Evaluation of deadweight spending in regional enterprise financing

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Abstract:

The problem of deadweight spending has been previously studied using diverse methods, but regional aspects have not yet been considered. We conduct an evaluation of regional business subsidies in Finland in 2000–2003. Our analysis reveals substantial regional differences; deadweight spending is negatively associated with economic development. The deadweight spending is dependent on many firm, project, and regional level factors, which also greatly account for regional differences. Nevertheless, there does seem to be some regional variation in deadweight spending that can originate from differences in the approval processes of subsidies between regions.

Keywords: enterprise financing, regional policy, deadweight spending, business projects, subsidies

JEL-codes: R58, H25, L53

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Introduction

Many governments grant business subsidies to promote growth and employment in regions that are lagging behind. The European Union also provides this type of subsidies (e.g. MOLLE, 2007). Two main arguments, equity and efficiency, motivate these subsidies. The equity argument says that the government should aim to equalize regional levels of development and thus should help firms with economic problems in backward regions. The firms in these regions do not benefit from agglomeration effects, which might lead to growing polarization between regions without government intervention (BERGSTRÖM, 2000). The second argument, efficiency, emphasizes the role of government in reducing different market failures that hinder profitable firms from implementing profitable projects. Such market failures are found to be higher in more remote regions (see e.g. COVAL and MOSKOWITZ, 1999).

The use of public resources may also result in a loss of efficiency. Inefficiencies arise if firms could implement their projects even without the public subsidies. Here, we are interested in deadweight spending, i.e., funding allocated to these non-additional projects. This topic has continually become more important in the EU expenditure evaluation, where the demands to maximize the 'added value' of spending have risen (cf. MAIRATE, 2006).

The problem of deadweight spending has been previously studied with a variety of methods (ROBINSON *et al.*, 1987; FOLEY, 1992; DE KONING, 1993; LENIHAN, 1999; LENIHAN *et al.*, 2005; TOKILA and HAAPANEN, 2009). A regional comparison of deadweight spending has been absent in the previous studies, however, even though many subsidy schemes are based on regional allocation. This applies to EU regional aid, which is granted according to the disadvantage level of the region. If a policy is well specified, deadweight spending should be minimal and no regional differences should be discovered. To study this, we conduct an evaluation of the regional business subsidies in Finland in 2000–2003. This study represents *ex ante* evaluation, which is needed to ensure the internal coherence of the programme (see JAKOBY, 2006). Furthermore, these results can be used to improve the planning of future programmes. As *ex ante* evaluation, deadweight spending represents funding that is accepted to be wasted in advance. It is not necessarily the same as realized *ex post* deadweight spending (see comparison in TOKILA and HAAPANEN, 2009).

Next, prior literature on deadweight spending is discussed. The Finnish subsidy system is then briefly described, followed by a discussion of our unique data, which comprise 5744 private sector business projects that were granted public subsidies in 2000–2003. Deadweight spending is estimated for the National Assisted Areas of European regional policy. Our descriptive results show substantial regional differences in deadweight spending, which contradicts the hypothesis that the allocation of subsidies is coherently specified. To provide an explanation, an ordered probit model for deadweight is estimated for each assisted area. A decomposition analysis of pair-wise regional differences is implemented to study the extent to which the regional differences can be explained by the differences in the business projects across the assisted areas. Before the concluding remarks, the policy implications are discussed.

Literature on deadweight spending

Theoretically, deadweight is defined as one of the two counterfactual components of additionality[1]; the other is displacement[2]. Additionality measures the net sum of the direct and indirect impacts of intervention, whereas possible deadweight and displacement tend to reduce them. At the project level, deadweight can be identified as a non-additionality (LUUKKONEN, 2000). The studies on deadweight represent "external reviews on financial efficiency" in the field of policy evaluation (see classification by

TUROK, 1990). These studies emphasize efficiency in the provision of public finance instead of effectiveness in generating desired economic outcomes (FOLEY, 1992). The interest in deadweight developed substantially in the 1980s (e.g. LAYARD and NICKELL, 1980; ZIMMERMANN, 1985; ROBINSON *et al.*, 1987). Along with the increasing importance of EU regional policy, the concept of deadweight and other related topics have been brought back to the literature (e.g. LENIHAN, 1999, 2004; LENIHAN and HART, 2004; LUUKKONEN, 2000; HEIJS, 2003; PICARD, 2001; TOKILA *et al.*, 2008).

Deadweight spending can be defined and estimated in different ways. Generally, deadweight spending is measured as the share of a subsidy that is not required to implement a project or as the share of a subsidy for non-additional employment. They both are used to evaluate different kinds of subsidies, but in the end they both describe the same phenomenon: public finance that is not strictly required. Some confusion is caused by the fact that the term 'deadweight spending' is occasionally used as a synonym for 'deadweight', that is, the extent to which projects would have gone ahead even without public assistance (e.g. ROBINSON *et al.*, 1987).

Since deadweight spending represents a loss of efficiency in the regional policy, the purpose of the government is to avoid or minimize deadweight spending. The evidence from prior studies shows that deadweight spending is a serious problem. The actual results vary according to the projects examined and the assumptions made. The degree of deadweight spending can be as large as 90% of subsidies (e.g. FOLEY, 1992), though DE KONING (1993) discovered deadweight spending as low as 40%. LENIHAN (1999) and LENIHAN *et al.* (2005) found deadweight spending to be between 40 and 80%. LENIHAN and HART (2004) estimated the range of deadweight spending to be 42.6–55.8%. TOKILA and HAAPANEN (2009) provided prior, but rather inexact, figures from Finland. They estimated deadweight spending between 0.2 and 63.5% using the public assessment. Assuming partial deadweight to be 50%, the deadweight spending was 31.9%.

Even if policies are planned carefully, deadweight spending is not completely avoidable because the government has never full information about a firm's actions in the absence of the subsidy (LAYARD and NICKELL, 1980). The source of deadweight spending lies in the asymmetry of information between the government and the private firm (PICARD, 2001). This was supported by TOKILA and HAAPANEN (2009) with the Finnish data.

Data and business subsidies

The Ministry of Trade and Industry (KTM) is the major distributor of aid to business, with over 50% of all subsidy appropriations in Finland. Although KTM participates in business venturing with many instruments such as loans and guarantees, the subsidies that we are concerned with are all grants. The recipient firm is not obliged to pay back the grant to the distributor. In 2000–2003, three types of direct business were available for firms: subsidies for investment, business start-up and development projects. These subsidies were granted to micro, small and medium-sized enterprises[3] and, in rare cases, to larger enterprises.

Investment subsidies can be granted to a firm for fixed asset investment projects when the firm is starting business, expanding its operations, or modernizing its fixed assets. A start-up subsidy can be granted to a small business starting its operations. Development subsidies can be granted for projects that enhance the competitiveness or internationalization of enterprise in the long term (MINISTRY OF JUSTICE, 2006). For development projects, the intensity of assistance is generally higher, reaching up to 50% of accepted costs. Start-ups are eligible to support up to 45% of accepted costs. With regard to investment projects, small firms may be granted 10–30% of the costs and medium sized firms 5–20% of the costs, but these figures are only directive (MINISTRY OF JUSTICE, 2000).

In practice, the subsidies are applied from the 15 local Employment and Economic Development Centres, where they are also mostly granted[4]. To be subsidized, a business must present feasible project and financing plans along with an assessment made by the researchers at the Employment and Economic Development Centre. In the assessment process, the project, the applicant firm and the need for public finance are fully described and evaluated. In addition, the predicted impacts of the project must be favourable.

We investigate deadweight spending in projects for which the Ministry of Trade and Industry granted subsidies between 2000 and 2003. Our data set comprises all the financed projects, whereas only those conducted by private sector firms were selected for the analysis.[5] The total amount of subsidies granted to these 5 744 projects is nearly € 205 million, and their total value is € 906 million. Average size of the project is € 158 000 (see Table 2 for details). The data set is extensive compared to many previous studies on deadweight spending (see reviews by FOLEY, 1992, and LENIHAN *et al.*, 2005), and it includes a broad range of information on the firms and their projects (see Table 4 below). Importantly, the register data set contains information on the assessment process in which the project and the firm are evaluated.

A fundamental difficulty in an evaluation is to establish what would have happened in the absence of intervention (MARTIN and TYLER, 2006; see also discussion in BASLÉ, 2006). In our study, the counterfactual is formed in the assessment, where the researchers answer a hypothetical question of what would happen if the project were not subsidized. The options they face are as follows: (1) the project will be abandoned; (2) the project will be implemented on a reduced scale; (3) the project will be implemented on a reduced qualitative level; (4) the project will be implemented at a later date; and (5) the project will be implemented unchanged. Hence, option (1) implies zero deadweight, options (2)–(4) imply partial degrees of deadweight, and option (5) implies pure deadweight. The frequency distribution of this deadweight measure is shown in Table 1. Over 80% of projects would have been implemented somehow even without the subsidy. Thus, some form of deadweight exists in most of the projects.[6]

<TABLE_1>

This assessment is used in calculation of deadweight spending, which measures the amount of spending on non-additional shares of the project. As such, our study represents *ex ante* evaluation. The appraisal of deadweight is made beforehand by the authorities, and thus deadweight spending can be interpreted as "accepted wasted money". In practice, the deadweight spending, d_i, is computed by multiplying the amount of public subsidy for project *i*, s_i, by the degree of deadweight, δ_{ij}:

$$d_i = s_i \delta_{ij}, \qquad j = 1, 2, 3, 4, 5 \tag{1}$$

where $\delta_1 = 0$ (zero deadweight), $\delta_5 = 1$ (full deadweight), and the degree of deadweight varies between 0 and 100%. Partial deadweight is a bit problematic to handle, as it can basically have any value between these limits. Fortunately, the order (2)–(4) emerges from the assessment guides of KTM (see also LENIHAN and HART, 2004). Therefore, we assume $\delta_2 = 0.25$ (reduced scale), $\delta_3 = 0.5$ (reduced qualitative level), and $\delta_4 = 0.75$ (reduced quantitative level). Since the estimates will depend on this operationalization, other scales are later used to check the robustness of our results.

In the regional analysis, the classification of National Assisted Areas for the funding period 2000–2006 is used (Figure 1). This classification is based on the regional level of development and development needs. Assisted Areas 1 and 2 have higher unemployment and weaker economic growth rates than the national average. Their economies depend heavily on the public sector as well as on agriculture and forestry. These two areas are identical to the European Union's Objective 1 Programme Area (i.e. Northern and Eastern Obj. 1). The Assisted Area 3 closely resembles the EU's Objective Programme Area 2.

<FIGURE_1>

Table 2 displays key descriptive statistics by region (see also Table 4 below and Table A1 in the Appendix). According to the treaty establishing the European Community (Article 87), public subsidies should be mainly targeted at lagging and peripheral regions (i.e. National Assisted Area 1). Hence, it is quite surprising to find that the intensity of assistance is, on average, almost as high in Assisted Area 1 as it is outside the Assisted Areas. The reasoning is that although more public subsidies are on average given to projects in Assisted Area 1 than outside the Assisted Areas, the project costs are also highest in Assisted Area 1. At the aggregate level, the largest shares of total assistance are allocated to Assisted Areas 1 and 3, even though the number of subsidized projects is highest outside the Assisted Areas.

<TABLE_2>

Regional deadweight measures are collected to Table 3. They show that the regional average of project-level deadweight varies between 32.3% (in Assisted Area 1) and 38.2% (in Assisted Area 3). The regional differences in average deadweight spending in monetary terms are more substantial. Somewhat surprisingly, the average deadweight spending is negatively associated with regional development and is highest in Assisted Area 1. However, the descriptive results suggest that regional differences in the deadweight spending are due to the larger amount of public subsidies given for projects in Assisted Area 1 rather than to a greater level of deadweight (see also Table 2). The largest amount of subsidies (€19.5 million) is wasted in Assisted Area 3. In total, €64.1 million is regarded as wasted spending.

<TABLE_3>

Methodology

The level of project deadweight is measured on an ordered, five-level scale ranging from 1 to 5. To model its determination, an ordered probit model is estimated for each region *r* (Assisted Area 1, 2, 3, and outside Assisted Areas). In each of the four regions, it is assumed that y_{ir}, the observed deadweight level of business project *i*, is determined according to a latent variable y_{ir}^*:

$$\begin{aligned} & y_{ir}^* = \beta_r' x_{ir} + \varepsilon_{ir}, \qquad i = 1, 2, \ldots, N_r, \qquad r = 1, 2, 3, 4 \\ & y_{ir} = j, \quad \text{if} \quad \kappa_{(j-1)r} < y_{ir}^* \leq \kappa_{jr}, \qquad j = 1, 2, 3, 4, 5 \\ & \varepsilon_{ir} \sim N(0, 1), \qquad \textstyle\sum_r N_r = N \end{aligned} \tag{2}$$

where x_{ir} is the vector of independent variables, β_r is a vector of unknown coefficients for a region *r*, and κs are unknown threshold parameters ($\kappa_0 = -\infty$ and $\kappa_5 = \infty$). For each region, the disturbance term, ε_{ir}, is assumed to be standard normally distributed. N_r is the number of observations in region *r*, and *N* is the total number of observations.

To explain the determination of the deadweight level in each region, we use variables describing the characteristics of the firm, project and region (Table 4); see Appendix, Table A1 for descriptive statistics. The theoretical hypotheses of these variables' behaviour can be drawn from the access to finance and risk literature.

The dummy variable of new firm indicates whether the firm was recently founded or has been operating for a longer time. The size of the firm is measured in terms of employees and annual turnover (€ millions) as well as with a self-employment dummy.[7] A firm's access to finance is likely to increase with business experience and size

(STOREY, 1994; WREN, 1998). Young firms do not have much evidence to show their competence and trustworthiness. Banks and other lenders may be too risk-averse, or too unfamiliar with the new business, to lend the money needed during the early loss-making and risky years. Small firms may also face financial constraints. Thus, public finance is more crucial for new and small firms, and wasted spending on these firms can be assumed to be lower.

<TABLE_4>

Alongside the characteristics of the firm, we must pay attention to the characteristics of the project, as it may have different risk attributes from the overall firm. Project costs and public subsidies are included as well as their interaction, intensity of assistance, which measures the amount of subsidies relative to the project costs. A high intensity of assistance may indicate dependence on public finance and thus decrease deadweight. At the same time, a high intensity and a large amount of public assistance may advance the chances of generating finance from the private sector. Three dummy variables control for the type of the project. Development projects are eligible for the highest intensity of assistance (ref. category), whereas investment projects are eligible for lower intensity, but the projects are larger in size. Starting a business is risky. Thus, start-up projects are supposed to have low deadweight.

Seven industry dummies capture the influence of factors common to all projects belonging to the same industry, with business as the omitted reference category. Traditionally supported industries (e.g. wood and transport industries) are assumed to show lower rates of deadweight, as they are dependent on the subsidies. Regional characteristics include unemployment rates and R&D expenditures. A high unemployment rate is often accompanied by a low regional level of purchasing power, which can have negative effect on financial capacity of the firms, thus inducing a severe need for subsidies. High R&D is often connected to low deadweight behaviour (e.g. HEIJS, 2003). Year dummies are used to capture cyclical changes in deadweight. It is expected that at the beginning of the program period, deadweight is the largest; grants are probably distributed more loosely as plenty of money still exists.

After estimating the model for the level of deadweight, we compute the expected value of the deadweight spending, $E(d_{ir})$, as follows:

$$E(d_{ir}) = s_{ir} \sum_{j=1}^{5} \delta_j P(y_{ir} = j), \qquad (3)$$

where s_{ir} is the amount of subsidy given to project *i* in region *r*, $P(y_{ir} = j)$ is the estimated probability of deadweight level *j*, and δ_j is the assumed degree of deadweight at that level (see equation 1 above). The probability of deadweight level *j* can be computed using the ordered probit model:

$$P(y_{ir} = j) = \Phi\left(\kappa_{jr} - \beta_r' x_{ir}\right) - \Phi\left(\kappa_{(j-1)r} - \beta_r' x_{ir}\right), \qquad (4)$$

where Φ (.) denotes the cumulative distribution function of the standard normal.

To evaluate the impact of particular explanatory variables on the expected deadweight spending, marginal effects are computed. By differentiating equation (3), the marginal effect for k^{th} explanatory variable x_{ir}^k is:

$$\frac{\partial E(d_{ir} \mid x_{ir})}{\partial x_{ir}^k} = s_{ir} \sum_{j=1}^{5} \delta_j \frac{\partial P(y_{ir} = j)}{\partial x_{ir}^k} \quad \text{if} \quad x_{ir}^k \neq s_{ir}, \qquad (5)$$

where the partial derivatives $\partial P_j \big/ \partial x_{ir}^k$ can be computed as shown, for example, in GREENE (2008). However, equation (5) is no longer valid for computing the marginal effect of subsidy s_{ir}. In that case, it has to be computed as a sum of the direct and indirect effects on deadweight spending using the product rule of differentiation:

$$\frac{\partial E(d_{ir} \mid x_{ir})}{\partial s_{ir}} = \sum_{j=1}^{5} \delta_j P(y_{ir} = j) + s_{ir} \sum_{j=1}^{5} \delta_j \frac{\partial P(y_{ir} = j)}{\partial s_{ir}}, \tag{6}$$

where the computation of $\partial P_j \big/ \partial s_{ir}$ is complicated by the fact that a marginal change in the subsidy will also change the intensity of assistance (another explanatory variable). The marginal effects are computed as discrete changes for non-continuous variables (cf. GREENE, 2008, p. 775).

Our descriptive analysis showed substantial regional differences in the average deadweight spending. These regional differences may simply result from discrepancies in the observed characteristics of the business projects and firms, or they may result from various characteristics having divergent effects on deadweight spending. To evaluate the amount explained by the observed differences in the characteristics, we adopt NEUMARK's (1988) decomposition analysis to our model (see also OAXACA and RANSOM, 1994; BAUER and SINNING, 2008). Namely, the difference in the expected deadweight spending between two regions, *A* and *B*, is expressed as follows:

$$\begin{aligned} E(d_{iA} \mid x_{iA}) - E(d_{iB} \mid x_{iB}) = & \left[E_{\beta^*}(d_{iA} \mid x_{iA}) - E_{\beta^*}(d_{iB} \mid x_{iB}) \right] \\ & + \left[E_{\beta_A}(d_{iA} \mid x_{iA}) - E_{\beta^*}(d_{iA} \mid x_{iA}) \right] \\ & + \left[E_{\beta^*}(d_{iB} \mid x_{iB}) - E_{\beta_B}(d_{iB} \mid x_{iB}) \right] \end{aligned} \tag{7}$$

The first term in square brackets on the right-hand side estimates the impact of the differences in the observed characteristics assuming similar behaviour across regions, whereas two latter terms estimate the behavioural differences assuming the same observed characteristics. A pooled model is used to derive the coefficient vector β^* in the absence of regional differences in the determination of deadweight spending. It captures the general structure of deadweight spending in the two compared regions. In practice, for each pair-wise comparison of regions, three models are estimated: one for region *A*, one for region *B*, and a pooled model for regions *A* and *B*. Expected deadweight spending values are then calculated for each observation in the two regions, and the terms in equation (7) are computed using regional averages of these predictions.

Results

Table 5 displays the estimation results of the ordered probit models for deadweight (cf. equation 2). The first four columns give estimates for the assisted areas, followed by estimates for the whole country. The latter estimates, however, conceal significant differences in the estimated behavioural parameters between the four areas: an approximate Likelihood Ratio test clearly rejected the homogenous specification in column 5.[8] Therefore, we conclude that the separate regional models reported in columns 1–4 are warranted. However, these results are not discussed in more detail, as they are only an intermediate step in the computation of the expected deadweight spending and marginal effects.

<TABLE_5>

The marginal effects show the direction and size of the effects on deadweight spending (Table 6). They have been computed using equation (5) and the regional averages of the explanatory variables ($\bar{x}_r$). To allow for comparison across the assisted areas, the percentage change in expected deadweight spending is reported in square brackets below the marginal effect.

As expected, deadweight spending tends to be smaller in the projects implemented by recently established firms, *ceteris paribus*. The marginal effect is largest in Assisted Area 1 (the area of lowest economic development): expected deadweight spending decreases by 8.2% from € 16 800 to € 15 423. Outside the Assisted Areas, deadweight spending is much smaller (-34%) for projects run by a self-employed person than for other projects. In Assisted Area 3, deadweight spending decreases with the number of employees but increases with the firm's turnover; when the turnover increases from the regional average of € 1.89 million to € 2.89 million, the expected deadweight spending increases by € 156, from € 10 648 to € 10 804. Although the impact is significant, it is small (1.5%).

<TABLE_6>

As discussed above, the interpretation of the marginal effects of public subsidies is complicated by the fact that a marginal change in the subsidy will also change the intensity of assistance. To allow for this indirect effect, we have also computed the marginal effects using equation (6). Our calculations imply that a € 10 000 increase in the amount of public subsidies raises deadweight spending by € 3 408 (20.3%) in Assisted Area 1, € 2 669 (18.1%) in Assisted Area 2, € 3 262 (30.6%) in Assisted Area 3, and € 2 693 (36.1%) outside the Assisted Areas. Similar computations for project costs imply that a € 10 000 increase in project costs has a negative impact on deadweight spending in Assisted Area 1 (- € 105) but a positive impact in all other areas (€ 66 – € 213). Looking solely at the intensity of assistance, it has a significant negative effect on deadweight spending in Assisted Area 3 and outside the Assisted Areas, ceteris paribus. The negative effect for Assisted Area 2 (or positive for Area 1) is not statistically significant.

Even after controlling for other factors, deadweight spending in Assisted Area 1 is estimated to be much (23.1% and 17.5%) higher on investment and start-up projects relative to development projects. In Assisted Area 3, the deadweight spending is particularly small for start-up projects, and outside the Assisted Areas it is particularly small for investment projects. No large differences exist between project types in Assisted Area 2. Overall, deadweight spending is particularly high in real estate, renting and business activities (ref. category) and is small in the wood industry. For example, the difference between these sectors in deadweight spending is almost 34% in Assisted Area 1. In Assisted Areas 2 and 3, the industry differences are considerably smaller, but again deadweight spending is smallest in the wood industry. No significant industry differences are found outside the Assisted Areas.

Of the regional variables, the marginal effect of the unemployment rate is only significant outside the Assisted Areas, and its magnitude is minor; a one percentage point increase in the unemployment rate raises expected deadweight spending by € 68 (i.e. 1%). In Assisted Area 3 and the outside Assisted Areas, the impact of regional R&D expenditures on the expected deadweight spending is positive. As we expected, deadweight spending tends to be higher during the beginning of the programme period (year 2000), when the programme is not stabilized and more funding are available. This calls for a closer selection of subsidized projects over the course of the programme period.

We turn to the question of whether the significant regional differences in deadweight spending can be explained by differences in the analyzed project, firm, and regional characteristics. Table 7 displays the decomposition of expected pair-wise regional differences in deadweight spending (cf. equation 7). The decomposition breaks the difference down to explicable and unexplained composites. In the first row, Assisted Areas 1 and 2 are compared. The results imply that of the average difference in the expected deadweight spending (€ 2 090), approximately 66% is explained by the analyzed characteristics. In all other pair-wise comparisons, a considerably larger proportion is explained (92.9–99.3%). For example, of the largest difference in expected deadweight spending (€ 9 344), almost 99% is explained by the differences in the observed factors between projects in Assisted Area 1 and outside the Assisted Areas. Similarly, the € 6 152 difference between Assisted Areas 1 and 3 is explained to a great extent (93.5%).

<TABLE_7>

Recall that so far we have assumed that in the cases of partial deadweight, reduced scale implies 25%, reduced qualitative level implies 50% and later date implies 75% of deadweight; see equation (1). To confirm that this assumption is not driving our decomposition results, the analyses were also conducted using alternative assumptions: that reduced scale, reduced qualitative level and later date all imply 50% of deadweight, and that reduced scale implies 50%, reduced qualitative level implies 70% and later date implies 90% of deadweight ("a conservative view"). The results of these robustness checks are reported in Table 8. For brevity, only the pair-wise regional differences due to differences in characteristics are reported. As seen in columns A.1–A.3, the results are quite robust to the computation of deadweight spending.

In our analyses, we have imputed missing values for a firm's turnover or number of employees. A second robustness check investigates the role of this procedure (columns B.1–B.3). Namely, the 812 projects with missing values were deleted from the data and the decomposition analyses were performed using the alternative assumptions about the deadweight spending as discussed above. Again the conclusion remains unchanged; apart from the difference between Areas 1 and 2, a very large proportion of the regional differences in deadweight spending can be explained by the observed factors.

<TABLE_8>

Policy implications

The tendency in EU regional policy is to limit available funding and to concentrate on the least-developed regions (see e.g. MAIRATE, 2006). Thus, we compare current policy to schemes where the subsidies are reallocated between the regions and finally also diminished in aggregate size (Table 9). In the alternative schemes, grants are redistributed evenly relative to the current amount of subsidies given to the projects. Then, deadweight spending is predicted for each project, and regional aggregates are computed.

The schemes that reallocate subsidies from developed regions to less-developed regions lower deadweight spending. When subsidies are distributed from outside assisted areas evenly to all assisted areas (i.e. case 2a), the total deadweight spending is decreased by 17.4%. A larger decrease is achieved if subsidies are concentrated on the most remote regions, i.e. on Assisted Areas 1 and 2. When these subsidies are merely distributed to Assisted Area 1, the decrease is 19.8% (case 2b), and it is even higher (21.7%) when dividing them between Areas 1 and 2 (case 2c). Reducing the amount of subsidies by 50% diminishes deadweight spending by 69% if subsidies are distributed to Assisted Area 1 (case 3a) and by approximately 55% if they are distributed to Assisted Areas 1 and 2 (case 3b).

<TABLE_9>

Conclusions

In this paper, we have estimated the level of deadweight spending in Finnish regions, and provided explanations for the regional differences. Based on prior literature, a relatively high deadweight was expected, but only little was known about its regional variation in advance. Thus, our results provide new information on the regional allocation of enterprise financing.

First, our descriptive analysis of deadweight spending showed substantial regional differences. It is, on average, the highest in Assisted Area 1 and the lowest outside the Assisted Areas. This difference is not explained by the variation in the level of deadweight but rather by the sizes of subsidies (and projects). Second, our econometric analysis showed regional variation in the determination of deadweight spending. These differences were particularly large for variables describing the type of the project and the size and industry of the firm. Third, the observed discrepancies explained a majority of the pair-wise regional differences in the expected deadweight spending. Only the comparison between Assisted Areas 1 and 2 indicates some sort of unexplained difference in spending. Hence, subsidies may be wasted more easily in Assisted Area 1 than in Assisted Area 2. Finally, we also compared current policy to alternative schemes that reallocate subsidies from developed regions to less-developed regions. Our findings suggest they would significantly lower deadweight spending.

This paper has provided one viewpoint of efficiency of regional enterprise financing. It shows that regional business subsidies are not intended to be very efficient, since relatively high wasted spending is accepted *ex ante*. More efficiency can be achieved by concentrating on projects that cannot be implemented in the absence of the subsidy. However, even if policies are planned carefully, deadweight spending is not completely avoidable. The reason is that the government never has full information about a firm's action in the absence of the subsidy. Deadweight spending does not, however, describe the benefits of subsidies as such. The subsidies have a variety of direct and indirect impacts on regional development. To get a fuller picture of the added value of regional subsidies in different types of areas, a further evaluation of their effectiveness and displacement effects is certainly needed.

Appendix

Table A1. Mean values of variables by region

Variable	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas
Firm characteristics				
New firm	0.247	0.241	0.218	0.252
Self-employed	0.041	0.064	0.074	0.041
Employees (persons)[a]	16.602	13.253	16.526	15.930
Turnover of firm (€ millions)[a]	1.660	1.424	1.891	1.743
Project characteristics				
Public subsidy (€ 1 000)	63.218	47.519	31.101	21.206
Project costs (€ 1 000)	209.585	177.363	193.844	91.761
Intensity of assistance	35.895	32.057	27.087	34.899
Type of project				
Investment project	0.647	0.715	0.621	0.315
Start-up project	0.265	0.242	0.295	0.510
Development project (ref.)	0.087	0.043	0.083	0.175
Industry				
Metal	0.252	0.154	0.317	0.219
Wood	0.143	0.205	0.150	0.087
Other manufacturing	0.249	0.194	0.243	0.293
Trade	0.041	0.134	0.044	0.053
Transport	0.020	0.059	0.007	0.014
Business services (ref.)	0.221	0.143	0.170	0.263
Other industries	0.073	0.112	0.069	0.071
Regional characteristics				
Unemployment rate	14.994	15.412	12.962	10.063
R&D expenditure	0.266	0.114	0.375	6.635
Year				
2000	0.371	0.405	0.356	0.312
2001	0.337	0.324	0.306	0.348
2002	0.207	0.190	0.230	0.228
2003 (ref.)	0.085	0.082	0.108	0.112
Number of observations	1 075	748	1 846	2 075

Notes: Definitions of variables are given in Table 4. [a)] observations with missing information have been imputed by regressing turnover and number of employees on the remaining variables.

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FIGURES AND TABLES

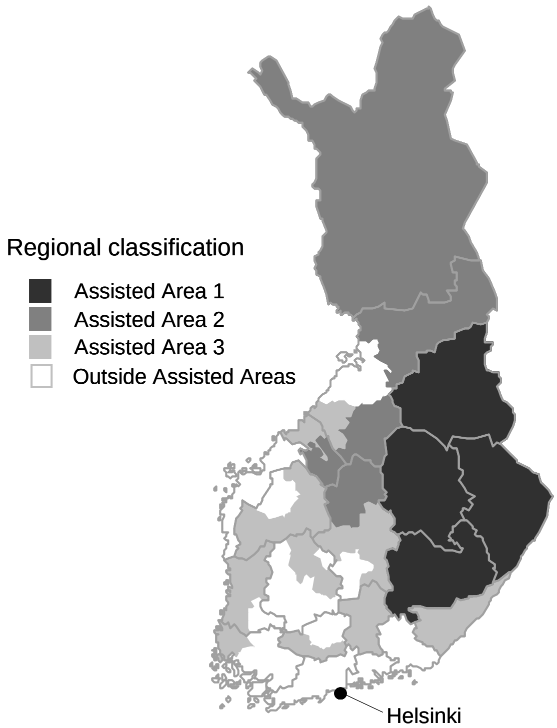

Figure 1. National Assisted Areas in 2000–2006 in Finland (with borders of NUTS III regions)

Table 1. Frequency distribution of deadweight

Deadweight	Number	Percentage
(1) Zero deadweight	967	16.8%
(2) Reduced scale	2 264	39.4%
(3) Reduced qualitative level	1 640	28.6%
(4) Later date	791	13.8%
(5) Full deadweight	82	1.4%
Total	5 744	100%

Notes: First the number of observations is given, followed by the percentages.

Table 2. Description of project characteristics by region

	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	All Areas
Project level averages					
Public subsidies, € 1 000	63.2 (197.7)	47.5 (120.1)	31.1 (70.0)	21.2 (25.7)	35.6 (106.0)
Project costs, € 1 000	209.6 (685.8)	177.4 (506.5)	193.8 (1231.0)	91.8 (194.5)	157.8 (790.2)
Intensity of assistance, %	36.0 (8.5)	32.2 (9.9)	27.1 (15.2)	34.9 (16.3)	32.3 (14.5)
Aggregate level					
Public subsidies, € 1 000	67 959	35 554	57 412	44 002	204 917
Project costs, € 1 000	225 303	132 668	357 836	190 403	906 210
Intensity of assistance, %	30.2	26.8	16.0	23.1	22.6
Number of observations	1 075	748	1 846	2 075	5 744

Notes: Standard deviations are given in parenthesis below the means.

Table 3. Deadweight and deadweight spending by region

	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	All Areas
Distribution of deadweight					
Zero deadweight, %	24.6	18.3	14.2	14.6	16.8
Reduced scale, %	38.1	34.1	36.9	44.2	39.4
Reduced qualitative level, %	23.3	30.9	31.3	28.0	28.6
Later date, %	11.5	16.3	17.0	11.2	13.8
Full deadweight, %	2.5	0.4	0.5	2.0	1.4
Total, %	100.0	100.0	100.0	100.0	100.0
Average project-level deadweight, %	32.3 (26.0)	36.6 (24.6)	38.2 (23.8)	35.5 (23.5)	35.9 (24.3)
Average project-level deadweight spending, € 1 000	16.9 (57.1)	14.7 (34.4)	10.5 (22.5)	7.4 (11.5)	11.1 (31.4)
Total deadweight spending, € 1 000	18 161.6	10 977.2	19 466.4	15 456.6	64 061.7
Number of observations	1 075	748	1 846	2 075	5 744

Notes: Standard deviations are given in parenthesis below the means.

Table 4. Definitions of variables

Variable	Definition
Firm characteristics	
New firm	1 if the project is implemented by a new firm that is up and running in the subsidy year (definition by Statistics Finland); 0 otherwise.
Self-employed	1 if the project is implemented by a self-employed person; 0 otherwise.
Employees[a]	The number of employees in the firm.
Turnover of firm[a]	Annual turnover of firm (€ millions).
Project characteristics	
Project costs	Total project costs (i.e. purchasing cost of the fixed assets) as estimated by the firm in its subsidy application (€ 1 000).
Public subsidy	Amount of public subsidy to the business project (€ 1 000).
Intensity of assistance	Ratio of the public subsidy to the project costs (%).
Investment project	1 if the project is an investment project; 0 otherwise.
Start-up project	1 if it is about starting up a business; 0 otherwise.
Development project	1 if it is a development project (enhancing competitiveness or internationalization of enterprise); 0 otherwise. (reference)
Industry	
Metal	1 if the project is manufacturing of fabricated metal products; 0 otherwise.
Wood	1 if the project is manuf. of wood and of products of wood and cork, incl. furniture, or of articles of straw and plaiting materials; 0 otherwise.
Other manufacturing	1 if the project is in another manufacturing industry (including textiles, rubber and plastic products, food products and beverages); 0 otherwise.
Trade	1 if the project is in wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods, or hotels and restaurants; 0 otherwise.
Transport	1 if the project is in transport, storage and communication, or financial intermediation; 0 otherwise.
Business services	1 if the project is in real estate, renting, and business activities; 0 otherwise. (reference)
Other industries	1 if the project is in another industry; 0 otherwise.
Regional characteristics	
Unemployment rate	Unemployment rate (%) in the municipality where the firm is located. Source: Statistics Finland.
R&D expenditures	Research & Development expenditures (€ 100 million) in the NUTS4 region where the firm is located. Source: Statistics Finland.
Location[b]	
Assisted Area 1	1 if the project is implemented in the National Ass. Area 1; 0 otherwise.
Assisted Area 2	1 if the project is implemented in the National Ass. Area 2; 0 otherwise.
Assisted Area 3	1 if the project is implemented in the National Ass. Area 3; 0 otherwise.
Outside Assistance Areas	1 if the project is implemented outside National Assisted Areas 1–3; 0 otherwise.

Notes: Only projects of private firms are included. Data also include four year dummies (2000–2003) that describe when the funding was granted. Industry dummies have been created using the TOL 2002 industrial classification. [a)] Observations with missing information have been imputed. [b)] See Ministry of Justice (2000) for a description of the Assisted Areas (see also Figure 1).

Table 5. Parameter estimates of the ordered probit models

Variable	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	All Areas
New firm	-0.092	-0.039	-0.076	-0.001	-0.031
Self-employed	-0.082	0.198	-0.147	-0.595***	-0.192***
Employees	0.004	-0.017	-0.027*	0.018	0.001
Turnover of firm	0.014	0.020	0.023**	-0.002	0.012*
Public subsidy	-0.053**	-0.056*	-0.017**	0.007	-0.006
Project costs	0.013*	0.010	0.000	-0.002	-0.001
Intensity of assistance	0.014	-0.006	-0.012*	-0.017***	-0.017***
Investment project[a]	0.259	-0.010	0.000	-0.227	-0.167**
Start-up project[a]	0.191	0.078	-0.257**	0.082	-0.010
Metal[b]	-0.179*	0.022	-0.113	-0.037	-0.087*
Wood[b]	-0.393***	-0.185	-0.162*	-0.047	-0.172***
Other manufacturing[b]	-0.194*	0.000	-0.162*	0.025	-0.090**
Trade[b]	-0.118	0.059	-0.107	-0.075	-0.044
Transport[b]	-0.195	0.032	-0.390	-0.154	-0.115
Other industries[b]	-0.276*	-0.091	0.035	0.094	-0.012
Unemployment rate	-0.002	0.014	-0.017	0.015*	0.009*
R&D expenditure	-0.019	-0.119	0.106*	0.010***	0.009***
2000[c]	0.324***	0.249	0.156*	-0.032	0.149***
2001[c]	-0.025	0.052	0.005	0.058	0.026
2002[c]	-0.071	-0.077	0.038	0.068	0.013
Threshold parameters					
κ_1	-0.202	-0.929*	-1.766***	-1.510***	-1.509***
κ_2	0.833	0.059	-0.632*	-0.204	-0.372***
κ_3	1.612***	0.994*	0.302	0.708***	0.515***
κ_4	2.536***	2.726***	1.963***	1.649***	1.699***
Log-likelihood	-1 470.05	-997.858	-2 416.97	-2 705.571	-7 710.41
Number of observations	1 075	748	1 846	2 075	5 744

Notes: Dependent variable is the level of deadweight (1, 2, 3, 4, 5) in project *i*. Estimated parameters are reported. Significance levels are based on robust standard errors. Definitions of variables are given in Table 4. * (**, ***) = statistically significant at the 0.10 (0.05, 0.01) level. [a)] Reference is development project; [b)] Reference industry is business services; [c)] Reference year is 2003.

Table 6. Marginal effects on the deadweight spending (€ 1 000)

Variable	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	All Areas
New firm	-1.377	-0.420	-0.518	-0.006	-0.251
	[-8.2%]	[-2.9%]	[-4.9%]	[-0.1%]	[-2.2%]
Self-employed	-1.221	2.147	-1.003	-2.557***	-1.529***
	[-7.3%]	[14.6%]	[-9.4%]	[-34.3%]	[-13.7%]
Employees (10 persons)	0.054	-0.184	-0.185*	0.084	0.008
	[0.3%]	[-1.3%]	[-1.7%]	[1.1%]	[0.1%]
Turnover of firm (€ million)	0.214	0.212	0.156**	-0.007	0.093*
	[1.3%]	[1.4%]	[1.5%]	[-0.1%]	[0.8%]
Public subsidy (€ 10 000)	-0.799**	-0.602	-0.117	0.031	-0.049
	[-4.8%]	[-4.1%]	[-1.1%]	[0.4%]	[-0.4%]
Project costs (€ 10 000)	0.195*	0.111	-0.003*	-0.010	-0.010
	[1.2%]	[0.8%]	[0.0%]	[-0.1%]	[-0.1%]
Intensity of assistance	0.208	-0.068	-0.083*	-0.080***	-0.134***
	[1.2%]	[-0.5%]	[-0.8%]	[-1.1%]	[-1.2%]
Investment project[a]	3.874	-0.104	-0.001	-1.033	-1.352**
	[23.1%]	[-0.7%]	[0%]	[-13.9%]	[-12.1%]
Start-up project[a]	2.932	0.847	-1.740**	0.380	-0.080
	[17.5%]	[5.8%]	[-16.3%]	[5.1%]	[-0.7%]
Metal[b]	-2.663*	0.238	-0.772	-0.168	-0.703*
	[-15.9%]	[1.6%]	[-7.2%]	[-2.3%]	[-6.3%]
Wood[b]	-5.692***	-1.995**	-1.101*	-0.213	-1.372***
	[-33.9%]	[-13.6%]	[-10.3%]	[-2.9%]	[-12.3%]
Other manufacturing[b]	-2.882*	0.005	-1.106*	0.116	-0.723**
	[-17.2%]	[0.0%]	[-10.4%]	[1.6%]	[-6.5%]
Trade[b]	-1.758	0.635	-0.728	-0.342	-0.355
	[-10.5%]	[4.3%]	[-6.8%]	[-4.6%]	[-3.2%]
Transport[b]	-2.867	0.345	-2.615	-0.693	-0.921
	[-17.1%]	[2.3%]	[-24.6%]	[-9.3%]	[-8.2%]
Other industries[b]	-4.027*	-0.980	0.240	0.435	-0.100
	[-24.0%]	[-6.7%]	[2.3%]	[5.8%]	[-0.9%]
Unemployment rate	-0.031	0.156	-0.118	0.068*	0.073**
	[-0.2%]	[1.1%]	[-1.1%]	[0.9%]	[0.6%]
R&D expenditure	-0.289	-1.282	0.723*	0.047***	0.073***
	[-1.7%]	[-8.7%]	[6.8%]	[0.6%]	[0.7%]
2000[c]	4.932**	2.694	1.067*	-0.148	1.206***
	[29.4%]	[18.3%]	[10.0%]	[-2.0%]	[10.8%]
2001[c]	-0.374	0.559	0.035	0.267	0.211
	[-2.2%]	[3.8%]	[0.3%]	[3.6%]	[1.9%]
2002[c]	-1.059	-0.830	0.257	0.313	0.104
	[-6.3%]	[-5.6%]	[2.4%]	[4.2%]	[0.9%]
$E(y \mid \bar{x}_r)$	16.800	14.710	10.648	7.455	11.171

Notes: Marginal effects have been computed using equation (5). Percentage changes in the expected deadweight spending are given in square brackets below. Both are computed at the regional means of the explanatory variables ($\bar{x}_r$). Definitions of variables are given in Table 4. * (**, ***) = statistically significant at the 0.10 (0.05, 0.01) level. Statistical significance is based on 500 bootstrap samples. [a)] Reference is development project; [b)] Reference industry is business services; [c)] Reference year is 2003.

Table 7. Decomposition of pair-wise regional differences in the expected deadweight spending

Two regions compared	Due to differences in observed characteristics		Unexplained difference		Total difference	
Area 1 & Area 2	€ 1 383	(66.2%)	€ 707	(33.8%)	€ 2 090[a]	(100%)
Area 1 & Area 3	€ 5 749	(93.5%)	€ 402	(6.5%)	€ 6 152	(100%)
Area 1 & Outside	€ 9 229	(98.8%)	€ 116	(1.2%)	€ 9 344	(100%)
Area 2 & Area 3	€ 3 773	(92.9%)	€ 289	(7.1%)	€ 4 062	(100%)
Area 2 & Outside	€ 7 203	(99.3%)	€ 52	(0.7%)	€ 7 254	(100%)
Area 3 & Outside	€ 3 038	(95.2%)	€ 155	(4.8%)	€ 3 193	(100%)

Notes: Figures have been computed using equation (7) and the parameters reported in Table 5 (averages over observations). Area 1, 2, 3 = Assisted Area 1, 2, 3; Outside = Outside Assisted Areas. [a)] Average deadweight spending in Assisted Area 1 – Average deadweight spending in Assisted Area 2.

Table 8. Robustness checks of the pair-wise differences due to differences in characteristics, %

Two regions compared	Alternative specifications					
	A.1	A.2	A.3	B.1	B.2	B.3
Area 1 & Area 2	66.2%	66.3%	74.4%	70.6%	60.4%	69.8%
Area 1 & Area 3	93.5%	99.9%	99.0%	101.0%	102.1%	101.5%
Area 1 & Outside	98.8%	110.9%	103.2%	104.4%	111.0%	104.6%
Area 2 & Area 3	92.9%	106.6%	96.5%	88.5%	101.0%	89.1%
Area 2 & Outside	99.3%	116.3%	101.8%	100.7%	114.3%	100.9%
Area 3 & Outside	95.2%	116.0%	97.0%	97.3%	114.8%	97.8%
Imputed missing values[a]	yes	yes	yes	no	no	no

Notes: 1–3 indicate alternative assumptions about the computation of deadweight spending. [a)] Missing values are imputed for firm's turnover and number of employees.

Table 9. Estimated regional deadweight spending with alternative policy schemes (€ 1 000)

Policy schemes	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	Total
(1) Current policy					
Public subsidies	67 959	35 544	57 412	44 002	204 917
Deadweight spending	18 060	11 003	19 656	15 470	64 188
(2a) Redistribute grants from Outside Areas to Assisted Area 1, 2 and 3					
Public subsidies	86 542	45 263	73 111	0	204 917
	[+27.3%]	[+27.3%]	[+27.3%]	[-100%]	[0%]
Deadweight spending	18 602	11 323	23 077	0	53 002
	[+3.0%]	[+2.9%]	[+17.4%]	[-100%]	[-17.4%]
(2b) Redistribute grants from Outside Areas to Assisted Area 1 and 2					
Public subsidies	96 850	50 655	57 412	0	204 917
	[+42.5%]	[+42.5%]	[0%]	[-100%]	[0%]
Deadweight spending	19 325	11 254	19 656	0	50 235
	[+7.0%]	[+2.3%]	[0%]	[-100%]	[-21.7%]
(2c) Redistribute grants from Outside Areas to Assisted Area 1					
Public subsidies	111 961	35 544	57 412	0	204 917
	[+64.7%]	[0%]	[0%]	[-100%]	[0%]
Deadweight spending	20 796	11 003	19 656	0	51 455
	[+15.2%]	[0%]	[0%]	[-100%]	[-19.8%]
(3a) Reduce the amount of grants by 50% and distribute them all to Assisted Area 1 & 2					
Public subsidies	67 273	35 185	0	0	102 458
	[-1.0%]	[-1.0%]	[-100%]	[-100%]	[-50.0%]
Deadweight spending	18 082	10 978	0	0	29 059
	[+0.1%]	[-0.2%]	[-100%]	[-100%]	[-54.7%]
(3b) Reduce the amount of grants by 50% and distribute them all to Assisted Area 1					
Public subsidies	102 458	0	0	0	102 458
	[+50.8%]	[-100%]	[-100%]	[-100%]	[-50.0%]
Deadweight spending	19 816	0	0	0	19 816
	[+9.7%]	[-100%]	[-100%]	[-100%]	[-69.1%]
Number of observations	1 075	748	1 846	2 075	5 744

Notes: Regional aggregates are given. They are based on the project-level simulations using equations (3) and (4). Percentage changes relative to the current policy are given in square brackets below. In the alternative schemes grants are redistributed evenly relative to the current amount of subsidies given to the project.

Notes

[1] Besides project additionality, output additionality, input additionality, behavioural additionality and cognitive capacity additionality are also recognized in the subsidy literature (see DAVENPORT *et al.*, 1998; GEORGHIOU *et al.*, 2002).

[2] Displacement occurs if a subsidized project reduces activity elsewhere in the economy (TERVO, 1989, 1990).

[3] A micro-sized (small-sized, medium-sized) enterprise is an enterprise that employs fewer than 10 (50, 250) persons, has an annual turnover not exceeding €2 (10, 50) million or an annual balance sheet total not exceeding €2 (10, 43) million, and fulfils the characteristics depicting the autonomy of an enterprise (EUROPEAN COMMISSION, 2003).

[4] The Ministry of Trade and Industry only makes the financing decision in cases where the cost of the investment project exceeds € 1.7 million.

[5] One hundred public sector projects were excluded from the analysis.

[6] Possible bias problems in the deadweight measures are discussed in TOKILA and HAAPANEN (2009).

[7] We have missing values on the turnover or the number of employees for 812 observations. These missing values were imputed using predicted values from two regression models, where turnover and number of employees were regressed on the remaining variables in the data.

[8] The LR-test compares the sum of the log-likelihoods of the regional models with the log-likelihood for the whole country. The $\chi^2(72)$ distributed test statistic was 239.9 ($p < 0.001$). We also estimated parameters in column 5 together with three regional dummies, but the specification was rejected in favour of columns 1–4 (LR-test statistic = 223.7).