 1998	National
New Deal for Partners of Unemployed People	To give unemployed partners of unemployed access to employment programs.	April 1999	National
New Deal for Disabled People	Helping people off disability benefit and into work	July 2001	National

Job Centre Plus	Merged services of working age welfare and unemployment benefits. Increased IT spending and incentives for public sector workers. Aim of getting more benefit claimants into work.	April 2002	National
Phoenix Fund	To encourage entrepreneurship in disadvantaged areas.	1999	National
Enterprise Fund	To give entrepreneurs access to finance by creating a £180m fund for debt and equity finance to SMEs with growth potential (e.g. UK High Technology growth fund specialized in fund of fund investments in venture capital).	December 1998	National
Regional Venture Capital Funds	Provision of small scale equity (under £500,000) to firms with growth potential.	West Midlands and East of England from 2002	All England from 2003
Grant for research and development	To provide grants for investigating innovative ideas and knowledge transfer.	1999	National
Single Regeneration Budget	To support local initiatives to make a contribution towards the area regeneration.	1994-2002	National

Notes: Details of different policies that could potentially confound the effects of RSA.

Table A20: Alternative approaches to spatial correlation

Method	OLS	Reduced Form	First Stage	IV
Panel A: Clusters based on Travel to Work Areas (TTWA); 322 clusters				
Dependent variable: ln(Manufacturing Employment)				
Maximum investment subsidy	0.124			0.953
NGE	(0.080)			(0.279)
Policy Rule Instrument		0.839	0.881	
		(0.238)	(0.133)	
Dependent variable: ln(Unemployment)				
Maximum investment subsidy	-0.137			-0.414
NGE	(0.052)			(0.198)
Policy Rule Instrument		-0.365	0.881	
		(0.180)	(0.133)	
Number of Clusters	322	322	322	322
Panel B: Clusters based on immediate neighbors; 102 clusters				
Dependent variable: ln(Manufacturing Employment)				
Maximum investment subsidy	0.124			0.953
NGE	(0.082)			(0.330)
Policy Rule Instrument		0.839	0.881	
		(0.259)	(0.140)	
Dependent variable: ln(Unemployment)				
Maximum investment subsidy	-0.137			-0.414
NGE	(0.053)			(0.237)
Policy Rule Instrument		-0.365	0.881	
		(0.197)	(0.140)	
Number of Clusters	102	102	102	102
Panel C: Clusters based on close neighbors; 80 clusters				
Dependent variable: ln(Manufacturing Employment)				
Maximum investment subsidy	0.124			0.953
NGE	(0.081)			(0.343)
Policy Rule Instrument		0.839	0.881	
		(0.275)	(0.145)	
Dependent variable: ln(Unemployment)				
Maximum investment subsidy	-0.137			-0.414
NGE	(0.053)			(0.239)
Policy Rule Instrument		-0.365	0.881	
		(0.198)	(0.145)	
Number of Clusters	80	80	80	80
Panel D: Clusters based on NUTS2 regions; 34 clusters				
Dependent variable: ln(Manufacturing Employment)				
Maximum investment subsidy	0.124			0.953
NGE	(0.087)			(0.458)
Policy Rule Instrument		0.839	0.881	
		(0.367)	(0.188)	
Dependent variable: ln(Unemployment)				
Maximum investment subsidy	-0.137			-0.414
NGE	(0.058)			(0.278)
Policy Rule Instrument		-0.365	0.881	
		(0.236)	(0.188)	
Number of Clusters	34	34	34	34

Notes: These are identical regressions to Table 4 (85,896 observations) except we allow the standard errors to be clustered at a higher level than the ward. Panel A clusters the standard errors at the Travel to Work Area (TTWA) level. Panel B clusters at the "neighboring ward" level defined to be wards that are (i) directly adjacent (ii) that receive the same level of support pre and post-2000. Wards not receiving any support are clustered at the NUTS2 level. Panel C defines neighboring wards more broadly to be (i) within 1km of each other and (ii) receiving the same level of support pre and post 2000. Wards not receiving any support are again clustered at the NUTS2 level. Panel D is the most conservative simply clustering at the NUTS2 level.

Table A21: Cost per job estimates in RSA compared to others in the literature

#	(1) Program	(2) Country	(3) Program Description	(4) Method	(5) Unit	(6) Cost per job (2010 USD)	(7) Source(s)
1	Regional Selective Assistance	UK	Investment subsidies to businesses in disadvantaged areas.	IV	Area (wards)	3,541	This paper
2	Regional Selective Assistance	UK	Investment subsidies to businesses in disadvantaged areas.	DD	Area (wards)	24,662	This paper
3	Regional Selective Assistance	UK	Investment subsidies to businesses in disadvantaged areas.	IV	Small Firms	26,572	This paper
4	Empowerment Zones	US	Grants, hiring credits and other benefits for businesses in distressed urban areas.	DD	Area (tract)	18,295	Bartik (2010), Busso et al. (2010)
5	Empowerment Zones	US	Grants, hiring credits and other benefits for businesses in distressed urban areas.	DD	Area (tract)	63,100	Glaeser and Gottlieb (2008), Busso and Kline (2008)
6	New Markets Tax Credit	US	Subsidised capital investment in low-income neighborhoods.	RDD	Area (tract)	50,820	Freedman (2012)
7	Small Business Administration loans	US	Guaranteed and partially-guaranteed loans up to $5.5m for small businesses.	IV	Firm	22,781	Brown and Earle (2017)
8	Law 488/91	Italy	Capital subsidies to businesses in least-developed regions.	RDD	Firm	42,638	Pellegrini and Muccigrosso (2017)
9	Law 488/91	Italy	Capital subsidies to businesses in least-developed regions.	RDD	Firm	68,409	Cerqua and Pellegrini (2014)

Notes: Cost per job estimates have been converted from original units to US$ using yearly average exchange rates for the year that costs were reported for and then deflated to 2010 using a US consumer price index from the World Bank. Midpoints are taken where cost per job is reported as a range. In cases where base year is not stated, the last year of reported expenditures is taken. In the methods column: IV is instrumental variables, DD is differences-in-differences and RDD is regression discontinuity design. If more than one source is cited, the first source provides the cost per job estimate based on job effects that are cited in the second source.