Evaluation of deadweight spending in regional enterprise financing

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Abstract

Objectives: Deadweight spending is a serious indicator of inefficiency in public enterprise financing. It means that firms receive subsidies for projects that would have been implemented even without the subsidy. In other words, public money is wasted. Here, we conduct an evaluation of the Finnish business subsidies. Our aim is to derive total and regional estimates for the deadweight spending and provide explanation for possible regional differences. Our data set comprises all 5 744 private sector business projects that were granted direct business subsidies in 2000–2003.

Prior work: The interest in the concept of deadweight developed much in the 1980s (see e.g. Layard and Nickell, 1980; Robinson et al., 1987). Along with importance of the EU regional policy, deadweight related topics have been brought back to the literature (see e.g. Lenihan, 1999, 2004; Luukkonen, 2000; Heijs, 2003; Picard, 2001; Tokila et al., 2008). Here, we utilize and develop the concepts and methods of deadweight spending building on the prior literature as well as bring out its regional aspect. The theoretical hypotheses of determination of deadweight spending are drawn from the literature on finance and risk.

Approach: Deadweight spending is calculated using deadweight distribution and granted subsidies. Determination of deadweight spending in each region is estimated using an ordered probit model that control for project, firm and regional level factors. Then we investigate the extent to which the regional differences in the deadweight spending can be explained by the observed variation in the control factors, and conduct simulations of alternative policy schemes.

Results: Our analysis reveals substantial regional differences; deadweight spending negatively associated with economic development. The results show that the deadweight spending is dependent on many firm, project and regional level factors, which also greatly account for regional differences. Our decomposition analysis shows that more than 65% of the pair-wise regional differences in the deadweight spending can be explained by the observed discrepancies in the analyzed factors. Nevertheless, there is seem to be some regional variation in deadweight spending that can originate from different approval processes of subsidies between regions.

Implications: The paper provides critical information on the wasted public subsidies for the policy makers who plan subsidy programs and for the authorities who grant the subsidies. In addition, this paper contributes to the scarce literature of project deadweight developing new approach.

Value: This paper provides new information on regional distribution of wasted public subsidies, which should interest all tax-payers. In addition, a synthesis of diverse prior literature on deadweight is made. The phenomenon of deadweight spending has not been studied within business subsidies of EU regional policy before.

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

JEL-codes: R58, H25, L53

1. Introduction

Many governments grant business subsidies in order to promote growth and employment in regions which are lagging behind. Also European Union provides this type of subsidies (e.g. Molle, 2007). To motivate these subsidies, two main arguments – namely equity and efficiency – have been used. Equity means that the government should aim at equalizing regional levels of development and thus, help the firms with economic problems in backward regions. The firms in these regions do not get 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[1]. Such market failures are found to be higher remoter the region is (see e.g. Coval and Moskowitz, 1999).

A loss of efficiency in the use of public resources, namely deadweight, may arise from different reasons. In that event, the firm could have implemented the project even without the received subsidy and thus public resources are wasted. Here, we are interested on deadweight spending i.e. funding on this kind of non-additional projects. This topic has become continually more important in the EU expenditure evaluation, when demands on maximization of 'added value' of spending have risen (cf. Mairate, 2006).

The problem of deadweight spending has been previously studied with diversity of methods (see e.g. Robinson et al., 1987; Foley, 1992; De Koning, 1993; Lenihan, 1999; Lenihan et al., 2005; Tokila and Haapanen, 2008). Regional comparison of deadweight spending has been absent in the previous studies, even though many subsidy schemes are based on regional allocation. This applies to EU regional aid, which is allowed according to disadvantage level of the region. If the 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 improve planning of future programmes.

First prior literature on deadweight spending is discussed. Then Finnish subsidy system is briefly described, followed by a discussion of our data and descriptive results. Our unique data comprise 5 744 private sector business projects that were granted public business subsidies in 2000–2003. To arrive at an estimate of the deadweight spending, defined as the non-additional share of the public assistance, we will distinguish between zero, partial, and pure deadweight. These estimates are calculated for the National Assisted Areas of European regional policy. Our descriptive results show substantial regional differences in the level of deadweight spending, which is against the hypothesis of coherently specified allocation of subsidies.

To provide explanation for the regional differences in the deadweight spending, ordered probit model for deadweight is estimated for each assisted area. Our explanatory variables include project-, firm- and regional-level factors. The models are used to predict expected deadweight spending for each project. A decomposition analysis of the pair-wise regional differences is then implemented, which allow us to study the extent to which the regional differences can be explained by the differences in the business projects across the assisted areas. Before concluding remarks policy implications of our results are discussed.

2. Literature on deadweight spending

Theoretically, deadweight is defined as one of the two counterfactual components of additionality[2], the other is displacement[3]. Additionality measures the net sum of the direct and indirect impacts generated due to intervention, whereas possible deadweight and displacement

[1] Besides 'equity' and 'efficiency', 'stability' is the third overarching objective of the EU regional policy (Molle, 2007).

[2] Additionality is a concept used with several meanings in the subsidy literature. Besides project additionality, output additionality, input additionality, behavioural additionality and cognitive capacity additionality are also known (see Davenport et al., 1998; Georghiou et al., 2002). Similarly, deadweight can be counterfactually recognized from these perspectives.

[3] Displacement occurs if subsidized project causes activity reduction elsewhere in the economy. Consideration of displacement is essential when evaluating regional net impacts of the policies (see e.g. Tervo, 1989; 1990).

tend to reduce them. At the project level, deadweight can be identified as a non-additionality (see e.g. Luukkonen, 2000). The studies on deadweight can be classified to the type of "external review: financial efficiency" in policy evaluation (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 much in the 1980s (see e.g. Layard and Nickell, 1980; Zimmermann, 1985; Robinson et al., 1987). Along with weight of the EU regional policy, the concept of deadweight and other related topics has been brought back to the literature (see 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 different ways. Generally, deadweight spending is measured as a share of subsidy that is not required to implement a project or as a share of subsidy for non-additional employment. The latter approach is suitable for employment based subsidies, but in the end they both describe the same phenomena: 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 to mere deadweight, that is, the extent to which projects would have gone ahead even without public assistance (e.g. Robinson et al., 1987).[4]

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 about the partial deadweight. Degrees of deadweight spending are up to 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 (2008) provide 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%.

However, it should be noted that deadweight spending is not completely avoidable. It would require that the government has full information on firm's action 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 (2008) with the Finnish data.

3. Data and business subsidies

The Ministry of Trade and Industry (KTM)[5] 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; that is, 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 the firms: subsidies for investment, business start up and development projects. These subsidies are granted to micro, small- and medium-sized enterprises[6], but only in rare cases to larger enterprises.

Investments subsidies can be granted to a firm for the fixed asset investment projects when a firm is starting business, expanding its operations, or modernizing its fixed assets. Start-up subsidy can be granted to a small business starting its operations. The aid is based on labour costs and/or investments. Development subsidies can be granted for the projects enhancing the competitiveness or internationalization of enterprise in the long term (Ministry of Justice, 2006). The intensity of assistance is dependent on type of assisted area, size of the firm, and form of

[4] In addition, the deadweight concept used here, i.e. project deadweight, is a one form of deadweight loss, which can be defined as a loss in economic efficiency in the market caused by, for example, taxation, subsidies, monopoly power, and price ceiling or floor (see e.g. Frank and Bernanke, 2001; Hines, 1999).

[5] However, the system for business subsidies is very fragmented. Public finance for enterprises is also granted by the ministries of Foreign Affairs, Transport and Communications, Labour, Agriculture and Forestry and Finance (Muotio, 1998).

[6] A micro-sized (small-sized, medium-sized) enterprise refers to enterprise which 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).

subsidy. 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 with 10–30% of the costs and medium-sized firms with 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[7]. To be subsidized, the presentation of feasible project and financing plans are required along with the 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 prediction on the impacts of the project must be favourable.

In the empirical analysis we investigate deadweight spending in these business projects, for which the Ministry of Trade and Industry granted subsidies between 2000 and 2003. Our data set comprise all the financed projects, of which 5 744 projects conducted by private sector firms were selected for the analysis.[8] The total amount of subsidies granted to these projects is nearly € 205 million and their total value reaches up to € 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 by the researchers at the Employment and Economic Development Centre.

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 is 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.

Table 1 shows frequency distribution of our deadweight measure. Partial deadweight dominates, while the number of full deadweight projects is the lowest. Over 80% of projects would have been implemented somehow even without the subsidy. Thus, some form of deadweight exists in most of the projects. However, this assessment conducted by a public sector researcher can be biased for different reasons. First, the researcher may not have full information of the firm due to asymmetric information. This bias is reduced by the fact that the assessment is done locally in the Employment and Economic Development Centres. Second, assessment may be influenced by subjective motives such as "pick-the-winners" effect. This means that authorities may favour the most potential projects, which could have been implemented unchanged without the subsidy, as those successful projects improve the records of the researcher and ensure performance pay. These possible bias problems are discussed with details in Tokila and Haapanen (2008).

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

[8] Also 100 public sector projects were subsidized from these funds, of which 93% were investment projects. These projects are excluded from the analysis as their subsidies are not directly granted to firms.

Table 1. Frequency distribution of deadweight

Deadweight	Frequency	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.

This deadweight assessment is used in calculation of deadweight spending, which measures the amount of spending on non-additional share of the project. As such this 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 a project *i*, s_i, with 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) and $\delta_5 = 1$ (full deadweight) as 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) emerge 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), $\delta_4 = 0.75$ (reduced quantitative level). Since the estimates will depend on the operationalization of the deadweight concept, other scales are also later used to check robustness of our results.

In the regional analysis, 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.

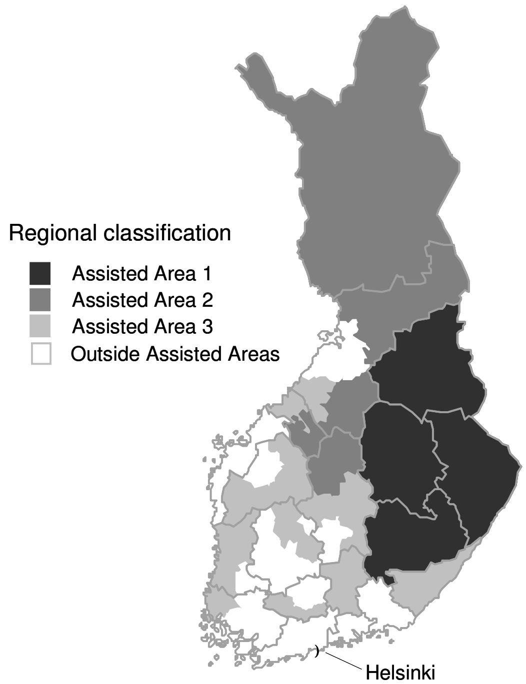

Figure 1. National Assisted Areas in 2000–2006 in Finland (with borders of NUTS III regions)

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. Projects in National Assisted Area 1 are eligible for the highest intensity of investment aid. Hence, it is quite surprising to find that intensity of assistance is, on average, almost as high in Assisted Area 1 as it is outside Assisted Areas. Reason for this finding is that although more public subsidies are on average given to projects in Assisted Area 1 than outside Assisted Areas, the project costs are also highest in Assisted Area 1.[9] 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 Assisted Areas.

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.

[9] Note also that the variation in the amount of public subsidies reduces gradually being by far largest in Assisted Area 1.

Regional deadweight measures are collected to Table 3. They show, first, some sort of deadweight in majority of projects. In Assisted Area 1, a share of projects with zero deadweight is greatest (24.6 %). The highest number of projects falls into a class of reduced scale in all the areas. Only a few projects would have been implemented unchanged without a subsidy (full deadweight). Second, average degrees of deadweight are the smallest in Assisted Area 1, where the deadweight spending is, however, on average the highest. On the contrary, total deadweight spending and the average degree of deadweight is the highest in Assisted Area 3. Hence, these descriptive results suggest that regional differences in the deadweight spending is due to larger amount of public subsidies given for projects in Assisted Area 1 than due to greater level of deadweight (see also Table 2). Looking at the standard deviations we can also see that the variation in the project-level deadweight spending is largest in Assisted Area 1. A comparison of Table 2 and 3 reveals this large variation does not arise from a particularly large variation in deadweight, but rather from a large variation in the amount of subsidies (see Table 2, row 1).

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.

4. Methodology

In the assessment 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 region, it is assumed that y_{ir}, the observed deadweight level of a business project *i*, is determined according to a latent variable y_{ir}^*:

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

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 $\kappa_5 = \infty$).[10] For each region the disturbance term, ε_{ir}, is assumed to be standard normal distributed. N_r is the number of observations in a region *r,* and *N* is the total number of observations.

[10] Due to normalization, only four threshold parameters, but no constant, are estimated.

In explaining the determination of deadweight in each region, we use variables describing the characteristics of the firm and the project as well as the characteristics of the region (Table 4); see Appendix, Table A1 for descriptive statistics of the variables. The theoretical hypotheses of variables' behaviour can be drawn from access to finance and risk literature; see also discussion Tokila and Haapanen (2008).

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 self-employment dummy.[11] The literature suggest that a firm's access to finance increases with business experience and size of the firm (e.g. 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 through the early loss-making and risky years. Small firms may also face financial constraints, as they are unlikely to be monitored by rating agencies or the financial press. Thus, public finance is more crucial for new and small firms, and part of wasted spending on them can be assumed to be lower.

[11] For 812 observations, we have missing values on the turnover or the number of employees. 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.

Table 4. Definitions of variables

Variable	Definition
Firm characteristics	
New firm	1 if the project is implemented by a new firm, which 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).

Alongside the characteristics of the firm, we must pay attention to the characteristics of the project as it may have different risk attributes than the overall firm. We include project cost and subsidies as well as their interaction, intensity of assistance, i.e. amount of public subsidies relative to project costs. High intensity of assistance may increase dependence from public finance and thus, decrease deadweight. High intensity of public assistance and large amount of public assistance may also advance the chances of generating finance from the private sector. In addition, three dummy variables (investment, start-up, development project) control for the project type. Development projects are eligible for the highest intensity of assistance, whereas investment projects are eligible for lower intensity, while the projects are larger in size. Also starting business can be assumed to be riskier than development projects by solid companies. Thus, development projects are those supposed with the lowest deadweight (ref. category; see also Heijs, 2003).

Seven industry dummies are used; business being the omitted reference category. The industry dummies can capture the influence of factors that are common to all projects belonging to the same industry. Traditionally supported industries (e.g. wood and transport industries) can be assumed to show lower rates of deadweight, as they are dependent on the subsidies. Regional characteristics include unemployment rate and R&D expenditure in the region. High regional rate of unemployment is often accompanied by a low regional level of purchasing power, which can have negative effect on financial capacity of the firms, thus inducing severe need for subsidies. High R&D is often connected with low deadweight behaviour (e.g. Heijs, 2003). Finally, the 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.

Our econometric model is used to obtain estimates for deadweight spending. Namely, 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 in that level (see equation 1 above). The probability of deadweight level *j* can be computed using our 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 $\Phi(.)$ 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_r^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 $\partial P_j / \partial x_{ir}^k$ can be easily computed; see, for example, Greene (2008). It is, however, important to note that equation (5) is no longer valid in the computation of the marginal effect of subsidy. In that case, the effect needs to be computed as:

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

where the computation of $\partial P_j / \partial s_{ir}$ is complicated by the fact that a marginal change in the subsidy will also change intensity of assistance (another explanatory variable). The marginal effects are computed as discrete changes for non-continuous variables (see e.g. discussion in Greene, 2008, p. 775): $E(d_r \mid x_r^k = a) - E(d_r \mid x_r^k = b)$. The marginal effects are computed using the regional average values of explanatory variables.

Our descriptive analysis showed substantial regional differences in the average deadweight spending - not only the amount of public subsidies but also in other factors. These regional differences may be simply result from the discrepancies in the observed characteristics of the business projects and firms, or they result from various characteristics having divergent effects on the 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:

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

The first term in square brackets on the right-hand side estimates the impact of the differences in the observed characteristics, whereas two latter terms estimate the behavioural differences assuming 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. That is, it captures the general structure of deadweight spending in the two regions compared. 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.

5. 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 this homogenous specification in column 5.[12] 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.

To obtain an overview of the direction and the size of the effects on deadweight spending, marginal effects are reported in Table 6. They have been computed using the equation (5) and the regional means of the explanatory variables ($\bar{x}_r$). In each model, a variable with a positive (negative) effect is associated with an increased (decreased) expected deadweight spending (€ 1 000). To allow for comparison across the assisted areas, a percentage change in the expected deadweight spending is reported in square brackets below the marginal effect. Marginal effects of dummy variables have been computed as discrete changes.

As expected, deadweight spending tends to be smaller in the projects implemented by recently established firms, *ceteris paribus*. The marginal effect is largest in the Assisted Area 1 (low economic development): expected deadweight spending decreases by 8.2%, from € 16 800 to € 15 423. Outside Assisted Areas deadweight spending is much smaller (34%) in projects run by self-employed person than in other projects. In Assisted Area 3, deadweight spending decreases with number of employees, but increases with 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%).

As discussed above, the marginal effects of public subsidies are complicated by the fact that a marginal change in the public grant will also change intensity of assistance. Thus the marginal effects reported in table 5 are not very informative in this case (cf. equation 5). To allow for indirect effects we have also computed the marginal effect using equation (6). Our calculations imply that € 10 000 increase in the amount of public subsidies raises deadweight spending by € 3 408 in Assisted Area 1, € 2 669 in Assisted Area 2, € 3 262 in Assisted Area 3, and € 2 693

[12] The LR-test compares the sum of the log-likelihoods of the regional models with 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).

Outside Assisted Area. Furthermore, we find that the deadweight spending decreases by approximately 1 per cent in Assisted Area 3 and outside Assisted Areas as the intensity of assistance increases by 1 per cent, ceteris paribus. No significant effects are found for Assisted Areas 1 and 2.

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 deadweight (1, 2, 3, 4, 5) in a 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.

Interestingly, even after controlling for other factors, including the size of the project, deadweight spending in Assisted Area 1 is much (23% and 17.5%) higher in the investment and start-up projects relative to the development projects. In Assisted Area 3, the deadweight spending is particularly small in start-up projects, and outside Assisted Areas in investment projects. No such a large differences between the project types exist in Assisted Area 2.

Looking at industry differences, overall, deadweight spending is particularly high in real estate, renting and business activities (ref. category), and small in wood industry. For example, their difference in the deadweight spending is almost 34% in Assisted Area 1. In Assisted Areas 2 and 3, deadweight spending is also smallest in the wood industry, but the industry differences are considerably smaller than in Assisted Area 1. No significant industry differences are found outside the assisted areas.

Of the regional variables, the marginal effect of unemployment rate is only significant for outside Assisted Areas: one percentage point raise in the unemployment rate increases expected deadweight spending by € 68 (i.e. 1%). In Assisted Area 3 and outside Assisted

Areas, the impact of the 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). This calls for a closer selection of subsidized projects in the future.

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	0.054	-0.184	-0.185*	0.084	0.008
(10 persons)	[0.3%]	[-1.3%]	[-1.7%]	[1.1%]	[0.1%]
Turnover of firm	0.214	0.212	0.156**	-0.007	0.093*
(€ million)	[1.3%]	[1.4%]	[1.5%]	[-0.1%]	[0.8%]
Public subsidy	-0.799**	-0.602	-0.117	0.031	-0.049
(€ 10 000)	[-4.8%]	[-4.1%]	[-1.1%]	[0.4%]	[-0.4%]
Project costs	0.195*	0.111	-0.003*	-0.010	-0.010
(€ 10 000)	[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.

Turning to the question of whether the significant regional differences in the deadweight spending can be explained by the differences in the analyzed project, firm, and regional characteristics. Table 7 displays decomposition of expected pair-wise regional differences in deadweight spending (cf. equation 7). When Assisted Area 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, considerably larger proportion of the regional difference is explained (92.9–99.3%). For example, of the largest difference in the expected deadweight spending (€ 9 344), almost 99% is explained by the differences in the observed factors between Assisted Area 1 and outside Assisted Areas. Similarly, € 6 152 difference between Assisted Areas 1 and 3 is explained to a great extent (93.5%).

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 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 the Assisted Area 1 – Average deadweight spending in the Assisted Area 2.

Recall that so far we have assumed that (1) reduced scale imply 25%, reduced qualitative level 50% and later date 75% of deadweight in the cases of partial deadweight; see equation 1. To confirm that this assumption is not driving our decomposition results, the analyses were also conducted by using alternative assumptions: (2) reduced scale, reduced qualitative level and later date all imply 50% of deadweight, and (3) reduced scale imply 50%, reduced qualitative level 70% and later date 90% of deadweight ("a conservative view"). Results of these robustness checks are reported in Table 8. In the interest of brevity, only the pair-wise regional differences due to differences in characteristics (%) are reported. We can see from columns A.1–A.3 that the results are quite robust to the computation of deadweight spending.

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

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.

6. Policy implications

Policy implications of the results are discussed with an example illustrating implication of alternative policy schemes (Table 9). The tendency in EU regional policy is towards the limitation of available funding and its concentration on the least-developed regions (see e.g. Mairate, 2006). Thus, we compare current policy to the schemes, where the subsidies are reallocated between the regions and finally also diminished in aggregate size. In the alternative schemes grants redistributed evenly relative to the current amount of subsidies given to the project.

The schemes which 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 per cent. Higher decrease is achieved, if subsidies are concentrated on the most remote regions i.e. on Assisted Areas 1 and 2:[13] when these subsidies are merely distributed to Assisted Area 1, the decrease is 19.8 per cent (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 per cent diminishes deadweight spending more than 69 per cent if they are distributed to Assisted Areas 1 and 2 (case 3).

[13] Assisted Areas 1 and 2 together form current National Assisted Area 1.

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	0	204 917
	[42.5%]	[42.5%]	[0%]	[-100%]	[0%]
Deadweight spending	19 325	11 254	19 656.0	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%]
(3) 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	18082	10 978	0	0	19 816
	[0.1%]	[-0.2%]	[-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 equation (3). Percentage changes relative to the current policy are given in square brackets below. In the alternative schemes grants redistributed evenly relative to the current amount of subsidies given to the project.

7. 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 relatively high deadweight was expected, but only little was known from its regional variation in advance. Thus, our results provide new information on 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 Assisted Areas. However, this difference is not explained by the variation in the level of deadweight, but rather in the size of subsidies (and projects). Second, our results from the econometric analysis showed regional variation in 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 majority of the pair-wise regional differences in the expected deadweight spending. Only 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.

This paper has provided one viewpoint of efficiency of regional enterprise financing. It shows that regional business subsidies are not intended to be that efficient. *Ex ante* deadweight appraisals yield very high intensities of wasted spending. More efficiency can be achieved by concentrating on the projects that cannot be implemented in the absence of the subsidy. Finally, it must be remembered that deadweight spending does not describe benefits of subsidies as such. The subsidies have variety of direct and indirect impacts on regional development. They may free up resources allowing them to used elsewhere more efficiently. In order to get a fuller picture of added value of regional subsidies in different types of areas, further evaluation on their effectiveness and displacement effect is certainly needed.

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Appendix

Table A1. Mean values of variables by region

Variable	Assisted Area 1	Assisted Area 2	Assisted Area 3	Outside Assisted Areas	All Areas
Firm characteristics					
New firm	0.247	0.241	0.218	0.252	0.239
Self-employed	0.041	0.064	0.074	0.041	0.054
Employees (persons)[a]	16.602	13.253	16.526	15.930	15.899
Turnover of firm (€ millions)[a]	1.660	1.424	1.891	1.743	1.733
Project characteristics					
Public subsidy (€ 1 000)	63.218	47.519	31.101	21.206	35.675
Project costs (€ 1 000)	209.585	177.363	193.844	91.761	157.767
Intensity of assistance	35.895	32.057	27.087	34.899	32.205
Type of project					
Investment project	0.647	0.715	0.621	0.315	0.528
Start-up project	0.265	0.242	0.295	0.510	0.360
Development project (ref.)	0.087	0.043	0.083	0.175	0.112
Industry					
Metal	0.252	0.154	0.317	0.219	0.248
Wood	0.143	0.205	0.150	0.087	0.133
Other manufacturing	0.249	0.194	0.243	0.293	0.256
Trade	0.041	0.134	0.044	0.053	0.058
Transport	0.020	0.059	0.007	0.014	0.019
Business services (ref.)	0.221	0.143	0.170	0.263	0.210
Other industries	0.073	0.112	0.069	0.071	0.076
Regional characteristics					
Unemployment rate	14.994	15.412	12.962	10.063	12.614
R&D expenditure	0.266	0.114	0.375	6.635	2.582
Year					
2000	0.371	0.405	0.356	0.312	0.349
2001	0.337	0.324	0.306	0.348	0.329
2002	0.207	0.190	0.230	0.228	0.220
2003 (ref.)	0.085	0.082	0.108	0.112	0.102
Number of observations	1 075	748	1 846	2 075	5 744

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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