Evaluation of State Aid

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MOTIVATION

• Many issues behind evaluation of business support/state aid from perspective of DG-COMP and Member States

• One basic issue is: does it work? Do the subsidies have a positive effect on the recipients?

• But many other issues in addition to private benefit
  – Costs
  – Effects on consumers
  – Negative competitive effects on rivals
  – Wider effects on area (supply chains, employment & wages)
  – Heterogeneity of the effects (e.g. large/small)

• Answers require considering the world “but for” the subsidies
The Evaluation Problem

Institutional Setting

Results

Conclusions & Implications
EVALUATION PROBLEM: CONSTRUCTING THE BUT-FOR WORLD

- Ex post qualitative surveys – what did you do with the money?
  - An IQ test. Pretty useless for evaluation

- Need to consider evaluation when designing/implementing schemes
  - Get quantitative baseline data before (as well as after) intervention. Ideally from administrative sources
  - Consider who is the control/counterfactual group prior to implementation. Key to understanding the “but-for” world
    Build in to scheme

- Question is whether firm would have done what it did without subsidy (e.g. big firms may have more spillovers, but is there a causal effect of the subsidy?)
EVALUATION PROBLEM: CONSTRUCTING THE BUT-FOR WORLD

• Simple difference before & after the scheme
  – But would firms have done the same regardless?

• Difference in differences
  – Look at how a control/comparison group did over the same period: e.g. same industry/area/size, etc. “matching”
  – Takes out the common effect to construct counterfactual
  – But maybe we’re still not comparing like with like (can check by looking pre-policy, etc.)
  – Need something exogenous that randomises a firm into treatment vs. control
LOOKING AT JOBS AFTER A POLICY OF INVESTMENT SUBSIDIES IMPLEMENTED - CHANGE IN JOBS SINCE 1997

Rule change in 2000
Areas that became eligible for subsidies

Source: Criscuolo, Martin, Overman and Van Reenen (2013)
LOOKING AT SIMPLE DIFFERENCE BEFORE AND AFTER THE SCHEME (CHANGE IN JOBS SINCE 1997)

-18  -16  -14  -12  -10  -8  -6  -4  -2  0
Change Relative 1997 [%]
Rule change in 2000
Areas that exogenously became eligible for subsidies

Source: Criscuolo, Martin, Overman and Van Reenen (2013)
RULE CHANGES TO GENERATE EXOGENOUS REASONS FOR AREAS BECOMING ELIGIBLE (CHANGE OF EMPLOYMENT RELATIVE TO 1997)

Change Relative 1997 [%]

Rule change in 2000

Areas that exogenously became eligible for subsidies

Areas not eligible for subsidies

Source: Criscuolo, Martin, Overman and Van Reenen (2013)
DIFFERENT COUNTERFACTUAL GROUPS

• Randomised Control Trials (RCT)
  – Gold standard like clinical trials & increasingly used
  – Too many equally good applicants? Decide by lottery
  – More ethical & fair

• Regression Discontinuity Design (RDD)
  – Score applicants. Usually budget will mean a threshold
  – Look at those who “just missed” compared to those which “just won” above & below threshold. The just missed a good control group

• Other quasi-experiments to make Instrumental Variable (IV)
  – Example: Criscuolo et al (2013) Key is exogenous variation
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CRISCUOLO, MARTIN, OVERMAN & VAN REENEN (2013)  
“The causal effects of an industrial policy”

• Estimate effects of business support program in UK **Regional Selective Assistance (RSA)** on jobs, investment, productivity, entry/exit & unemployment  
  – Selected firms are given investment subsidies in disadvantaged geographical areas (mainly manufacturing)  

• Rich panel data for non-treated and treated plants & firms  
  – Administrative data on population of all RSA recipients matched to population of plants (2.2m observations over 350k plants)  

• **Quasi-experiment:** EU-wide definition of a “disadvantaged area” determined by EU State Aid rules & revised every 6-9 years.  
  – In sample period 1986-2004 there were two changes in eligibility and maximum subsidy in 1993 & 2000
REGIONAL SELECTIVE ASSISTANCE: RSA

- Provides investment grants to firms in “eligible” areas. The grants cover between 10% to 35% of capital expenditure. Location determines eligibility & size of grants.

- Different types of Assisted Areas:
  - **Development Area/Tier 1**: grant can cover 20% to 35% net grant equivalent (NGE) of investment project costs
  - **Intermediate Area/Tier 2**: grants can cover 10% to 30% project costs

- In our sample period major map changes in 1993 & 2000: Map of assisted areas changed because of EU-wide rules.
• RSA is a form of State Aid to industry that could distort competition between EU Member States

• State aid illegal except under restrictive conditions. Changes in area eligibility depend on:
  – Changes in eligibility criteria (& weights given to them)
  – Changes in EU wide values; e.g. one criteria is area’s GDP/capita relative to EU average GDP/capita. When Poland & other A8 countries joined EU, EU GDP/capita fell so some UK areas exogenously lost eligibility
  – Changes in area’s characteristics (potentially endogenous)
EXAMPLES OF CRITERIA ON AREA ELIGIBILITY

The 1993 rules
• Peripherality
• Population Density
• GDP per capita relative to EU average
• Relative unemployment (level and long-term)
• Activity Rates
• Occupational Structure
• New business growth

The 2000 rules
• Peripherality
• Population Density
• GDP per capita relative to EU average
• Relative unemployment (level and long-term)
• Activity Rate
• Manufacturing share of employment
• With the different rates reflecting the seriousness of the disadvantage
PROBLEM WITH IV: CHANGING AREA CHARACTERISTICS

- Changes in area’s values of GDP, unemployment, etc. These could be endogenous, but:
  - Would bias treatment effects probably downwards (areas with worse trends more likely to get treated)

- Construct an IV based solely on the rule changes & ignore any changes in area characteristics
  - Exogenous to firm/area changes
The Evaluation Problem

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AREA LEVEL ANALYSIS: POSITIVE EFFECT ON JOBS & NET ENTRY, NO EVIDENCE OF DISPLACEMENT

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>ln(Employment)</th>
<th>ln(#Plants)</th>
<th>ln(Employment)</th>
<th>ln(#Plants)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of aggregation</td>
<td>Wards</td>
<td>Wards</td>
<td>TTWA</td>
<td>TTWA</td>
</tr>
<tr>
<td>NGE (invest subsidy)</td>
<td>0.287** (0.118)</td>
<td>0.171*** (0.049)</td>
<td>0.355*** (0.133)</td>
<td>0.248*** (0.083)</td>
</tr>
<tr>
<td>Observations</td>
<td>177,794</td>
<td>177,794</td>
<td>6,001</td>
<td>6,001</td>
</tr>
<tr>
<td>#Fixed effects/Clusters</td>
<td>10,737</td>
<td>10,737</td>
<td>322</td>
<td>322</td>
</tr>
</tbody>
</table>
## PLANT LEVEL FIXED EFFECT REGRESSIONS: LN(EMPLOYMENT)

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>Red. Form</th>
<th>First Stage</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. ALL Plants; 2,258,571 obs; 353,626 plant Fixed Effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.108***</td>
<td></td>
<td></td>
<td>0.358***</td>
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<tr>
<td></td>
<td>(0.008)</td>
<td></td>
<td></td>
<td>(0.135)</td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td>0.086***</td>
<td>0.240***</td>
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<td></td>
<td>(0.033)</td>
<td>(0.018)</td>
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**PLANT LEVEL FIXED EFFECT REGRESSIONS: LN(EMPLOYMENT)**
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<td></td>
<td>(0.018)</td>
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</tr>
<tr>
<td><strong>B. Plants in SMALL Firms (under 150 employees); 2,151,881 obs; 339,767 plant Fixed Effects</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.117***</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td>(0.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>C. Plants in LARGE Firms (over 150 employees); 106,690 obs; 13,859 plant Fixed Effects</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.130***</td>
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<td>-0.157</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td></td>
<td></td>
<td>(0.563)</td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td>-0.042</td>
<td>0.268***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.150)</td>
<td>(0.062)</td>
<td></td>
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</tr>
</tbody>
</table>
The Evaluation Problem

Institutional Setting

Results

Conclusions & Implications
MAGNITUDES (1986-2004)

• Estimate the implied aggregate increase in jobs every year using reduced form coefficients and Investment subsidy (NGE)
  – A subsidy of 10% creates 3% more jobs
  – Including costs **Euro €4,700** per job in 2010 prices

• Other results
  – Big effect on entry of new firms
  – Positive effects on investment
  – No effect on productivity
CONCLUSIONS

• Importance of designing a good evaluation strategy. Using quasi-experiment of EU driven changes in eligibility for UK areas

• Results:
  – positive effect on jobs, investment and net entry (simple diff-in-diffs badly underestimates)
  – No evidence of large displacement effects from other areas.
  – No effect on larger firms. Probably gaming the system (also could be financial constraints). Implication is that policy should be targeted to SMEs/entrants

• No effect on Total Factor Productivity & possibly negative aggregate effect because recipients tend to be large & low productivity

• Cost per job of ~ €4,700 seems good value for money, especially since this seems to come from falls in unemployment
McCallum Bagpipes Ltd

based in Kilmarnock (Scotland) established in 1998 manufactures Scottish bagpipes, blow pipes & mouth pieces.

November 2002: receives a RSA grant of £13k for £61k project of producing new types of bagpipes: Breton and Spanish pipes and Bombards. The company has a current total employment of 20 and is one of the world’s best known manufacturers of bagpipes.

http://www.mccallumbagpipes.com/products/bagpipes/

...Are you still wondering whether RSA was a “sound Investment”
Back Up

Full paper available http://cep.lse.ac.uk/pubs/download/dp1113.pdf
NEXT STEPS

• Longer run evaluation of the place-based policy (cf Kline and Moretti, 2012 on TVA)

• Why such a larger effect on small firms than large firms
  – Gaming
  – Financial constraints
  – Selection
  – Interaction with other parts of policy system

• Welfare & productivity

• Heterogeneity across industries and areas
NON-CRISIS STATE AID FOR BUSINESS IN THE EU, 2010 (AS % OF GDP)

Source: Confederation of British Industry (2013)
WHAT IS THE EFFECT OF AN INVESTMENT GRANT?

Cost of Capital, $\rho$

Supply of funds

Marginal Revenue Product of Capital (MRPK)

Capital, $K$

$\rho_1$

$K_1$
WHAT IS THE EFFECT OF AN INVESTMENT GRANT?

Cost of Capital, $\rho$

Supply of funds

Marginal Revenue Product of Capital (MRPK)

Δ$K$

$K_1$, $K_2$
EFFECTS DEPEND ON MONITORING MARGINAL INVESTMENT: HARDER IF FIRM IS LARGE?

Cost of Capital, $\rho$

Supply of funds

Infra-marginal

marginal

$\Delta K$

Marginal Revenue Product of Capital (MRPK)

$K_1$ $K_2$

$\rho_1$ $\rho_2$
IF AGENCY HAS ZERO MONITORING ABILITY NO EFFECT ON INVESTMENT UNLESS FINANCIAL CONSTRAINTS

Cost of Capital

MRPK (unconstrained firm)

MRPK (constrained firm)

$\rho_1$

$K_1$

$K'_1$

Capital
INVESTMENT GRANT – AGENCY CANNOT TARGET MARGINAL INVESTMENTS BUT FINANCIAL CONSTRAINTS

Cost of Capital

MRPK (unconstrained)

MRPK (constrained)

K

K

K'

K'

INVESTMENT GRANT – AGENCY CANNOT TARGET MARGINAL INVESTMENTS BUT FINANCIAL CONSTRAINTS

ΔK
GENERAL CASE: AGENCY HAS IMPERFECT TARGETING SO BIGGER EFFECT ON MONITORED/CONSTRAINED FIRMS

Cost of Capital

MRPK (unconstrained)

MRPK (constrained)

K_1

K_2

K'_1

K'_2

\Delta K

\Delta K'
RELATED LITERATURES

• **Industrial Subsidies**
  – Lending programs (e.g. Banerjee and Duflo, 2008)

• **Place-based policies**
  – US Empowerment Zones (Busso et al, 2010; Neumark & Kolko, 2010)
  – Tennessee Valley Authority (Kline and Moretti, 2012)
  – Tax-based (Holmes, 1998; Albouy, 2009)
  – French Enterprise Zones (Gobillon et al, 2010; Mayer et al, 2011)
  – Regional policy in EU (Wren and Taylor, 1999; Bronzini & Del Basio, 2008)

• **RSA & similar UK regional policies**
  – Other UK regional schemes (Gibbons et al, 2011; Eino & Overman, 2011)

• **Innovation subsidies (grants)**
  – RDD Bronzini and Iachini (2010) and Jacob and Lefgren (2010)
<table>
<thead>
<tr>
<th>Unit of Observation</th>
<th>Year</th>
<th>Total Number of Units</th>
<th>Units which changed their eligibility to RSA</th>
<th>Increase in eligibility</th>
<th>Decrease in eligibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas (wards)</td>
<td>1993</td>
<td>10,737</td>
<td>1,893</td>
<td>1,034</td>
<td>859</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>10,737</td>
<td>4,048</td>
<td>1,424</td>
<td>2,624</td>
</tr>
<tr>
<td>Plants</td>
<td>1993</td>
<td>146,420</td>
<td>23,225</td>
<td>14,369</td>
<td>8,856</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>163,796</td>
<td>50,920</td>
<td>14,967</td>
<td>35,953</td>
</tr>
<tr>
<td>Firms</td>
<td>1993</td>
<td>125,444</td>
<td>19,866</td>
<td>12,505</td>
<td>7,361</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>148,598</td>
<td>45,692</td>
<td>13,520</td>
<td>32,172</td>
</tr>
</tbody>
</table>
**TABLE 1: DESCRIPTIVE STATISTICS - PARTICIPATING FIRMS TEND TO BE LARGER AND LESS PRODUCTIVE THAN NON-PARTICIPANTS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>non treated</th>
<th>Treated before</th>
<th>mean</th>
<th>Sd</th>
<th>median</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Employment</td>
<td>22.25</td>
<td>79.39 ***</td>
<td>118.92</td>
<td>241.45</td>
<td>2</td>
<td>3,193,504</td>
</tr>
<tr>
<td>Firm Employment</td>
<td>253</td>
<td>417 ***</td>
<td>737</td>
<td>957</td>
<td>111</td>
<td>145,389</td>
</tr>
<tr>
<td>Real Value added per worker</td>
<td>31.05</td>
<td>26.32 **</td>
<td>162.51</td>
<td>23.51</td>
<td>24.27</td>
<td>136,524</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>0.02</td>
<td>-0.03 ***</td>
<td>0.33</td>
<td>0.29</td>
<td>0.01</td>
<td>134,755</td>
</tr>
</tbody>
</table>

**Notes:**
- **Mean:** Average value.
- **Sd:** Standard deviation.
- **Median:** Middle value.
- **Obs.:** Observations.
- *****:** Statistically significant at the 0.001 level.
- ****:** Statistically significant at the 0.01 level.
**TABLE 5: FIRM INVESTMENT REGRESSIONS (ARD SAMPLE)**

<table>
<thead>
<tr>
<th>Method</th>
<th>OLS</th>
<th>Red. Form</th>
<th>First Stage</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>Ln(INV)</td>
<td>Ln(INV)</td>
<td>RSA</td>
<td>Ln(INV)</td>
</tr>
<tr>
<td><strong>A. All Firms (129,584 obs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.227***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td></td>
<td></td>
<td>0.621</td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td></td>
<td>0.290</td>
<td>0.462***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.198)</td>
<td></td>
<td>(0.060)</td>
<td></td>
</tr>
<tr>
<td><strong>B. Small Firms (87,765 obs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.222***</td>
<td></td>
<td></td>
<td>0.973*</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td></td>
<td></td>
<td>(0.501)</td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td></td>
<td>0.500*</td>
<td>0.514***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.259)</td>
<td></td>
<td>(0.066)</td>
<td></td>
</tr>
<tr>
<td><strong>C. Large Firms (41,819 obs)</strong></td>
<td></td>
<td></td>
<td></td>
<td>-0.148</td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.233***</td>
<td></td>
<td></td>
<td>-0.148</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td></td>
<td></td>
<td>(0.761)</td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td></td>
<td>-0.050</td>
<td>0.361***</td>
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</tr>
<tr>
<td></td>
<td>(0.274)</td>
<td></td>
<td>(0.105)</td>
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</table>
WHAT DO WE FIND?

• Overall program effects (ATT):
  – Increases investment & employment on intensive (incumbent) & extensive (net entry of plants) margins.
  – A 10 percentage point investment subsidy in area generates ~3% higher employment
  – Reduces unemployment, little displacement from other areas
  – OLS has large downward bias
• Zero effect for large firms – suggestive of “gaming”
• No effect on Total Factor Productivity & recipients mainly low productivity
• Cost per job around €4,700, so relatively cheap
• Doesn’t mean policy good, but a necessary condition
### TABLE 5: FIRM PRODUCTIVITY REGRESSIONS (ARD SAMPLE)

<table>
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<tr>
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<tr>
<td>Dependent variable</td>
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<td></td>
<td></td>
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</tr>
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<td>0.009</td>
<td>(0.004)</td>
<td></td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td>0.004</td>
<td>0.434***</td>
<td>(0.024)</td>
<td></td>
</tr>
<tr>
<td><strong>B. Small Firms (87,765 obs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>0.004</td>
<td>0.026</td>
<td>(0.005)</td>
<td></td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td>0.012</td>
<td>0.474***</td>
<td>(0.031)</td>
<td></td>
</tr>
<tr>
<td><strong>C. Large Firms (41,819 obs)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSA (Participant)</td>
<td>-0.008</td>
<td>-0.090</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>NGE (investment subsidy)</td>
<td>-0.030</td>
<td>0.352***</td>
<td>(0.038)</td>
<td></td>
</tr>
<tr>
<td>Dependent Variable</td>
<td>( \ln(\text{Employment}) )</td>
<td>( \ln(\text{Unemployment}) )</td>
<td>( \ln(\text{Service Employment}) )</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Level of aggregation</td>
<td>Wards</td>
<td>Wards</td>
<td>Wards</td>
<td></td>
</tr>
<tr>
<td>NGE (invest subsidy)</td>
<td>0.210* (0.109)</td>
<td>-0.700*** (0.044)</td>
<td>0.090 (0.061)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>73,896</td>
<td>73,284</td>
<td>73,829</td>
<td></td>
</tr>
<tr>
<td>#Fixed effects &amp; clusters</td>
<td>10,737</td>
<td>10,716</td>
<td>10,737</td>
<td></td>
</tr>
</tbody>
</table>