Evaluations of Business Development Programmes – Technical Annex

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Technical Annex - evaluation methodology

This annex provides detail on the methodologies used in the Business Development Programme evaluations relating to cost benefit analysis, control groups and deadweight. It is important to note that while the all efforts are made to take similar approaches with regard to methodologies, it is not always appropriate or possible to undertake CBA, control group analysis or deadweight in exactly the same way. This may be due to factors such as data availability (for example, which impacts on control group analysis) or the nature of the programme (for example, where the time it takes to realise economic impact differs). This annex therefore covers the main technical features of the methodologies. However, the reader should refer to the individual evaluations regarding the specific methodologies which can vary according to factors such as programme scale and data availability.

Approach to cost-benefit analysis

The cost-benefit framework compares the economic benefits attributable to the programme by way of benefits such as additional wages, profits and taxes in Ireland, both direct and indirect, to both direct and indirect costs incorporating grant costs and agency overhead costs that are apportioned to the operation and administration of the grant programme.

The number of years of benefit included in the calculations may differ depending on the programme and data availability. Furthermore, a time lag for impact will typically be allowed for in the calculations and, again, the duration of the time-lag will depend on the nature of the programme. Notwithstanding these differences in terms of how long benefits are captured, a consistent approach to cost benefit analysis has been applied across the evaluations where undertaken.

Direct benefits relate to value added (the additional profit earned and payroll spent by the beneficiary firms, as well as the additional taxation - both payroll and corporation tax - associated with them). Indirect benefits are similar variables arising elsewhere in the economy and are measured using output multipliers for the main sectors in which the grant recipients operate. These multipliers are sourced from the CSO input-output tables.

A range of other parameters and values are utilised in the CBA. These are shown in Table 1 and reflect current Department of Public Expenditure and Reform guidance. Survey findings and results of econometric analysis inform values used for deadweight, displacement, etc.

Table 1 Key CBA parameters and values

Shadow Price of Labour (Shadow Wage)	80%
Shadow Price of Public Funds	130%
Discount Rate	5%
Payroll Tax Rate	35%
Profit Tax Rate	12.5%
Deadweight	Varies depending on the programme
Displacement	Varies depending on the programme
Substitution	Varies depending on the programme
Leakage	Varies depending on the programme

The benefits are adjusted to reflect the shadow price of labour where relevant and are discounted to reflect net present values. Benefits are also adjusted for deadweight and displacement. Costs are adjusted to reflect the shadow cost of public funds. These adjustments are explained in greater detail below.

Shadow prices

The project inputs should be valued at their opportunity cost. It is generally recommended that market prices are used to value the cost of inputs as these best reflect the opportunity cost involved. Market prices are generally reliable and verifiable. However, in some cases market prices do not reflect opportunity costs due to market failures. Shadow prices may then be used where there are clear and convincing reasons for doing so. The shadow prices used in our CBA methodology are set out below.

Shadow price of labour

The shadow price of labour has a significant influence on the outcome of a CBA. It captures the opportunity cost to the project of the labour used in delivering the project benefits. Labour conditions can vary on a regional and sectoral basis e.g. unemployment can be higher in certain regions and there are certain economic sectors where demand for labour varies due to the differing levels of skills required. The wage rate can overstate the overall social opportunity cost and it can be argued that people who are unemployed and who subsequently gain work on a supported project would otherwise not be employed in a productive way. In this case, the wage rate is replaced with a lower opportunity cost. The shadow price of labour is often expressed in percentage terms. The value of this parameter depends on labour market conditions (e.g. unemployment, regional variations, labour force participation etc.), project characteristics and

skill levels. The parameter value recommended by DPER is 80 percent and this is used in the Forfás evaluations.[1]

Shadow price of public funds

Taxation gives rise to economic distortions by altering the incentives facing economic agents, leading to changes in their behaviour and reduced economic activity. For this reason, the shadow price of public funds is greater than one. Put another way, a €1 private benefit resulting from a €1 grant raised by extra taxation does not imply a neutral result for the economy. A premium must be attached to the nominal costs of the proposal in order to make private cash flows commensurate with public cash flows and account for the deadweight loss of taxation. If public costs and private benefits are treated equally, the net present value of projects will be systematically overestimated. In practice, the distortionary costs can be incorporated in cost-benefit analysis by adjusting public benefits and costs by a factor to make them commensurate with private benefits and costs. The existing recommended parameter is 130 percent, i.e. nominal costs should be multiplied by 1.3 to reflect the true economic cost.

Discounting

Costs and benefits occur at different points in the life of the project so the valuation of costs and benefits must take into account the time at which they occur. This concept of time preference is fundamental to CBA and so it is necessary to calculate the present values of all costs and benefits.

The discount rate affects the outcome of the net present value (NPV). A high discount rate tends to reduce the NPV because the benefits of capital projects tend to materialise in later time periods whereas costs are incurred in earlier time periods. The Public Spending Code provides that a common discount rate should be used for appraising public expenditure. The Test Discount Rate (TDR) for use in cost benefit analysis and cost effectiveness analysis of public sector projects is currently 5 percent. This is the rate in real terms (i.e. excluding projected inflation) and should be applied to a project's future costs and benefits expressed in constant prices (i.e. excluding projected inflation).[2]

Other factors impacting on additionality

Displacement

Displacement occurs when enterprise support programmes replace or 'crowd-out' private investments. Displacement is a clear negative effect of an enterprise intervention, which can partly annul or counteract the benefits of the intervention. Displacement can also occur across enterprises if, for example, subsidising a feasibility study for one firm results in the termination of the same feasibility study by one of its competitors.

In addition to displacement, positive side effects are also possible. In the area of research, development and innovation (RD&I), this might include knowledge spillovers. and other companies may benefit through knowledge dissemination. In our evaluations we have typically found displacement to be low as the interventions are targeted at foreign owned or indigenous firms that are exporting.

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[1] Ibid. DPER acknowledges that a single central value cannot take into account all these factors as these must be taken into account in individual project appraisals.

[2] Ibid.

Leakage

Leakage is the proportion of outputs that benefit those outside the target area of the intervention. In the case of enterprise, leakage refers to any support which may have 'leaked' to non-target groups of enterprises.

Substitution

Substitution is defined as a negative effect that arises when an enterprise substitutes a jobless person to replace an existing worker to take advantage of the public sector assistance.

Multipliers

Multipliers quantify the further economic activity stimulated by the direct benefits of an intervention. The additional incomes of those employed by the intervention result in an induced multiplier while the additional supply result in an indirect multiplier. Typically we use multipliers derived from the CSO input-output tables.

Deadweight

Deadweight refers to the policy support outcomes which would have occurred anyway.[3] The approach taken to calculating deadweight has been to use company surveys and/or econometric analysis. Survey approaches have some limitations as there is concern around selection bias of the firms surveyed in overestimating the impacts of the programme. Conversely, econometric estimations of deadweight only control for the observable factors selected and may not fully reflect the programme impact. Using both approaches therefore provides a deadweight range for reference.

It should be noted that deadweight assumptions applied in the CBAs in the Forfás evaluations are at the upper end of the range and therefore represent a conservative approach to the calculation of benefits. These survey and econometric approaches to deadweight are described below.

Survey approach to calculating deadweight

When surveying companies about deadweight a two- step approach is used:

- First, the companies are asked if the project had not received State support would it have gone ahead anyway or not.

- Second, in relation to the projects which would have gone ahead without grant assistance questions are asked as to whether these projects would have:

  - *Gone ahead unchanged* (in terms of scale, timing and location);

  - *Gone ahead but in a different location* (this would depend on type of grant and company e.g. whether it is an Enterprise Ireland or IDA client);

  - *Gone ahead but delayed*;

  - *Gone ahead but on a reduced scale; or*

  - *Gone ahead but with a combination of delay and reduced scale.*

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[3] HM Treasury, The Magenta Book, Guidance for Evaluation, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220542/magenta_book_combined.pdf

The two-stage question used follows the distinction between "full" and "partial" deadweight used by Helena Lenihan (University of Limerick). [4]

Econometric approach to calculating deadweight

An alternative approach to calculating deadweight is to use econometric modelling to calculate the change brought about by an intervention as against what would have happened anyway by using a control group. For example, in measuring the impact of a programme on *employment*; we first look at change in employment among participant companies (E^2-E^0). This only provides an estimate of the impact of the programme. To be able to calculate the additional benefit *directly attributable* to the programme (or, conversely, discount the change in employment that would have happened anyway) the change in employment in the counterfactual scenario is subtracted.
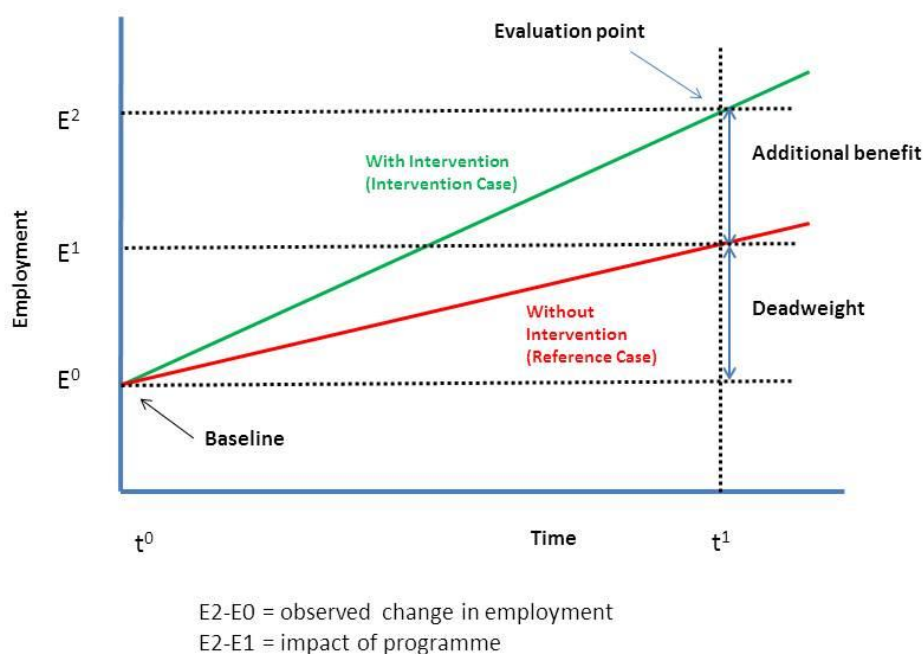
The impact of the programme is only positive if the change on employment for participant companies (E^2-E^0) is greater than the change in employment from non-participant companies (E^1-E^0).

Table 3: Measuring impact (I)

	Before (t^0)	After(t^1)	Change over time
Participant	E^0	E^2	E^2-E^0
Non-participant	E^0	E^1	E^1-E^0
Impact			(E^2-E^0) minus (E^1-E^0)

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[4] H. Lenihan, Evaluating Irish Industrial Policy in Terms of Deadweight and Displacement: A Quantitative Methodological Approach, Applied Economics, 36:3, PP 229-252, 2007.

Figure 1 Measuring impact (II)

Figure contents:
- Y-axis: Employment
- X-axis: Time, from t^0 to t^1
- Evaluation point
- E^2, With Intervention (Intervention Case)
- E^1, Additional benefit
- Without Intervention (Reference Case)
- Deadweight
- E^0, Baseline

E2-E0 = observed change in employment
E2-E1 = impact of programme

Source: Forfás' Framework for the Evaluation of Enterprise Supports (2010)

Approach to establishing control groups

A control group is a group that is as close as possible in terms of characteristics to the treatment group prior to the incidence of the treatment (i.e., drawdown of assistance funds). Where possible control groups of non-assisted client firms are used, and econometric modelling has been applied to match assisted and non-assisted firms for comparison by characteristics such as size, sector, age, R&D expenditure, export intensity, etc. Accounting for these factors allows for the isolation of the impact of a support programme.

Propensity score matching (PSM)

Propensity Score Matching (PSM) has been used (where possible) to estimate this impact. The PSM method is a widely used econometric tool in policy evaluation. The PSM technique has been used in a number of policy evaluations across different sectors including the labour market, health and enterprise supports.

The PSM approach explicitly accounts for possible selection bias by creating a control group based on statistical methods.[5] The essential idea is to account for a number of factors that are

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[5] Rosenbaum and Rubin (1983) "The Central Role of the Propensity Score in Observational Studies for Causal Effects" Biometrika, Vol. 70, no.1.

observable to the researcher which may influence the selection decision of the participant. This selection decision may be correlated with the eventual outcome and it is vital to account for this.

It is important to remove as much selection bias as possible between the treatment and control groups prior to comparison of the average outcomes. The PSM statistical technique has been developed for this purpose. A key assumption of the PSM approach is the Conditional Independence Assumption (CIA) which is, once observations have been matched on observables, the only factor driving any difference in the outcome variable of interest between the treated and untreated groups is the treatment itself.[6] Differences between the outcomes of the treated and untreated groups can then be attributed to the treatment.

PSM involves the use of statistical techniques to identify within a given population or sample, observation units which are as identical as possible or very similar.[7] Each unit is given a propensity score and units with similar propensity scores can then be regrouped into sub-populations or sub-samples. Thus, the idea is that the control group, and subsequently estimated treatment effect is based on comparing like-for-like treated and untreated samples.

Observed characteristics (matching covariates) are used to estimate the propensity score using binary regression models.[8] The propensity score (p-score) is then a predicted value between 0 and 1 depending on the closeness of the match. Intuitively, the propensity score is the probability of treatment based on observed characteristics. Thus, two firms with identical characteristics[9] will be matched based on their p-score to form one treated group and one control (untreated) group.

The choice of inclusion variables will likely have an impact on the estimation of the impact and thus it is important to test the model selection. The choice of matching variables is typically based on a balancing test that tests whether certain matching variables create bias in the outcomes for the treated vis-à-vis the untreated groups.[10]

Once the propensity score is estimated, beneficiaries and non-beneficiaries of the programme are matched[11] based on the estimated propensity score which is based on their covariates.

A challenge faced by any controlled experimental approach is unobserved factors that may influence the outcomes. Similarly, with PSM, it must be noted that matching of firms is based solely on observed characteristics.[12] Some of the variables that have been controlled for in PSM

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[6] Another key assumption is that there is a Common Support Region, which implies that a match can be found for each treated observation among the non-treated (the region defined by the set of observable characteristics). Intuitively, this means that the more variables that are chosen in selection model the harder it is to find observations that have matching characteristics.

[7] Little or no statistical difference in the means of the matching variables.

[8] Logit or probit estimation can be used and previous research in the area does not provide any specific guidance on which estimation method is preferred. In particular Caliendo and Kopeining (2005) note that results obtained by the two methods generally are very similar and the choice therefore seems to be mainly a matter of taste.

[9] It must be noted that we want variation in the selection model. For example, if one attributes always led to selection, then it would not be possible to use a PSM approach.

[10] These balancing tests have been undertaken for the various propensity score matching models.

[11] Note that several matching strategies exist and the results may be somewhat sensitive to these choices.

[12] Thus, any unobserved characteristics that are causing the difference in outcomes between treated and non-treated firms will be not be accounted for using a matching approach.

analyses include average wage, R&D activity, company size, sector, region, internationalisation, and whether or not the company is receiving other State grants.

Approach to surveys

The complex nature of the issues requiring investigation as part of the evaluations means that existing official and other datasets are insufficient on their own to enable detailed assessment. A particular feature of the evaluation methodology is the application of further detailed primary/survey research among firms assisted under the support programmes. The questionnaires have been designed to complement the existing data sources and enable further interrogation of factors such as deadweight and identification of spillovers or behavioural additionality from the programme such as enhanced capabilities, new strategies or increased ambition. These spillovers are not determinable from econometrics. Firms have been able to complete the surveys online via a secure encrypted link to an electronic version of the relevant questionnaire.

Self-assessment and the econometric results

A difference between the self-assessment and the econometric results has arisen during the course of the evaluations. There are a number of methodological reasons that could explain this difference.

First, the self-assessment could include an 'optimism bias', which implies that surveyed companies could be overestimating the impact of programme.

Second, in order to increase the response rate for questions, survey respondents are offered band options to quantify what would have happened in the absence of the support provided by the company (e.g. between 0 percent and 20 percent). A bold assumption is then needed to be able to arrive to a final figure: if a respondent chose the option 'between 0 percent and 20 percent', then it is assumed that export/employment/turnover would have been 10 percent lower in the absence of the support. However, following this methodology it is not possible to know where respondents placed themselves within that band. It could be the case that their estimates are closer to 0 percent rather than to 20 percent.

In face-to-face interviews, and with some guidance from the evaluator, companies are more likely able to provide a closed figure for the self-assessment scenario (and not just a band). Access to data such as those available in ABSEI provides a unique opportunity to test how accurate these estimates are, as it provides a quasi-experimental setting to measure what would have happened in the absence of the support.

Self-assessment is recommended in several guidelines as a second-best option (UK Magenta Book (2011), the UK HM Treasury Green Book (2009) Forfás' Framework for the Evaluation of Enterprise support in Ireland (2011)), to be used when information and data to measure changes before and after, for a treatment and control group, is not available.