Evaluating the Employment Impact of Business Incentive Programs in EU Disadvantaged Areas. A case from Northern Italy

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Abstract

Business incentive programs have been increasingly popular within the EU as regional economic development tools to promote employment growth in areas with severely distressed and/or declining socio-economic conditions. Reliable evidenced on the effective net employment impact of such initiatives are greatly needed to help refining future intervention as, to these days, European policy makers' decisions can mostly be supported only by monitoring and survey analyses. This paper proposes a method of analysis to assess the employment impact of the business incentive initiatives implemented in the EU areas with declining industrial production (EU "Objective 2" areas). The proposed method is a comparison-group evaluation approach that uses panels of employment data aggregated by geographic areas (similarly to the evaluation approach successfully adopted by recent studies of the US Enterprise Zone Programs). Details of the proposed method of analysis are illustrated through an empirical application: the evaluation of the business incentive program co-funded by the European Regional Development Fund in the "Objective 2" areas of the Piedmont region (Italy). Results from such application prove the effectiveness and the robustness of the proposed method for impact evaluation analyses with longitudinal data, and highlight how the Piedmont's business incentive program did not significantly affect employment in the "Objective 2 areas".

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1. Introduction

In the last decade, business incentives co-financed through the structural funds (and in particular through the European Regional Development fund –ERDF) have become a popular regional economic development tool for EU areas with declining industrial production ("Objective 2" areas).

Business incentive packages have been offered in more than 80 "Objective 2" (Obj.2) areas covering 18% of the EU population. In the 1994-96 programming cycle alone, about 5 billion Euros (amounting to 11% of the entire EU budget dedicated to the fulfillment of economic and social cohesion objectives) were drawn from the ERDF to finance incentive packages to support small and medium enterprise (SME) investments in Obj.2 areas. These types of initiatives have also an important role in the current 2000-06 cycle of EU regional policies and follow similar incentive packages offered from the beginning of the eighties in disadvantaged areas (referred to as Enterprise Zones) of the US and the UK.

Despite the wide popularity of these initiatives, no robust and consistent ex-post evidence on their employment impact in the Obj.2 areas is yet available to help EU policy makers refining future geographically-targeted economic development policies. Available ex-post employment impact results are indeed mostly derived through applying standard macroeconomic multipliers to the volume of investments co-financed by the ERDF in the Obj.2 areas. This evaluation practice is of limited use as it does not attempt to measure the actual net pre-post intervention employment change in the target areas and as it cannot estimate marginal differences in the employment impact due to the different program features adopted across EU regions and/or countries.

Robust ex-post impact evaluations based on actual pre-post intervention data, however, are difficult to achieve. Assessing the causality link between the program intervention and the observed employment outcomes is a difficult task as it requires disentangling changes due to the program from changes due to all of the economic and social factors exogenous from the program intervention. This task is also particularly demanding due to the lack of experimental data for the evaluation: Obj.2 areas have disadvantaged local economies that would perform differently from their respective national economies. As a consequence, impact estimates can be severely biased if the analysis is not carefully implemented controlling for the different spontaneous economic trends and/or for all of the exogenous economic factors affecting employment outcomes concurrently with the program interventions (Bondonio 2000).

The main feature of this paper is to propose a method of analysis to robustly estimate the ex-post net employment impact of business incentives offered in the EU Obj.2 areas. The proposed method is developed using a "comparison group evaluation design" where pre-post employment changes recorded in the target areas are compared to those of adjacent non-target areas. Impact employment estimates are then retrieved from empirical models that make use of a panel of employment data sorted by industry and aggregated by geographic units corresponding to the Obj.2 areas and adjacent regions (such types of data are typically available from national social security sources and/or census of enterprises). This general evaluation strategy has proven reliable for the US Enterprise Zone programs (Boarnet and Bogart 1996, Papke 1993, 1994, Dowall 1996, Bondonio and Engberg 2000, Bondonio 2001) and is implemented in this study through a number of econometric specifications that allow impact estimates to be retrieved net of the following unobservable factors exogenous to the program intervention:

- local economic trends that may affect Obj.2 areas differently from the non-Obj.2 areas of the EU;
- cyclical macroeconomic factors that may affect employment growth in both Obj.2 and non-Obj.2 areas during the program intervention period;
- sector-specific market trends that may affect the performance of firms in the targeted industrial sectors differently than in non-targeted sectors;
- structural characteristics of Obj.2 areas that may affect firm performances differently than in non-Obj.2 areas.

The econometric specifications developed in this study also allow the marginal employment impact of different degrees of the programs' financial generosity to be estimated together with differences in the employment impact due to different labor-intensity levels across industries.

The proposed method is illustrated in this paper through a case study: the employment impact evaluation of the business incentive program implemented in the Obj.2 areas of Piedmont (a region in the northwestern corner of Italy) in the 1995-98 period (corresponding to the interventions of the 1994-96 programming cycle). The results of the analysis show that the incentive program implemented in the Piedmont region did not significantly affect the employment growth recorded in the Obj.2 areas. The robustness of these results is tested through the development of an extensive sensitivity analysis that highlights how the non-significance of the impact estimates is consistent across a number

of different specifications, data, and assumptions on the selection process of the target areas and industries. The non-significance of Piedmont's incentive program is in line with the recent ex-post empirical evidence produced from the US state Enterprise Zone programs (Boarnet and Bogart 1996, Dowall 1996, Greenbaum 1998, Bondonio and Engberg 2000, Bondonio 2001).

The remainder of the paper is organized as follows. Section 2 describes the case study. Section 3 illustrates the proposed evaluation strategy. Section 4 presents the data used in the analysis. Section 5 and 6 summarizes the empirical model and the case-study results. Section 7 describes the features and the results of the sensitivity analysis. Section 8 contains concluding remarks.

2. The case study: business incentives in the declining industrial production areas of Piedmont

From the beginning of the nineties, the regional government of Piedmont has promoted business incentive programs (co-funded by the European Regional Development Fund - ERDF) targeting small and medium enterprises (SMEs) located (or willing to start operations) in the Piedmont's areas with the sharpest declining industrial production. Target areas of the program intervention were mainly all of the city jurisdictions within the Turin province. There, the predominantly auto component industry experienced in the last decades a severe recession that prompted the Italian national government to support the designation of the entire Turin province as an EU "Objective 2" (Obj.2) area.

For the 1994-96 programming period, those intervention were implemented entirely between 1995 and 1998, the business incentive initiatives promoted by the Piedmont regional administration were as follows:

- capital grants to support investment expenditures (up to 15-30% of the total investment) aimed at expanding production capacity and/or supporting technological upgrades of the production process or restructuring of plants and machineries;
- subsidies to support consulting expenditures (covering 50% of the consulting costs) for services to improve the efficiency of the production process;
- 50% abatement of interest rate costs for investment expenditures to increase production capacity and/or ameliorate existing production equipments or plants.

3. The evaluation strategy

The regional business incentive program implemented in the Obj.2 areas of Piedmont (as those implemented in other EU Obj.2 areas and as geographically-targeted business incentive programs in general) are specifically aimed at geographically re-direct economic development toward areas with deteriorating socio-economic conditions. The economic rationale that most convincingly supports the provisions of such programs stems from the negative externalities that would occur if the determination of the geographical location of new or expanding economic activities were left to pure market forces. Negative externalities that may call for interventions to geographically re-direct economic development are numerous. Among them: excessive increase of urban sprawl if decaying inner city districts are not recuperated as vital economic and/or residential places. Increased pollution and traffic congestion if economic development does not occur uniformly with a balanced exploiting of metro and non-metro lands. Increased criminal activity if abandoned industrial and/or residential inner city areas are left in their decaying state instead of being properly rehabilitated. Labor market inefficiency arising from under-using resources in high unemployment inner-city areas because of people's inability or unwillingness to move from those areas. Missed positive opportunities that could be brought about by urbanization and localization economies, if private incentives were not the only factors affecting firms' location decisions.

To favor job growth and economic development in target areas, the platform of incentive packages offered to SMEs located in Obj.2 areas of Piedmont is set to be more generous (mainly with respect to the number of beneficiary firms) than the platform of incentives offered (from other regional and national sources) in non-Obj.2-areas. Obj.2-area incentives, however, are not the unique source of public business incentives in Piedmont, as incentives from other national and regional programs are available to SMEs anywhere in the region with no specific geographic targets.

3.1. Using geographically aggregated firm-level data

The non-uniqueness of the Obj.2-area incentives compared to the rest of Piedmont leads to choose comparisons of geographically aggregated outcome data between target and non-target areas (within each specific industrial sector) as the best suited evaluation strategy for the analysis. Firm-by-firm comparisons of employment data between treated and non-

treated firms would be instead a less effective evaluation strategy for the following reasons:

A) If treated firms were compared to non-Obj.2-area firms that did not receive any other type of financial aid (e.g. the business incentives offered by the 488/1992 or the 1329/1956 Italian national programs), unobserved managing abilities of non-Obj.2 area firms would be likely to be lower than those of firms in the treated group (as non-Obj.2-are firms did not succeed in applying for any financial help, while treated firms completed their Obj.2-area application successfully). Such difference would generate selection bias in the impact estimates of the program intervention as it would be likely that Obj.2-area firms would outperform comparison-group firms even in the absence of the Obj.2-aea business incentives.

B) If treated firms were compared to non-Obj.2-area firms that did receive financial aid from sources different than the Obj.2-area program, the validity of impact estimates would crucially depend on correctly observing and timing the amount of financial aid received by such non-Obj.2-area firms. It is worth noting that in such case results from the analysis would have to be interpreted as estimates of the employment elasticity to firm-side subsidies rather than as estimates of the employment impact of program interventions targeting selected geographically-defined economies.

The evaluation strategy of choice is a *difference in difference* approach that uses geographically-aggregated outcome data recorded in non-target areas as estimates of the counterfactual growth rate that would be recorded in the target areas without the program intervention. Such a *difference in difference* approach is also the one recently implemented for the analysis of the US Enterprise Zone programs (Engberg and Greenbaum 1999, Greenbaum e Engberg 2000, Bondonio 1998, Bondonio 2001, Bondonio e Engberg 2000, Boarnet e Bogart 1996, Papke 1993, 1994).

3.2 Threats to the validity of the analysis and control variables

Comparisons of employment performances between Obj.2 areas and non-Obj.2 areas yield reliable impact estimates only if they are performed through empirical models that successfully control for all factors, exogenous to the program intervention, that may affect employment outcomes differently between target and excluded areas. The main factors

that may lead to selection and/or omitted variable biases in the analysis can be summarized as follows:

A) Economic conditions affecting prospected costs and revenues of all firms located within a same local economy. Such common local economic conditions may affect firm investment and hiring decisions for all firms located within a same geographic area regardless of whether or not firms are eligible to receive public subsidies.

B) Sector-specific market conditions that could affect prospected costs and revenues for all firms operating in the same industrial sector.

C) National- or regional-economic cycles (and/or economic conditions) that could homogenously affect earning prospects (and therefore investment and hiring decisions) for all firms operating in a same national or regional economy.

When the analysis is implemented with a *difference in difference* approach that compares the pre-post intervention employment performances in Obj.2 areas and non-Obj.2 areas, the national- or regional-business cycle factors of point C) do not pose any particular threats to the validity of the analysis. National- or regional-economic cycle conditions would affect in the same way Obj.2-area and non-Obj.2-area firms: comparing employment performances between target and adjacent non-target areas would yield estimates of the program intervention free of biases from broad economic cycle conditions. Empirical program evaluation studies have commonly adopted such *difference in difference* approach to control for national- or regional- economic cycle factors (e.g. Batik 1995, Dowall 1996, Greenbaum 1998, Boarnet e Bogart 1996).

Exogenous factors such as the local economic conditions and sector-specific market conditions of points A) and B) could instead pose significant threats to the validity of the analysis. As for the local economic conditions of point A), however, it has to be noted that firms eligible for receiving Obj.2-area incentives are predominantly those operating in industrial manufacturing productions. Conditions of the local economy surrounding the location of such firms do not typically have noticeable impact on their perspective costs and revenues, as outputs and production factors of industrial manufacturers tend to be sold and acquired on national and international markets (rather than on local markets, as it would be instead the case for service oriented or retail firms). Moreover, implementing the proposed *difference in difference* approach with panel data estimators (such as *fixed effects*, *first-* or *long-differencing*) would allow any residual local

economic condition (that may affect firm earning perspectives in Obj.2 areas differently than in non-Obj.2 areas) to be controlled for, provided that such differences are relatively time-unvarying (Bondonio 2000). The sector-specific market conditions of point B) pose instead the greatest threat to the analysis of the Obj.2-area incentive program. If firms operating in different industrial sectors are affected by different sector-specific market conditions, they would make different investment and hiring decisions and, therefore, display different employment growth rates even in the absence of the program intervention. If the sector composition of Obj.2-area and non-Obj.2-area economies differs greatly (as it is the case in the Piedmont region due to the prevailing auto component sectors in Obj.2 areas), impact estimates retrieved without properly controlling for sector compositions of target and non-target areas would be biased. To retrieve impact estimates without selection bias, the *difference in difference* approach proposed for the analysis have to be implemented with geographically aggregated employment data precisely sorted by industrial sector. With such data, the empirical model used for the analysis can yield unbiased impact estimates by conditioning to the same industrial sectors the comparison between Obj.2-area and non-Obj.2-area employment performances.

One possible drawback of conditioning on industrial sectors is that impact estimates may not be reliable in the event that the Obj.2-area incentives spur investments that allow firms to begin operating in different industrial sectors than those of their original core business. This occurrence, however, is likely to be quite rare as SMEs typically operate in the industrial sectors in which their owners/managers posses the best ability and/or experience. Such owner-specific abilities and/or experience do to vary easily over time, making unlikely the occurrence of SME business expansions into other industrial sectors due to new investments.

4. Data

Implementing the evaluation strategy described in section 3) requires the availability of geographically-aggregated employment data, sorted by industrial sector and firm size (to single out data on SMEs alone). Data have to cover both Obj.2- and non-Obj.2-areas and at least years from 1995 to 1998 (corresponding to the implementation period of the interventions that are the focus of the analysis). Geographic units of analysis have to be the administrative districts that best overlap Ob.2 areas.

Such data is offered for the Piedmont region (as for the rest of Italy) by the "Enterprise Observatory" (EO) of INPS (the national social security agency of italy) which tabulates firm-side employment data by province (with a total of 6 Provinces coded in Piedmont), industrial sector (with a total of 45 industrial sectors) and firm size (with a total of 9 categories sorted by number of employees). INPS EO are the most adequate available data to implement the analysis for the following reasons. A) They offer more reliable employment figures than self-reported employment data obtained from firm interviews and/or firm application forms for Obj.2-area incentives. B) They include annual employment flows from 1984 to 1998, covering the 1995-98 intervention period. C) They allow employment changes to be sorted into those which occurred in Obj.2 areas and non-Obj.2 areas and those which are accounted for by SMEs and large firms[1]. D) Being the focus of the analysis limited to SMEs, INPS EO data do not suffer from the imprecise geographic sorting that would arise from places of social security registration of workers (which determine the INPS EO geographic sorting by province) being very different from the actual working places of workers. Contrary to largest firms, all administrative offices and production plants of SMEs are usually located within a same site, preventing that, for example, a worker hired in a Southern Italian plant is counted as working in the Turin province because of the company's legal offices being located in Turin.

Table 1 contains the 1984-1998 yearly employment level data accounted for by SMEs in Piedmont (source INPS EO)

Table 1

Data on the amount of Obj.2-are financial subsidies received by treated firms are taken from the program monitoring reports produced by the consulting firm Viatec (1997, 1999). Such data allow Obj.2-area financial subsidy figures to be aggregated by industrial sector and sorted by the four EU programming periods of the intervention (1989-1991; 1992-1993; 1994-1996; and 1997-1999).

[1] Accuracy in sorting employment changes accounted for by SMEs is however somehow limited by the fact that INPS EO data sorts employment size in six classes up to 200 employees and then in only one class from 200 to 499 employees . Thus, the legal SME limit of 250 employees cannot be pinpointed in INPS EO data with high accuracy.

5. Method of Analysis

Employment impact estimates of the Obj.2-area business incentives in Piedmont are retrieved through three models of analysis and a number of different specifications within each model.

Adopting three different models of analysis was required due to the imprecise sorting by industrial sector of the Viatec data on the subsidies received by treated firms from the interventions implemented from 1989 to 1993 (in 1994 no subsidies were insteaqd paid). For subsidies paid to treated firms in such years, Viatec data allow Obj.2-area subsidy figures to be sorted only into few general industrial sectors that do not guarantee optimal controlling for sector-specific market conditions. In such case the advantages of exploiting the entire 1984-98 span of INPS EO data would be offset by the poor precision of the industrial sector sorting of the Obj.2-area subsidies awarded in years prior to 1994. The three different models of analysis implemented allow the robustness of the impact estimates to be checked against the lack of precision due to either limiting the year-span of the INPS EO or using data sorted only into few general industrial sectors.

This result is achieved by implementing a first model that exploits only the 1994-98 portion of the INPS EO data with a pre-post intervention long-differencing panel data estimator, so that employment data is precisely sorted into narrowly defined industrial sectors and no bias may arise from poor sorting by sector and/or year of the Obj.2-area subsidy payments within the 1995-98 period. The second model checks the robustness of the results retrieved from the first model (those validity may be compromised by the lack of pre-intervention data) by exploiting the entire 1984-98 span of the INPS EO data with a first-differencing estimator, implemented on data sorted into fewest industrial sectors. The third model implemented for the analysis further asses the robustness of the first two models by exploiting the entire 1984-98 span of the INPS EO with employment data sorted into narrowly defined industrial sectors. This result is achieved by zeroing all Obj.2-area incentives paid to treated firms prior to 1994, relying on the low volume of pre-1994 incentive payments compared to the 1995-98 payments.

For space constraints and in favor of clarity of exposition, exact formal specifications and results will be detailed in the next section only for the first of these models. Exact specifications and results for the two remaining models will be instead briefly summarized in the sensitivity analysis section.

5.1 The baseline model

The first model implemented for the analysis (which exploits the 1994-98 portion of the INPS EO data with narrowly defined industrial sector sorting) is formalized as follows:

$$\ln(Y_{jpt}/Y_{jpt-4}) = \lambda A_t + \beta S_j + \gamma P_p + \phi T_{jpt} + e_{jpt}, \quad (1)$$

where:

j = industrial sector;

p = province;

Y_{jpt}/Y_{jpt-4}= employment growth recorded by industrial sector *j* in province *p* in the 4-year period ending with year *t* (with *t*=1998 and *t-4*=1994);

S_j = 1 if industrial sector *j* is awarded with Obj.2-area incentive payments in any Obj.2 areas of Piedmont;
0 otherwise;

P_p= 1 if province *p* is ever designated as Obj.2 area;
0 otherwise;

A_t= 1 if the 4-year period ending with year *t* is such that Obj.2-area incentives have been paid to any industrial sector in any Obj.2-area of Piedmont;
0 otherwise [limiting the analysis to 1994-98 data, A_t is always equal to 1 and the term λ represents the baseline growth rate of the model];

$T_{jpt}=(S_j*P_p*A_t)$=1 if Obj.2-area incentives are paid to sector *j* in province *p* in the 4-year period ending with time *t*;
0 otherwise;

e_{jpt} =white noise error, iid $(0,\sigma^2)$.

The model of eq. (1) [in which cross-section units of analysis are sector-province pairs (pj) and time units are 4-years periods *t – (t-4)*] regresses 4-year employment growth rates of pairs *(j,p)* on a baseline growth rate, a sector and a province dummy, and a treatment status variable. The model stems from long-differencing (with 4-year intervals) the following general specification:

$$\mathrm{Ln}Y_{jpt} = \lambda A_t + \beta t S^*_j + \gamma t P^*_p + \phi T_{jpt} + \alpha_{jp} + u_{jpt}, \quad (2)$$

where:

$S^* = S/3$; $P^* = P/3$;

$t = 1994, \ldots 1998$;

α_{jp} = sector-province (j,p) fixed effect component (part of the employment level Y_{jpt} accounted for by unobservable, time unvarying, sector-province characteristics)

u_{jpt} =white noise error, iid $(0,\sigma^2)$.

The long-differencing transformation yielding the model of eq. (1) is necessary to eliminate the fixed effect component α_{pj} of eq.(2). Direct OLS estimation of eq.(2) would be likely to yield impact estimates with selection bias due to $cov(\alpha_{pj}, T_{pjt}) \neq 0$ [i.e. correlation between treatment assignment and unobservable characteristics specific of each *(j,p)* pair]. Long-differencing is chosen over more traditional panel-data transformations [such as *first-differencing* ($Y_{pjt}-Y_{pjt-1}$) or *differences from the mean* ($Y_{pjt}-Y_{pj.}$)] due to the suspected imprecise sorting by year within the 1995-98 interval of the Obj.2-area incentive payments.

Eq. (1) summarizes the evaluation strategy described in section 3) in a simple linear specification which is recommendable due to the limited number of observations available for the analysis [cross tabulating the 6 provinces and the roughly 45 sectors in which the Piedmont INPS EO data are sorted generates 266 observations available for the analysis. In eq. (1), the impact estimate of the program intervention (ϕ) is retrieved through comparisons of employment growth rates between Obj.2 areas and non-Obj.2-aeas controlling for the exogenous market conditions specifically experienced by the set of industrial sectors targeted by the program intervention (S_j) and the province-specific economic trends (P_p) affecting employment growth rates of all sectors located within Obj.2-areas independently from the program intervention.

Thus, in sum, the baseline model illustrated in eq. (1) allows impact estimates of the program intervention to be retrieved net of the following linear exogenous influences:

-cyclical macroeconomic factors that may affect the general baseline employment growth rate in Piedmont during the 1995-98 period;

-sector-specific market conditions that may affect employment growth of targeted sectors differently than that of non-targeted sectors;

-province-specific socio-economic factors that may affect employment growth in Obj.2 areas (i.e the Turin province) differently than elsewhere in Piedmont;

-unobserved time unvarying characteristics of sector-province (*j,p*) pairs that may affect employment growth of targeted (*j,p*) pairs differently than non-targeted (*j,p*) pairs.

Eq. (1) model, instead, would yield biased impact estimates in the event of selection into treatment of (*j,p*) pairs based on their unobservable future growth potential [such unobservable potential could be formalized by adding to eq. (2) a simple linear term such as: $\beta_{jp}t$)]. If such (*j,p*) pair-specific growth potential were correlated with the treatment assignment variable [i.e. $cov(\beta_{jp}t, T_{jpt})\neq 0$], only a random growth rates model (Heckman and Hotz 1989, Papke 1993, 1994, Boarnet and Bogart 1996, Bondonio 2000, and Bondonio and Engberg 2000) would yield unbiased impact estimates of the program intervention. Random growth rates model , however, are not applicable in this case due to:

- data having limited number of observations and imprecise sorting by year of the Obj.2-area incentive payments;
- the hypothesis $cov(\beta_{pj}t, T_{pjt})\neq 0$ being very little plausible: correlation between (j,p) pair–specific unobserved employment growth potentials and assignment into treatment would require the program intervention to target sector-province pairs based on their future economic performances, awarding best or worst future performers. Such hypothesis is highly implausible because selection into treatment of firms and/or eligible locations for Obj.2-area incentives follows a ranking process based on well defined criteria that do not contemplate forecasting future economic performances based on information not available to the evaluator.

Finally, it is worth noting that, unlike the case of the US Enterprise Zones (Greenbaum e Engberg 2000, Engberg e Greenbaum 1999, Bondonio e Engberg 2000), the analysis could not be implemented adopting a *statistical matching* or *conditioning on a propensity score* method due to the limited number of observations available in the data (as a result of Obj.2 areas being significantly larger than the US EZ areas).

5.2 Model specifications

Two additional specifications are implemented to add flexibility to the baseline model of eq. (1). These two additional models allow the analysis to estimate whether or not greater volumes of incentive payments spurred greater employment changes in the targeted

sector-province (*j,p*) pairs, and whether or not the employment impact of the program intervention varied across targeted sectors:

$$\ln(Y_{jpt}/Y_{jpt-4}) = \lambda A_t + \sum_J \beta_J S\_J_j + \gamma P_p + \varphi Fin_{jpt} + e_{jpt}, \quad (3)$$

where:

t= 1998;

J = 1,…M,; being M the total number of treated industrial sectors (S=1);

$\sum_J \beta_J S\_J_j$ = set of M dummy variables ($\beta_1 S\_1, \ldots \beta_M S\_M$), being:

S_1 = 1 if j=1

= 0 otherwise;

Fin_{jpt} = thousand of EUROs per employee awarded to the sector-province (j,p) pair in the 4-year period ending with year t;

$$\ln(Y_{jpt}/Y_{jpt-4}) = \lambda A_t + \sum_J \beta_J S\_J_j + \gamma P_p + \sum_J \varphi_J Fin\_J_{jpt} + e_{jpt}, \quad (4)$$

where:

t=1998;

$\sum_J \varphi_J Fin\_J_{jpt}$ = set of M terms ($\varphi_1 Fin\_1, \ldots \varphi_M Fin\_M$), such that:

Fin_1 = thousand of EUROs per employee awarded to the sector-province (j,p) pair in the 4-year period ending with year t if j=J;

= 0 otherwise.

The specifications of eqs. (3) and (4) differ from the baseline model of eq. (1) as they substitute the treatment dummy (T_{jpt}) with the variable (Fin_{jpt}) and the set of M variables (Fin_J_{jpt}), respectively. Specification (4) differs from (3) as it allows the analysis to estimate whether or not the employment impact of the program intervention varies across sectors, due to across-sector differences in the labor intensity of production (so that

[2] Some specifications estimated from the model of eq. (3) do not include the term γP_p and/or contain a single term βS_j in place of the set of variables $\sum_J \beta_J S\_J_j$. Table 5 illustrates the complete set of estimated specifications.

[3] Due to the limited number of observations available for the analysis, the term γP_p was omitted from some of the estimated specifications in eq. (5) and/or a single term βS_j was included in place of the set of variables $\sum_J \beta_J S\_J_j$. Table 5 illustrates the complete set of estimated specifications.

investments of the same financial amount may produce different employment outcomes across sectors).

6. Results

6.1 Descriptive statistics

Table 2 illustrates 1994 employment stocks and 1994-98 employment growth rates sorted into Obj.2 and non-Obj.2 areas and cross tabulated by targeted and non-targeted industrial sectors. The employment growth posted by targeted industrial sectors has been 9.5% in Obj.2 areas and 7.1% in the non-Obj.2 areas of Piedmont. However, such employment growth differential between Obj.2 and non-Obj.2 areas cannot be interpreted as a net result of the program intervention. As mentioned in the previous section, other factors, independent from the program intervention, may have contributed to determine the observed employment outcome. Indeed, Table 2 shows that such Obj.2- versus non-Obj.2-area differential is recorded also in non targeted industrial sectors, a circumstance in sharp contrast with the hypothesis of the program intervention being the sole cause of the observed employment growth gap.

Table 2

Table 3 summarizes the total volume of subsidies and capital grants awarded to targeted SMEs in Obj.2 area within the 1994-98 period, aggregated and sorted by industrial sectors. Metal manufacturing and mechanical productions are the sectors most generously awarded, receiving a total of nearly 58 million Euros of subsidies and contributions. Chemical, pharmaceutical, and synthetic fiber productions come second, with nearly 9 million Euros of subsidies and contributions (Viatec 1999). Table 4 tabulates the non-targeted industrial sectors that are included in the INPS EO data.

Table 3

Table 4

6.2 Results from the impact evaluation analysis

Models of eq. (1, 3 and 4) are estimated with various specifications that include a different number of control variables. Due to space constraints and for the sake of clarity of

exposition, only results from the specifications described in Table 5 are illustrated in this section. Results from other specifications will be instead briefly summarized in the sensitivity analysis section of the paper.

Table 5

Table 6 shows the results from specifications (I-IV) of eqs. (1) and (3). Impact estimates retrieved from such specifications show that the employment growth recorded in the targeted sectors within the Obj.2 areas was not significantly affected by the program intervention, once sector-specific, time-specific and area-specific exogenous influences are properly accounted for. Estimates for both treatment variables [i.e *T* and *Fin*] are highly insignificant in all four specifications (I-IV). Coefficient estimates of the control variables in the four specifications show that the marginal employment growth rate recorded in the targeted sectors was 10 percentage points lower than that recorded in the other sectors of the Piedmont economy [i.e. the coefficient estimates for the variable S being -0.105, -0.100, -0.100 and -0.097 for specifications (I), (II), (III) and (IV) respectively]. Aggregated employment growth rate of Obj.2 areas is instead estimated to be marginally similar to that of non-Obj.2 areas [i.e. the coefficient estimates for the variable P being highly insignificant in both specification (II) and (IV)]. In this respect, results from Table 6 do not highlight any province-specific employment growth differential between Obj.2-area and non-Obj.2-area economies.

Table 6

Table 7, finally, reports results from specifications (V-VII) of eq. (4). As mentioned in section 5) such specifications should offer greater flexibility to the analysis, allowing impact estimates to capture across sectors marginal differences in the employment effect of the program intervention. Results from Table 7 (in which all coefficient estimates are highly insignificant), however, suggest that the limited number of observations available for the analysis does not allow such specifications (which contain a high number of control variables) to be estimated with sufficient precision.

Table 7

7. Sensitivity analysis

As mentioned in section 5), the robustness of the results reported in Tables 5-7 is tested by replicating the analysis with two additional models and a variety of different specifications that allow the entire temporal span of the data to be exploited under a number of alternative restrictions. The first of such models exploits yearly employment changes (sorted by province, industrial sector and firm size) from 1984 and 1998. The analysis is performed with a first-differencing estimator implemented on data sorted only into a few grossly defined industrial sectors. Data on program incentive payments to target SMEs are aggregated and sorted by year and industrial sector. Incentive payments are then operationalized either as a treatment dummy or as the per-worker monetary value of all incentives paid for each sector-province (j,p) pair in each year (t). In its single-treatment dummy form, such model can be formalized as follows:

$$\ln(Y_{jpt} / Y_{jpt-1}) = \lambda A_t + \beta S_j + \gamma P_p + \phi T_{jpt} + e_{jpt}, \qquad (5)$$

where:

t = year (1985-98);

A_t = 1 if year t is within the payment period of the program incentives;
= 0 otherwise.

Eq. (5) model differs from eq. (1) in at least two ways:

- the model is implemented as a *first differencing* (Y_{pjt}-Y_{pjt-1}) [rather than a *long differencing* (Y_{pjt}-Y_{pjt-3})] transformation of eq. (2);
- industrial sectors (j) are fewer and less precisely defined than those of eq. (1);

Using instead monetary values of the incentives as treatment variables, the model can be formalized in the two following specifications:

$$\ln(Y_{jpt} / Y_{jpt-1}) = \sum_{py}\lambda_{py}A\_py_t + \sum_J \beta_J S\_J_j + \gamma P_p + \varphi Fin_{jpt} + e_{jpt} \qquad (6)$$

where,

py = 1990, 1991,…1998 (payment years = years in which Obj.2-area incentives were paid);

$\sum_{py}\lambda_{py}A\_py_t$ = set of nine terms ($\lambda_{1990}1990_t$, ...$\lambda_{1998}1998_t$), being:

1990_t = 1 if year t is 1990;

= 0 otherwise;

Fin_{jpt} = thousand of EUROs per employee awarded to the sector-province (j,p) pair in year t;

and,

$$\ln(Y_{jpt} / Y_{jpt-1}) = \sum_{py}\lambda_{py}A\_py_{t\backslash} + \sum_J\beta_J S\_J_j + \gamma P_p + \sum_J\varphi_J Fin\_J_{jpt} + e_{jpt} \quad (7)$$

where,

$\sum_J\varphi_J Fin\_J_{jpt}$ = set of M terms ($\varphi_1 Fin\_1$,… $\varphi_M Fin\_M$), being:

Fin_1 = thousand of EUROs per employee awarded to the sector-province (j,p) pair in year t if sector j = 1;

= 0 otherwise.

Eq. (7) differs from eq. (6) as it retrieves impact estimates of the intervention through a set of sector-specific monetary values of the Obj.2-area incentives awarded, rather than through a single treatment variable.

The second model with which the analysis is replicated varies from those of eqs. (5-7) only due to the greater number of industrial sector into which employment data are sorted [as mentioned in section 5), such result is achieved at the cost of neglecting pre-1994 program incentive payments]. Thus, formal specifications of this last model is identical to those of eqs. (5-7) except for industrial sectors (j) being coded as more narrowly defined Italian standard classification classes, and years of incentive payments being only 1995-1998.

Sensitivity analyses were finally completed by estimating each of the proposed model with a number of alternative specifications defined by simplifying or omitting those control variables that were too highly correlated with the treatment variable/s. Results from all of the described alternative models and specifications are very similar to those presented in section 6), highlighting the robustness of the impact estimates presented in Tables (5-7). For space constraints and for the sake of clarity of expositions, the results

from such additional models/specifications are not illustrated here, but are available upon request to the author.

8. Conclusion

Business incentives co-financed through the structural funds have become in recent years a popular regional economic development tool for the EU areas declining industrial production ("Objective 2" -Obj.2- areas). This paper proposes a method of analysis to robustly estimate the ex-post net employment impact of Obj.2-area business incentives through a "comparison group evaluation design" based on geographically-aggregated panels of employment data from official statistical sources (national social security or national census bureaus). The proposed method is applied to a case study: the employment impact evaluation of the Obj.2-area business incentive program implemented in the Piedmont region (Northwestern Italy) from 1995 to 1998 (corresponding to the interventions of the 1994-96 EU programming cycle). The results of the analysis show that no significant employment change was induced by the program in the Obj.2 areas. Such finding can be interpreted in at least two ways:

- Piedmont Obj.2-area business incentive program did not significantly modify investing and hiring behaviors of targeted firms. As targeted entrepreneurs would have make the same investment and hiring decisions even in the absence of the program intervention, Obj.2-area incentive payments constituted a money prize to entrepreneurs that would invest and hire workers in the target areas anyway. Such money prices benefited all of the economies where the goods and services bought by entrepreneurs with the prize money were produced;
- Obj.2- area incentives induced only very small employment changes in the targeted areas of Piedmont compared to the size of their economies. Even if marginally affecting investment and hiring decisions of some targeted firm, the program intervention was not sufficient to achieve any employment change large enough to be relevant for the economy of Obj.2 areas.

The zero-impact results of the analysis are in line with the findings of some recent evaluations of similar geographically-targeted business incentive programs such as the US Enterprise Zones (e.g. Dowall 1996, Boarnet and Bogart 1996, Bondonio and Engberg 2000). Findings from this paper are instead difficult to compare with those produced on the business incentive programs implemented through co-funding from the European

Regional Development Fund in other EU Obj.2 areas. Employment evaluation studies on EU Obj.2-area business incentive programs have been so far predominantly produced as either monitoring reports (assessing the employment impact of the program intervention through applying standard economic multipliers to the volume of subsidized investments), or as business survey studies. As none of the available empirical evidence on Obj. 2 area programs is derived from employment data collected by official statistical sources, indeed one of the main contributions offered by the paper (beyond the specific empirical results produced on the Piedmont case study) is illustrating a model of analysis that can be replicated for other Obj.2-area business incentive programs in order to offer results with improved reliability and/or robustness than those currently available to European policy makers.

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Table 1: SME employment in Piedmont (1984-1998 annual data)

	Obj. 2 areas*				Non-Obj.2 areas			
Years	*Employees in industrial sectors***	*Employees in other sectors***	*Yearly % change in industrial sect.*	*Yearly % change in other sect.*	*Employees in industrial sectors***	*Employees in other sectors***	*Yearly % change in industrial sect.*	*Yearly % change in other sect.*
1984	163,599	80,373	-	-	177,684	55,922	-	-
1985	164,273	84,445	1,38%	4,38%	179,556	58,914	1,29%	5,54%
1986	167,100	87,601	4,38%	6,61%	179,068	61,800	4,43%	5,88%
1987	171,722	92,357	3,30%	5,86%	184,379	65,465	2,45%	6,21%
1988	178,309	96,348	4,18%	4,09%	189,052	69,054	2,89%	4,80%
1989	184,225	99,577	3,97%	3,94%	191,344	72,283	2,97%	4,64%
1990	181,868	100,949	0,13%	1,43%	191,233	75,017	0,45%	3,08%
1991	177,227	101,570	-2,35%	0,84%	190,607	77,036	0,19%	2,00%
1992	173,087	100,959	-2,79%	-0,49%	186,874	77,959	-2,87%	1,65%
1993	166,037	98,429	-5,39%	-2,47%	180,866	77,954	-3,27%	0,71%
1994	169,379	97,157	1,43%	1,69%	184,228	81,316	1,71%	3,31%
1995	175,479	99,315	3,49%	2,82%	188,753	82,830	2,73%	3,70%
1996	173,738	100,347	0,46%	1,51%	186,830	84,228	-0,03%	1,88%
1997	174,381	102,197	1,70%	2,72%	187,746	86,152	1,08%	2,76%
1998	178,999	109,011	3,28%	5,24%	189,239	89,471	2,01%	4,91%

Source: INPS "Enterprise Observatory"
* Obj.2 areas = Turin Province
** stocks at 31/12

Table 2: 1994-98 employment growth in industrial SMEs

Sectors	*Geographic areas*	*1994 employment stock in industrial SMEs*	*1994-98 absolute employment change*	*1994-98 % employment change*	*Employment change difference between Obj.2 and non-Obj.2 areas (% points values)*
Target sectors[(a)]	Obj.2 areas*	156,83	14,905	0.095	0.024
	Non-Obj.2 areas	161,322	11,519	0.071	
Non-target sectors	Obj.2 areas*	109,706	12,824	0.116	0.017
	Non-Obj.2 areas	104,223	10,327	0.099	

* Turin Province
(a) Target sectors are those in which at least one firms received incentive payments in the 1994-98 period

Table 3: 1994-98 incentive payments to Obj.2-area SMEs

Industrial sectors (group name)	*Description*	*ISTAT Ateco81 Sectors*	*Incentive payments* [(a)]
food	Food, sugar, drinks and tobacco products	41, 42	2,517,727
craft	Furniture and fixtures, leather and leather products, stone, clay, glass and concrete products	24, 44,46,49	4,660,961
chpha	Chemical, pharmaceutical and synthetic fiber products	25,26	9,013,085
constr	Constructions	50	1,654,705
mining	Metal and coal mining, oil and gas extraction, mining and quarrying of nonmetallic minerals	11,12,13,14, 21,23	194,701
hardware	Electronic, industrial and commercial machinery and computer equipment	33	1,376,339
metal	Fabricated metal products	22,31,32,34, 35,36,37	57,775,777
rubplast	Rubber and miscellaneous plastic products	48	6,404,496
repair	Automotive and miscellaneous repairs	67	499,923
textile	Textile mill products, apparel and other finished products	43,45,	3,723,088
paper	Paper and allied products, printing, publishing and allied industries	47	4,892,330
trasp	Ground transportation	72	785,004
utilities	Electric, gas and sanitary services	16, 17	51,128
		Total	93,549,269

(a) In Euro. Actual payment period: 1995-1998.

Table 4: 1994-98 non-target sectors

Industrial sectors (group name)	*Description*	*ISTAT Ateco81 Sectors*
comm	Wholesale and retail trade, hotel services	61,62,63,64, 65,66
wairtran	Water and air transportation	73,74,75
atrs	Transportation services	76,77
cmca	Communications	79
crfibser	Credit, finance and business services	81,82,83
serv	Public and other private services	92,93,94,95, 96,97,98

Table 5: Estimated specifications
(Sensitivity analysis non included)

Model	Specification	Independent variables		
Eq. (2)	(I)	S		T
	(II)	S	P	T
Eq. (3)	(III)	S		Fin
	(IV)	S	P	Fin
Eq. (4)	(V)	S	P	Fin_J (21 dummies)
	(VI)	S_J (21 dummies)		Fin_J (21 dummies)
	(VII)	S_J (21 dummies)	P	Fin_J (21 dummies)

Table 6: Employment impact of Obj.2-area incentive payments to SMEs
Results from eq. (1) and (3) [Dependent variable: 1994-98 employment growth]

Independent variables		Regression coefficient estimates(+)			
		Specific. (I)	Specific. (II)	Specific. (III)	Specific. (IV)
CONSTANT		**0.166*** (0.028) *0.000***	**0.161*** (0.031) *0.000***	**0.166*** (0.028) *0.000***	**0.159*** (0.028) *0.000***
TREATMENT VARIABLE					
1 if sector and province are targets of the intervention, 0 otherwise	T	0.034 (0.077) *0.654*	0.007 (0.108) *0.947*	-	-
Fin=thousand of Euros per employee (if sector and province are targets)	Fin	-	-	0.007 (0,045) *0,929*	-0.021 (0,052) *0,826*
CONTROL VARIABLES					
Sector-specific economic trend	S	**-0.105** (0.042) *0.014***	**-0.100** (0.045) *0.026***	**-0.100** (0.041) *0.017***	**-0.097** (0.042) *0.023***
Area-specific economic trend P=1 if province is Obj.2 area 0 if province is not Obj.2 area	P	-	0.027 (0.075) *0.713*	-	0.037 (0.062) *0.542*
Number of observations		266	266	266	266
Adjusted R2		0.255	0.202	0.177	0.154
F		3.88	3.19	2.98	2.11
Prob>F		0.0176	0.0234	0.0324	0.0597

* p-value<0.1 ** p-value<0.05 *** p-value<0.01

Standard deviations in parenthesis. P-values in *italics*

Table 7: Employment impact of Obj.2-area incentive payments to SMEs
Results from eq. (4) [Dependent variable: 1994-98 employment growth]

Independent variables		Regression coefficient estimates(+) Specification (V)	Specification (VI)	Specification (VII)
CONSTANT		**0.161*** *0.000***	**0,166*** *0,000***	**0,161*** *0,000***
INCENTIVE PAYMENT VARIABLES (1=1,000 euros per employee)				
(SECT. ATECO81)				
Petroleum refining and related services	Fin_14	0.385 *0.805*	0.247 *0.885*	1.258 *0.726*
Electric, gas and energy production	Fin_16	0.354 *0.856*	1.574 *0.457*	1.423 *0.943*
Extraction and mining	Fin_23	0.755 *0.603*	-0.702 *0.654*	-0.817 *0.511*
Fabricated products from non-metal minerals	Fin_24	0.216 *0.770*	0.116 *0.998*	-0.046 *0.611*
Chemical and synthetic fiber products	Fin_25	0 *0.990*	-0.036 *0.819*	-0.048 *0.955*
Fabricated metal products	Fin_31	0.017 *0.972*	-0.019 *0.970*	-0.058 *0.768*
Mechanical machinery	Fin_32	0.156 *0.703*	-0.104 *0.813*	-0.137 *0.915*
Computers and information system equipments	Fin_33	1.570 *0.232*	1.155 *0.415*	1.053 *0.763*
Electronic and communication machineries	Fin_34	0.005 *0.991*	-0.121 *0.855*	-0.170 *0.468*
Automotive and automotive components production	Fin_35	0.048 *0.840*	-0.042 *0.868*	-0.061 *0.803*
Non-automotive transportation equipments	Fin_36	0.478 *0.345*	0.666 *0.225*	0.625 *0.815*
Bio-medical and optical goods, precision tools	Fin_37	-0.071 *0.958*	0.164 *0.912*	0.056 *0.264*
Food, sugar, drinks and tobacco products	Fin_42	-0.154 *0.426*	-0.112 *0.596*	-0.125 *0.970*
Textile production	Fin_43	-0.228 *0.676*	-0.005 *0.990*	-0.048 *0.556*
Leather products	Fin_44	-0.251 *0.710*	0.178 *0.807*	0.125 *0.934*
Furniture and wood products	Fin_46	-0.302 *0.687*	-0.052 *0.947*	-0.110 *0.866*
Paper and allied products, printing, publishing and allied industries	Fin_47	-0.056 *0.917*	-0.044 *0.939*	-0.085 *0.892*
Rubber and miscellaneous plastic products	Fin_48	0.063 *0.855*	-0.050 *0.896*	-0.077 *0.884*
Miscellaneous manufacturing industries	Fin_49	-0.824 *0.893*	2.927 *0.658*	2.439 *0.843*
Constructions	Fin_50	-1.186 *0.820*	-0.007 *0.999*	-0.416 *0.717*
Automotive and miscellaneous repairs	Fin_67	-0.383 *0.915*	-0.034 *0.993*	-0.315 *0.942*
Ground transportation (no railroads)	Fin_72	1.277 *0.614*	0.991 *0.717*	0.793 *0.777*
CONTROL VARIABLES				
Sector-specific economic trend	S	**-0.100** *0.031***	**(a)**	**(a)**
Area-specific economic trend P=1 if province is Obj.2 area 0 if province is not Obj.2 area	P	0.357 *0.722*	-	0.027
Number of observations		266	266	266
Adjusted R2		0.0632	0.0844	0.0887
F		1.44	1.53	1.54
Prob>F		0.1014	0.0993	0.0994

* p-value<0.1 ** p-value<0.05 *** p-value<0.01

P-values in *italics*

(a) Coeffiicent estimates for the 21 sector-specific dummies of specifications (V) and (VI) are omitted for clarity of expositions. Complete results are available upon request to the author.