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| Title | The economic appraisal system for projects seeking support from the industrial development agencies |
| Authors(s) | Murphy, Anthony, Walsh, Brendan M., Barry, Frank |
| Publication date | 2003 |
| Publication information | Murphy, Anthony, Brendan M. Walsh, and Frank Barry. "The Economic Appraisal System for Projects Seeking Support from the Industrial Development Agencies." Forfás, 2003. |
| Publisher | Forfás, 2003, Forfás |
| Item record/more information | http://hdl.handle.net/10197/1600 |

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**The Economic Appraisal System
for Projects Seeking Support from
the Industrial Development
Agencies**

Forfás

Foreword

The Economic Appraisal System is used by the development agencies to assist them in deciding whether to provide support for enterprise development projects in Ireland. The model essentially involves obtaining conservative projections of tangible benefits, and costs for the project, assessing what proportion of the benefits are additional or new to the economy, and calculating the net benefits of the project over a set period. The agencies have used a system of cost-benefit analysis since the late 1970's. In light of the changed business environment in Ireland and the policy objectives set out in Enterprise 2010, Forfás with IDA Ireland and Enterprise Ireland commissioned Prof. Brendan Walsh and Associates, UCD to update the economic appraisal system, which was last up-dated by the ESRI in 1995/6. This report presents the results of this study.

The key role of the Economic Appraisal System is to ensure that specific supports provided by the development agencies will yield benefits to Ireland in excess of the associated costs, in order to ensure that the State gets value for money. The revised model from Prof. Brendan Walsh and Associates outlines where interventions from the development agencies can produce a positive economic benefit for the economy, and provides a system that allows these benefits and costs to be quantified. Going forward, all major proposed enterprise development projects will be assessed using this system.

The new economic appraisal system recognises the significant changes that are facing the Irish economy and the objectives of the development agencies, as set out in *Enterprise 2010*¹. Enterprise 2010 outlines that productivity growth will be central to future economic development, and that the development agencies can play a significant role in promoting regional development, developing the internationally traded manufacturing and services sectors further, and increasing the proportion of higher productivity, higher skilled and higher knowledge-based jobs. As the economic appraisal system recognises the greater benefits arising from higher productivity employment and balanced regional development, it will ensure that funding provided by the development agencies is closely aligned with national economic and enterprise policy.

Evaluation mechanisms are critical to ensuring that the State receives value for money. Prof. Brendan Walsh and Associates have concluded that a cost benefit procedure remains the most appropriate

¹ Enterprise 2010 - New Strategy for the Promotion of Enterprise in Ireland in the 21st Century

mechanism for assessing value for money for enterprise development projects. Having updated the system to reflect the changed economic environment in Ireland, I hope that by publishing this report, the concepts and methodology developed may prove useful to other organisations. The revised appraisal system also strongly recognises the shift in national economic strategy from focusing primarily on employment creation, to identifying and recognising the benefits to Ireland from the creation of higher quality employment, the promotion of regional development, and greater investment in human capital. The publication of this report from Prof. Brendan Walsh and Associates should stimulate further debate on this strategy.

Martin Cronin

CEO, Forfás

**The Economic Appraisal System for Projects Seeking Support from the Industrial
Development Agencies**

Commissioned by Forfás from

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Acknowledgements

This report has been prepared in consultation with a Steering Committee comprised of representatives from the Industrial Development Agencies (Forfás, IDA Ireland, and Enterprise Ireland), the Department of Enterprise, Trade and Employment, the Department of Finance and the National Development Plan-Community Support Framework Evaluation Unit. An earlier version of this paper was presented to a workshop held in the University Industry Centre, University College, Dublin, on 9th November 2000. We are grateful to participants in this Workshop and in particular to Professor Frank Convery who acted as discussant, and to Dr Patrick Honohan, for their comments. Eric Strobl provided helpful inputs to earlier versions of the document.

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1.0 Introduction

Since the mid-1990s the Irish economy has made remarkable progress. Growth in employment has outstripped that in almost all other developed economies. Employment and output in the enterprise sector, and specifically the internationally traded sectors, have grown very rapidly. There was a marked increase in industrial employment at a time when it was static or declining in many advanced economies.

Ireland's success in attracting foreign direct investment (FDI) is usually given much of the credit for the phenomenon of the 'Celtic Tiger', while an increasing number of strong indigenous companies, particularly in information technology and consumer food sectors, also made an important contribution. While many other factors were important, the grants and other incentives used to promote enterprise development undoubtedly played a significant role in the recent transformation of the economy. The recent boom has, however, dramatically changed the context in which industrial policy operates. Whereas five years ago the emphasis was primarily on job creation in order to lower unemployment and stem emigration, today the evidence of 'full employment' is widespread and calls for a reassessment of priorities.

Since the late 1970s the industrial development Agencies (Forfás, the IDA Ireland (formerly the Industrial Development Authority and subsequently the Industrial Development Agency), and Enterprise Ireland) have applied cost benefit analysis (CBA) to assess projects. The role of this economic appraisal system is to identify whether specific supports by the Agencies are likely to yield benefits in excess of the associated costs and to ensure that the State gets value for money. The version of the model that has been in use since 1997 is based on the review completed in 1996 by the Economic and Social Research Institute (Economic and Social Research Institute, 1996; Honohan, 1998). The model involves calculating the discounted present value of a project's benefits (net of costs) over a medium term horizon, generally seven years. While the projects reviewed can be classified in a variety of ways - Irish/overseas owned, greenfield/expansions, labour/ capital intensive, etc., – in general the same appraisal methodology is applied to all.

The economic appraisal system is only one part of a wider appraisal process. A satisfactory 'benefit to cost ratio' is a crucial condition if a project is to be deemed eligible for funding, but does not create an automatic entitlement to funding. The key role of the model is to discriminate between projects with different characteristics, so that resources are devoted to assisting projects that most closely match the criteria as set down under legislation and industrial policy.

The radical changes in the labour market situation since this system was put in place prompted Forfás to commission the authors to re-examine the methodology in the 1996 Review and to propose an updated version of the model that reflects the contemporary economic environment.

The objectives of the present review are therefore:

- To establish the most effective approach for the economic appraisal of industrial development projects in the future. In particular to establish a procedure that, together with the other elements of the Agency project appraisal system, can contribute effectively and practically to the overall evaluation process, to guide the Agency Boards, and the Government where appropriate, in deciding whether and to what extent the State should support particular projects;
- To set out a range of model options that can be considered, their parameters and structures and their advantages and disadvantages particularly in terms of practical application and ease of use by the development agencies;
- To recommend the most appropriate model in the context of the economic and policy changes outlined above and to provide a working model;

This report contains the results of this review.

2.0 Irish Industrial Policy

The main enterprise development agencies are the Industrial Development Agency Ireland (IDA Ireland) (dealing with overseas firms) and Enterprise Ireland (EI) who, together with Shannon Development and Udarás na Gaeltachta support the development of indigenous industry. Forfás is the policy and advisory body responsible for encouraging and promoting the development of enterprise, trade, science, technology and innovation in Ireland and for advising the Government on these.

Expenditure and commitments by these Agencies declined sharply relative to GDP in the second half of the 1990s. Between 1996 and 1999 the level of incentive approvals of the two main agencies combined fell from 0.88% to 0.34% of GDP, while the level of incentive payments fell from 0.41% to 0.26% of GDP. The grant cost per job sustained over a seven-year horizon fell from £16,000 in 1985-91 to £10,000 in 1993-99 (constant 1999 prices). This was mainly due to the halving of the grant cost per job in foreign-owned firms.

The report *Enterprise 2010*², published by Forfás in January 2000, presents a comprehensive review of the aims and objectives of Irish industrial policy and the strategy to be adopted in the first decade of the new century. The basic objective is to increase employment in the internationally-traded sector (manufacturing and internationally-traded services) from 310,000 in 1998 to 400,000 in 2010, while at the same time achieving an annual rate of productivity growth of 7% a year. The review concluded that achieving these objectives requires:

- Accelerating the shift towards high-growth, high-tech, high-productivity activities and from production to services activities;
- A gradual shift in employment to higher value-added sectors;
- An increase in labour productivity in existing firms;
- A continuous upgrading of the educational and skills profile of the workforce;
- A deepening of the base of R&D performing firms;

² Source: Enterprise 2010 - New Strategy for the Promotion of Enterprise in Ireland in the 21st Century, Forfás, 2000.

- Reversing the trend of concentration of economic activities in major urban centres to achieve more balanced spatial development; and,
- A shift in development agency assistance from ‘capacity’ support for employment creation and fixed asset investment to ‘capability’ support in areas such as human resource development, R&D, marketing and market development.

Our review of the appraisal system of projects seeking assistance from the Agencies has taken these goals as valid and explores how they may be most cost-effectively advanced in light of the changing labour market situation.

3.0 The Changing Labour Market Situation

Ireland has experienced an extraordinary economic boom since the early 1990s. The rate of growth of GDP has been exceptional both by international standards and by reference to the historical Irish record. The growth in employment has been even more exceptional. The concomitant fall in unemployment and replacement of emigration by immigration have removed the traditional justification for continued industrial grant assistance, which was based on the need to reduce high rates of involuntary unemployment and emigration. The case for subsidising job-creation is less compelling now than at any time in modern Irish history. While industrial promotion played a key role in the transformation of the economy, it is now timely to re-examine its role in light of the present labour market situation.

Table 1 contains a set of indicators that summarise how the Irish labour market was transformed in the course of the 1990s. All the indicators point to the growing tightness of the labour market. The overall unemployment rate fell from 15.7% in 1993 to 4.4% in 2000 and to 3.6% in January 2001. The short-term unemployment rate is often taken as a better indicator of current labour market conditions than the overall rate because it reflects the numbers recently in employment who are currently seeking employment. This rate fell from 6.8% in 1993 to 2.5% in 2000. The broadest measure of 'potential labour supply' fell from 21.5% in 1996 to 8.6% in mid-2000.³ The net immigration rate reached 5 per 1,000, and gross immigration to 12.7 per 1,000, in 1999. Immigration now accounts for almost half of the increase in population and a higher proportion of labour force growth. It has been predicted that meeting the investment targets laid out in the National Development Plan will only be possible if substantially higher rates of immigration are permitted. There has also been a marked rise in vacancies, with 27% of firms in the private non-agricultural sector reported having unfilled vacancies in the 1999 ESRI National Survey of Vacancies. The tightness of the labour market is reflected in a rising rate of wage inflation. There is abundant evidence that pay rates are rising rapidly in many sectors. All these indicators strongly suggest that the economy is now at 'full employment'. Despite the economic slowdown in the latter half of 2001, employment growth has remained strong. The unemployment rate was

4.3% in the third quarter of 2001, compared with 3.7% in the previous quarter and 4.3% in the corresponding quarter of 2000.

The switch from net emigration to net immigration is of great significance to the economic appraisal system because some key features of the existing model were designed to deal with a situation where the main effect of job creation was to reduce the net emigration rate. We discuss in a later section how we propose to change the model to make it more appropriate for an economy where further employment growth implies a higher net immigration rate.

The rate at which the economy can grow without a build-up of severe inflationary pressures is constrained by the rate of growth of the labour force. In 1999 the Central Statistics Office published labour force projections for the period 1996-2011. A key finding of these projections is that the rate of natural increase of the working age population is much lower now than it was ten years ago: the bulge of school leavers corresponding to the high birth rate of the 1970s is being replaced by considerably smaller birth cohorts. (The peak number of school leavers was probably reached in 1999-2000). Even when a generous allowance is made for continued increases in labour force participation rates and substantial net immigration, the projections show that the net increase of the labour force will decline to an annual average rate of 1.7% (or about 30,000 a year) over the period 2001-2006. This is still high by international standards, but much lower than the 2.7% growth rate recorded during the 1990s and the even higher rate of the past four years. (Table 1 illustrates).

³ This measure is derived from the Quarterly National Household Survey (QNHS) and labelled S3. It adds those marginally attached to the labour force who are interested in employment and those involuntarily working part-time to the both the numerator and denominator of the conventional unemployment rate.

| | <i>Employed</i> | <i>Unemployed</i> | <i>Labour force</i> | <i>Population 14+</i> | <i>Unemployment rate</i> | <i>Labour force participation rate</i> | <i>Employment rate</i> |
|---------|-----------------|-------------------|---------------------|-----------------------|--------------------------|--|------------------------|
| | 000 | 000 | 000 | 000 | % | % | % |
| 1990 | 1,159.7 | 172.4 | 1,332.1 | 2,551.2 | 12.9 | 52.2 | 45.5 |
| 1991 | 1,155.9 | 198.5 | 1,354.4 | 2,585.1 | 14.7 | 52.4 | 44.7 |
| 1992 | 1,165.2 | 206.6 | 1,371.8 | 2,623.7 | 15.1 | 52.3 | 44.4 |
| 1993 | 1,183.1 | 220.1 | 1,403.2 | 2,657.1 | 15.7 | 52.8 | 44.5 |
| 1994 | 1,220.6 | 211.0 | 1,431.6 | 2,687.3 | 14.7 | 53.3 | 45.4 |
| 1995 | 1,281.8 | 177.4 | 1,459.2 | 2,723.4 | 12.2 | 53.6 | 47.1 |
| 1996 | 1,328.5 | 179.0 | 1,507.5 | 2,766.7 | 11.9 | 54.5 | 48.0 |
| 1997 | 1,380.0 | 159.0 | 1,539.0 | 2,815.1 | 10.3 | 54.7 | 49.0 |
| 1998 | 1,494.5 | 126.6 | 1,621.1 | 2,869.9 | 7.8 | 56.5 | 52.1 |
| 1999 | 1,591.2 | 96.9 | 1,688.1 | 2,915.5 | 5.7 | 57.9 | 54.6 |
| 2000 | 1,692.4 | 75.7 | 1,768.1 | 2,974.8 | 4.4 | 59.4 | 56.8 |
| 2000 Q4 | 1,710.3 | 68.8 | 1,779.1 | 3,003.6 | 3.9 | 59.2 | 56.9 |

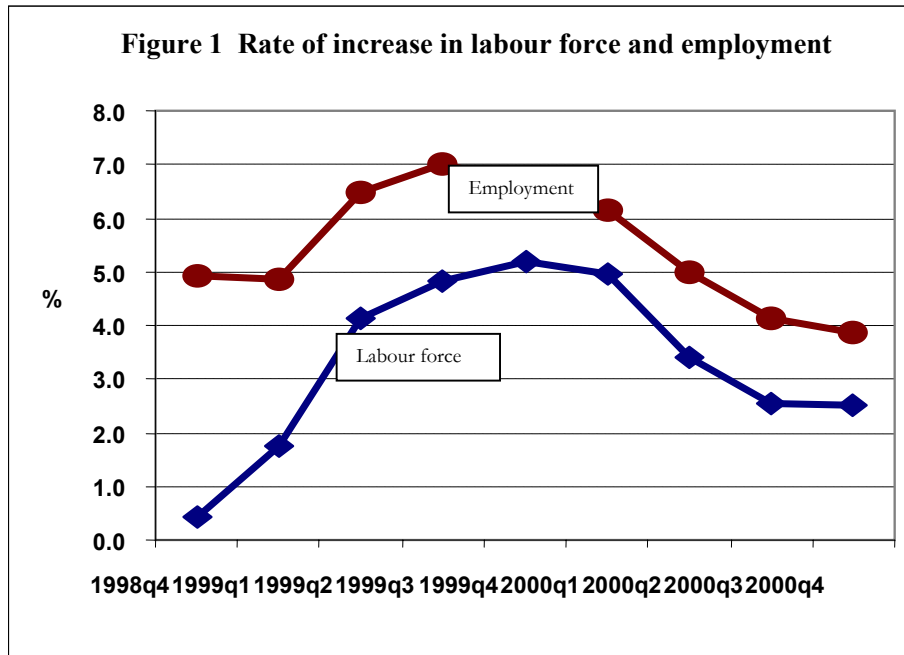
| Table 1B | 1993 | 2000 |
|--|--------------------|---------------------|
| Short-term unemployment rate | 6.8% | 2.5% (Q4) |
| Long-term unemployment rate | 8.9% | 1.4% (Q4) |
| Broad measure of labour availability ¹ | 21.5% ² | 8.2%(Q4) |
| Net migration rate per 1,000 | -0.0 | +5.3 |
| Index of earnings in construction (Annual % change) | +7.0% | +15.2% ³ |
| 1. (The unemployed + those expressing some interest in employment)/(the labour force + those expressing some interest in employment) 2. 1996 (first year available) 3. Mid year Q4 = Sept-Nov 2000 | | |

Source: Labour Force Survey and Quarterly National Household Survey

While the factors that determine the rate of population and labour force growth— especially migration and labour force participation rates – are not independent of the rate of economic growth, the implication is that the availability of labour will be an increasing constraint on the attainable rate of economic growth in Ireland.

The indications are that the rate of growth of the labour force is already slowing markedly. Figure 1 displays the year-on-year rate of growth of (i) employment and (ii) the labour force since end-

1998. It may be seen that the rate of growth of the labour force has fallen from over 5% at end-1999 to only 2.5% at end-2000. The period of exceptional employment growth that characterised the late 1990s may now be over. These developments should prove informative for the review of the economic appraisal model.



Source: Central Statistics Office

The policy-relevant measure of labour market conditions is the ‘natural’, ‘equilibrium’, or ‘non-accelerating inflation rate of unemployment’ (NAIRU). This is the unemployment rate consistent with a low and stable rate of wage and price inflation in the absence of external shocks. If the actual unemployment rate falls below the NAIRU internal inflationary wage pressures build up. Since Ireland is now a small open economy without an independent currency, the main consequence of wage inflation that is not supported by productivity gains will be a loss of competitiveness. This would tend to serve as a self-correcting mechanism, dampening the demand for labour and/or increasing labour supply by attracting more immigrants to the economy. This implies that the idea of a NAIRU is not as relevant in an Irish context as it is in larger economies. Moreover, it is now acknowledged that the NAIRU is not an immutable constant but changes over time as the structure of the labour market changes. The most recent estimates put the Irish NAIRU in 1999 at 9.3% \pm 3% (McMorrow and Roeger, 2000). While the range of this estimate highlights the uncertainty surrounding the concept, the Irish unemployment rate is now

well below the lower limit of this range. While the inflationary effect of rapid increases in wages may be offset by rapid productivity growth in the manufacturing sector these gains are less marked in other sectors. For example, the annual rate of wage inflation to mid-2000 was 12% in the Construction and Distribution sectors, implying a rapid increase in unit labour costs. Recent developments in Irish industrial relations reveal the clear danger that wage increases that might be justified by the pace of productivity growth in the industrial sector spill over to the sheltered sectors of the economy, where their inflationary implications are obvious.

We conclude from this review of recent Irish labour market developments that the national economy is now close to full employment. This implies that the goal of job creation for its own sake is no longer a priority. The appraisal process must now focus on the quality of the jobs available and on the external or spillover benefits of projects that apply for assistance. At the same time the risks of destabilising the labour market by attempting to push the national unemployment rate below a level that is consistent with the orderly development of wages and salaries should be taken into account. These considerations have been at the forefront of our thinking on the revisions to the existing economic appraisal system that are now called for.

4.0 Regional Issues

Even if the economy as a whole is at ‘full employment’ account should be taken of regional variations in labour market conditions and the persistence of employment ‘black spots’. Table 2 displays some indicators of regional labour market conditions, using three regions – Great Dublin, the Border-Midlands-West (BMW), and the Rest of Ireland. The absolute regional differences in unemployment rates are relatively small, and have declined in recent years, but employment rates show somewhat larger regional variations. This is due to the lower labour force participation rates outside the Dublin region. It may be that low participation rates are a better indicator of labour slack than overt unemployment. This is supported by the fact that the broader indicator of labour availability, S3, (which also includes those marginally attached to the labour force who are interested in employment and those involuntarily working part-time) is higher in the BMW region than in the Dublin region – 10.3% compared with 7.3%. There are grounds for believing that the distribution of employment, and employment growth, between the regions is not optimal from the perspective of trying to minimise the social costs (rising housing costs, increased congestion, and environmental depredation) associated with rapid economic growth. There are also marked differences in regional industrial wages that probably exceed the regional variations in the cost of living. Wages have been rising most rapidly in the already-rich regions and least rapidly in the poorer regions with the disparity between high- and low-income regions tending to increase over time. Finally, the old dependency ratio is much higher in the poorer regions than in the Dublin area – a reflection of high emigration rates in the past. It is important that the appraisal procedure should now reflect these regional considerations.

Table 2: Regional Labour Market Indicators

| Regions | Unemployment rate | Participation rate | Industrial wages (all employees) CIP 1998 | Old Dependency ratio, 1996 (Pop 65+)/ (Pop 15-64) |
|-------------------|-------------------|--------------------|---|---|
| | 2000 Q4 | | | |
| Greater Dublin | 3.1% | 63.3% | £19,291 | 14.3 |
| Rest of the State | 4.2% | 56.6% | £18,293 | 18.6 |
| BMW | 4.8% | 56.4% | £14,879 | 21.3 |

Source: CSO

Data suitable for measuring the trend in regional incomes are not readily available. The published series on Gross Value Added or Gross Domestic Product by region is distorted by the importance

of Multinational Companies (MNCs) in the regions. A large multi-national plant can generate a lot of valued added in a region but the concomitant is a sizeable outflow of profits from the region. Gross National Income estimates adjust for these flows but do not take into account the regional pattern of net transfer payments. Nonetheless it is significant that the convergence of regional GNP per person that was recorded between 1960 and 1979 was reversed between 1979 and 1996 (O’Leary, 2001). Similar evidence of regional divergence in living standards after 1987 is presented in Boyle, McCarthy and Walsh (1998-99).

Another relevant consideration is the trend in regional wage differentials. The tendency for regional incomes and wage rates to converge or diverge over time is a major theme in the economics literature (Sala-i-Martin, 1997). Neo-classical β -convergence refers to a negative correlation between the annual average growth rate of wages (*aagr*) over the period and relative wages at the start of the period (*relwage*). Ireland seems to be an exception to the general tendency for regional convergence across the regions of Europe: a regression using the nine former ‘planning regions’ over the period 1979-99 yields a positive and significant estimate of β , which implies divergence:

Nine regions:

$$aagr_i = 0.08 + 0.012 \text{ relwage}_{i, 79} \quad R^2 = 0.31$$

(1.8)

Nor is there any evidence of σ -convergence, that is, a reduction in the relative dispersion of regional wage rates. The coefficient of variation of wages increased from below 11% in the early 1980s to over 13% in recent years. Thus wages have been rising most rapidly in the already-rich regions and least rapidly in the poorer regions.

A final consideration is the growing concentration of population and economic activity in the Greater Dublin region. The share of the national population in the Greater Dublin region increased from 37.5% in 1981 to 38.8% in 1996, while that of the BMW region declined from 27.4% to 26.6%. Over the 1991-96 inter-censal period, the Greater Dublin region was the only one to attract a net inflow from the rest of the country; all other regions recorded net outflows to the rest of the country. Over half the net in-migration to the State came to the Greater Dublin

region.⁴ A continuation of these trends implies further significant growth not only in the absolute level of economic activity in the Dublin region but also in its share of the national total.

We believe that these indicators and trends justify the regional differentiation of the project appraisal procedure. This is also consistent with the policy advocated in *Enterprise 2010*.

5.0 Economic Circumstances Justifying State Aids to Industry

Our point of departure is the proposition that in the absence of economic or social justifications for public-sector intervention, laissez-faire yields the optimal outcome. However, a well-established body of economic theory identifies situations where public intervention can be justified. Given this, the role of a project appraisal system is to identify whether specific interventions are likely to yield benefits in excess of the associated costs. In the previous section we raised the issue of congestion in the major growth centres that justify the opposite type of intervention, namely taxes on further development to bring private and social costs in line.

The situations where social benefits may exceed private benefits of most relevance to the present study that justify intervention are:

- (i) when the labour market is ‘distorted’; and,
- (ii) when ‘externalities’ or ‘spillovers’, ‘agglomeration effects’ or more generally ‘increasing returns to scale’, are present.

‘Distorted Labour Markets’

Even at full employment labour markets may continue to be distorted, justifying support of particular types of projects. This would be the case if, for example, labour markets were ‘segmented’. The segmented labour markets hypothesis distinguishes between jobs in the primary labour market (which pay high wages and provide significant returns to investment in education and employment experience), and those in a secondary labour market which pay lower wages and lower or insignificant returns to education and experience (Hughes and Nolan, 1997). If this is the

⁴ Central Statistics Office, unpublished data from the QNHS.

case, there must be some rationing of jobs in the primary sector since equally well qualified workers in the secondary labour market would otherwise bid wages down to the competitive level. Under these conditions the secondary labour market, where wages are flexible, will be too large and the primary sector too small. There is therefore an argument for supporting industries that offer higher wages by attracting firms in the primary sector. Workers who move into these jobs from secondary occupations will see their pay and conditions improving substantially, yielding efficiency as well as equity gains. The distinction between “job ladders” and “job chains” is relevant if newly created jobs succeed in drawing Irish workers away from existing relatively menial jobs to better paid employment. Industries differ in terms of the security of employment offered, and in terms of associated positive spillovers, so that it is important that the country's industrial structure be continually upgraded. Recent trends indicate a rising rate of job losses in internationally traded sectors as some sub-sectors of the economy become uncompetitive and as employment moves to higher value-added sectors. This illustrates the continuing need – even in a ‘fully employed’ economy - to create new employment in higher-value added sectors while minimising displacement of existing high-value added jobs.

Another justification of intervention to subsidise employment relies on the existence of positive externalities or spillovers. An example is the spillover benefits that can arise for the rest of the economy from the introduction and diffusion of best-practice management techniques in a sector. If other firms then imitate these practises, a case can be made for subsidising the firm that takes the lead in their application. This is a rationale for Ireland trying to attract world-class, market-leading firms. These firms will not take into account spillover benefits in evaluating whether or not to locate in Ireland because they receive no return from the other firms to whom these benefits accrue. This may therefore lead to a sub-optimal level of investment in Ireland by these firms, justifying some degree of subsidisation by the development agencies. We need therefore to review the evidence regarding the importance of these justifications for subsidies to industrial projects.

The relevant question is whether spillover effects can be shown to be associated with foreign direct investment in Ireland. Barry, Görg, and Strobl (2000) investigate whether demonstration/agglomeration effects help explain UK and US foreign direct investment in Ireland. US direct investment in Ireland has increased dramatically in recent years. So called ‘flagship projects’ are

an example of the demonstration effect. Barry *et al.* model the number of new US and UK firms in a manufacturing sector locating in Ireland in each of the years 1973 to 1996. Agglomeration effects are proxied by the numbers employed by existing US, UK, and other foreign and Irish firms in each sector. Other explanatory variables include industry specific measures of Ireland's relative cost competitiveness and comparative advantage.

In the case of US firms, the number of new firms locating in Ireland is positively related to the number of employees in existing US and other firms, other things being equal including Irish cost competitiveness. These results are consistent with the agglomeration story. However, when the sample is split into high and low technology sectors, Barry *et al.* find that the number of employees in existing US firms has a statistically significant effect on the entry rate of new US high tech firms only. The entry rate of low US tech firms is affected by the number of employees in existing Irish firms. The results for UK firms are also consistent with the agglomeration story. Overall the econometric results for the entry of US and UK firms to Ireland provide some support for the demonstration / agglomeration effect of FDI inflows.

In a second paper, Barry and Strobl (2000) look for evidence of spillover effects from the presence of foreign firms and R&D activity. They estimate a regression model that attempts to identify these spillover effects. The stock of FDI and the extent of R&D activity in a NACE 2-digit manufacturing sector do help explain labour productivity in individual firms within that sector. *A priori*, one might expect that a larger foreign presence and more R&D activity would be associated with higher labour productivity. Labour productivity is measured as gross value added per employee and may be biased upwards by transfer pricing. The degree of foreign presence is measured by the share of employment within that sector accounted for by foreign firms and the measure of the extent of R&D activity is the share of employment in R&D active firms within the sector. The regression equation contains a number of other explanatory variables that attempt to control for labour quality, capital intensity, firm size and market concentration effects. Labour quality is proxied by the ratio of average earnings in the firm relative to average earnings in the sector.

Separate results are presented for the eight combinations of high and low technology sectors, foreign and indigenous firms, and R&D active and inactive firms.⁵ Unsurprisingly, high labour productivity in a firm is associated with high relative earnings in that firm, the proxy for labour quality. The authors find that the number of new US firms locating in Ireland is positively related to the number of employees in existing US and other firms, other things (including Irish cost competitiveness) being equal. These results are consistent with the agglomeration story. When the sample is split into ‘high’ and ‘low’ technology sectors, they find that the number of employees in existing US firms only has a statistically significant effect on the entry rate of new US ‘high tech’ firms. The results for UK firms are rather similar, so that the econometric results can be deemed to provide some support for demonstration and agglomeration effects on FDI inflows. Görg and Strobl (1999) conduct an empirical study of the effect of the presence of foreign multinational companies on the entry rate of indigenous firms in Irish manufacturing. At the theoretical level these effects can operate in either direction. Foreign-owned multinational companies can exert positive effects on the development of indigenous suppliers through linkage effects, or they may exert negative effects through competing with indigenous firms in product or labour markets. Görg and Strobl’s results indicate that the effect over the period analysed has generally been positive.

We also argue, as hypothesised in *Enterprise 2010*, that plants with the following characteristics contribute to the upgrading of skill levels and consequently wage rates in the economy:

- (1) high-tech R&D performers;
- (2) plants intensive in the use of educated/high-skill labour; and,
- (3) high-wage plants.

Agency support of such firms is justifiable, even at full employment, because the replacement of other jobs by jobs with these characteristics represents a net gain. This argument suggests a rule of thumb whereby higher-wage jobs are more deserving of subsidy and, as we shall argue below, that a lower shadow wage be adopted for such projects.

⁵ The explanatory power, as measured by R^2 , of some of the equations is very low so overly strong conclusions cannot be drawn from the results.

The following evidence supports this view. First, R&D performing plants pay higher wages than non-performers; (see the average wage by firm type in Table 3).

Table 3: Average wage in R&D-active and inactive plants, 1998

| Firm Type | Average Wage £000 |
|--------------|-------------------|
| R&D Inactive | 18,230 |
| R&D Active | 20,760 |

Source: unpublished Forfas data

Second, we know that employment in the modern sectors is more highly-skilled than in traditional industry and that employment in foreign-owned industry is generally more highly-skilled than in indigenous industry: (Barry, Bradley and O'Malley, 1997). Table 4 shows that these skilled-labour-intensive sectors are also the high wage sectors. Finally, other research has shown that R&D active firms make a larger contribution to the economy than R&D inactive firms, both in terms of the length of time they are likely to survive and in terms of the quality of the employment they provide (Kearns and Ruane, 2001).

Table 4: Distribution of Newly Created Jobs,⁶ 1998

| Sample | Of which | Jobs Created |
|-----------|------------------|--------------|
| High Wage | <i>% Foreign</i> | 82.0 |
| | <i>% Modern</i> | 63.7 |
| Low Wage | <i>% Foreign</i> | 58.8 |
| | <i>% Modern</i> | 45.0 |
| | <i>% Young</i> | 16.5 |

Source: unpublished Forfas data

The development of a strong and vibrant Irish-owned SME sector and the development of locally controlled, internationally-traded businesses that are world-class competitors within niche markets must be a central element in the development of a competitive enterprise sector. The development of these companies is important because locally owned businesses are more likely than others to:

⁶ The modern sectors we define as NACE 24, 25 and 29-33. All others are defined as traditional.

- Generate a self-sustaining cycle of growth and reinvestment because the full set of corporate and entrepreneurial competencies are located in Ireland and the company's profits are more likely to remain in Ireland and seek new investment and business opportunities within existing businesses or new start-ups;
- Form part of a balanced portfolio of economic activities that provide insurance against technology, sector or market-specific shocks;
- Provide and sustain a base of sub-supply and services companies to service the multinational company base; and,
- Generally operate a wide range of business functions in Ireland and provide opportunities for employee advancement and for the development of world-class companies.

In addition, locally controlled multinationals are more likely to locate higher-value jobs closest to home and their assets provide an income stream for Irish citizens.

The level and scope of state aids appropriate for the promotion of output, investment and employment growth in the enterprise sector is a function of a number of factors. The less favourable the "business environment" for investment in capacity and in building capability, relative to alternative locations or investment opportunities in other sectors, the greater the case for compensating investment incentives. The converse is also true. The degree to which the business environment is supportive or otherwise of investment can be measured by reference to the following factors:

- The availability, cost and quality of labour;
- The availability, cost and quality of access and transportation;
- The availability, cost and quality of national physical infrastructure;
- The availability, cost and quality of business services;
- The availability, cost and quality of equity and working capital;
- The impact of taxation on the profitability of business and motivation of entrepreneurs and workers;
- The pro-business stance of public sector administrative regulation;
- The level of unemployment in an area and the employment supporting incentives; and,

- The scope and level of incentives in alternative competing locations for investment.

While any presumption of the need for state aids to encourage private sector investment may appear incongruous in a market-led economy, the reality is that such aids are widespread across developed economies, including the EU, at present. It is also the case that market forces are unlikely to achieve an appropriate regional balance in social and economic opportunities within an acceptable timeframe either at trans-national level in Europe or at sub-national level here in Ireland. There is also a need to ensure balanced development between indigenous and overseas sectors and to raise productivity levels. Accordingly some recourse to state aids in Ireland in the years ahead will continue to be appropriate. Their scope, level and availability will be a function of the factors outlined above, including the regional dimension.

All of these considerations can be used to justify state aid to certain types of firms even when the economy is fully employed. But of course any subvention must be subject to a rigorous appraisal and we now turn our attention to the methodology of the appraisal procedure.

6.0 Methods of Project Appraisal for State Aids

The appraisal system is used to evaluate the benefits obtained from grants and other outlays financed from exchequer sources.

6.1 Alternative Project Appraisal Techniques

Various appraisal techniques might be considered when evaluating states aids to enterprises. Some possibilities are:

- One-dimensional evaluation criterion, such as profitability or number of jobs created. We consider this approach too narrow due to its failure to take account of several outcomes and broader impacts that are important from a policy perspective;
- Non-aggregative procedures, which suffer from the limitation of not presenting overall assessment of impact; or,

- Multi-dimensional aggregative procedure, including decision (utility) analysis, planning balance sheets and goals achievement matrices, which may be more flexible than cost benefit analysis (CBA) but are open to the risks of subjectivity and double counting.

Cost Benefit Analysis (CBA) is generally justified on the grounds that it is the only methodology that provides a consistent ranking of projects' measured benefits and costs. It reduces the overall effect to a monetary amount and aggregates. It appears to be superior to rival methodologies in enabling agencies to evaluate projects according to the extent that they contribute to overall economic well being and meet defined economic criteria. It allows agencies to take into account all relevant influences on overall well being, unlike more simple (one-dimensional) decision procedures and it enables agencies to weigh the advantages and disadvantages of projects in a clear, systematic and relatively objective way. An explicit CBA model plays the important political role of increasing regulatory transparency. It requires that the criteria used to evaluate projects be made explicit. Agencies can use a CBA model to guide judgement in a way that rationalises and clarifies their preferences and decisions.

6.2 The Role of Cost Benefit Analysis (CBA)

CBA is widely used by governmental agencies as a tool in the evaluation and ranking of projects. The method has been criticised on grounds such as how certain issues, particularly to do with the environment (extinction of species etc.) and health (value of life) are treated. Many distributional and ethical issues are also unresolved, while measurement problems are pervasive, and as Little and Mirlees (1994) note there are many implementation problems, especially in developing countries. Nevertheless, the use of CBA is justified since it provides a consistent ranking of measured benefits and costs of projects, and no better alternative is available. To quote Adler and Posner (1999):

'Benefit-cost analysis, suitably constrained, is consistent with a broad array of appealing normative commitments, and it is superior to alternative methods of project evaluation. It is a reasonable means to the end of maximising overall welfare when preferences are

undistorted or can be reconstructed. And it both exploits the benefits of agency specialisation and constrains agencies that might otherwise evaluate projects improperly.'

The following points need to be brought out regarding the role of CBA in the Irish evaluation process:

- A CBA of projects is one part of a wider project evaluation system used by each of the development agencies, which includes an assessment of management, financial track record, target markets, and so on. It is used by the investment committees and boards of the development agencies in their decision making, and in applications for State support that require Government approval. A satisfactory benefit to cost ratio is a crucial condition for a project if it is to be deemed eligible for funding, but does not create an automatic entitlement to it;
- Because projects come forward for approval on an on-going basis throughout the year rather than together, the CBA is not used to rank projects ex-ante with a view to deciding on the allocation of a limited budget between competing projects; and,
- The key role of CBA is to discriminate between projects with different characteristics so that resources are devoted to assisting projects that most closely match the criteria of creating sustainable, high-income employment in Ireland.

Qualitative and other factors that are difficult to quantify are not included directly in the existing or proposed model but are dealt with in the wider appraisal system, of which the CBA is only a part. In particular the Quality Ranking Matrix takes into account additional intangible (non-quantifiable) benefits associated with a project, as part of a multi-objective approach, to take full account of the value of support provided by the development agencies. This Matrix evaluates the potential of projects to contribute to the general objectives of industrial policy (summarised in Section 2.0) and in particular focuses on projects from well-managed, innovating companies in high-growth, high-productivity sectors (*Enterprise 2010*, p. 63).

6.3 The Existing Appraisal System

The conceptual framework that underpins the appraisal system adopted in 1996 is described in Honohan, 1998. The 1996 Review recommendations led to a major revision of the appraisal system in force up to the mid-1990s. It reduced the net economic benefits attributed to job creation relative to the earlier procedures.

Our proposed revised model takes the model now in force as its point of departure and we therefore summarise its main features. The existing model concentrates on benefits and costs that are amenable to measurement. Among the *benefits* particular attention is paid to the direct and indirect employment consequences of projects and the associated tax flows. The principal *costs* included are tax-financed grants expenditure.

6.3.1 The Shadow Wage

The principal justification for grant assisting employment creation traditionally has been to reduce the level of involuntary unemployment. To allow for the fact that involuntary unemployment is not reduced one-for-one by each job created in industrial projects, the market wage is replaced in the appraisal model by a shadow wage that reflects the opportunity cost of labour. In the existing appraisal system the shadow wage is set equal to 80% of the market wage to reflect the net economic gain associated with the employment it generates. This implies out of every £100 of a project's domestic wage bill, £80 is required to elicit the supply of labour, which is an opportunity cost, while the remaining £20 is the value attached to the reduction in involuntary unemployment, which is a net economic gain. In a fully employed economy the market wage is the same as the shadow wage – no net economic gain is attributed to generating employment *per se*. (We discuss the treatment of a higher net immigration rate below).

A key element underpinning the existing model is the belief that the Irish unemployment rate is insensitive to the rate of job creation. This belief was based on the view that the openness of the labour market tended to maintain an equilibrium rate of unemployment that equalised the expected value of wages in Ireland with those obtainable by emigrants. This was expressed as follows:

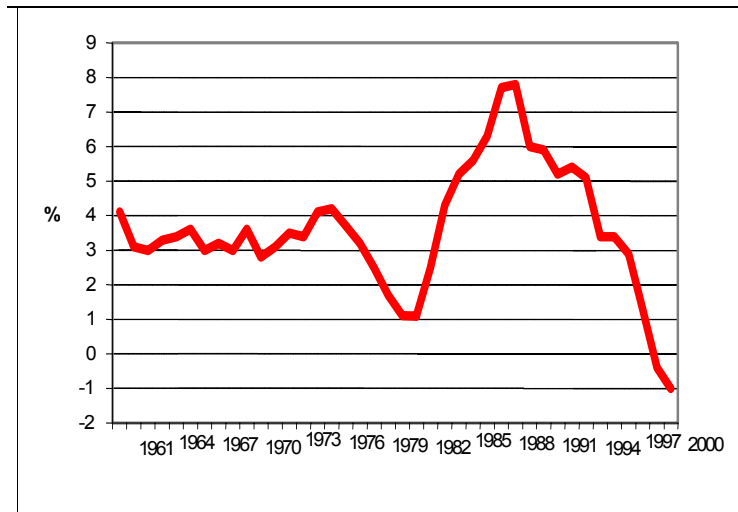
$$W_{ir1} = (1 - u) W_{uk}$$

where $W_{irl, uk}$ = UK and Irish wages respectively, and u is the Irish unemployment rate.

It was argued that Irish wages are set largely by a process of negotiation and are above the market-clearing level. As a result ‘Irish unemployment adjusts fully to changes in the UK rate of unemployment’ and ‘fluctuations in domestic employment levels have only a transitory effect on domestic unemployment’ (Honohan, 1998). The initial tendency of job creation to lower Irish unemployment is fully eroded by its tendency to reduce net emigration over time. Job creation therefore serves mainly to increase the size of the Irish economy (which is questionable as a goal of economic policy) rather than to reduce the rate of unemployment (which is an appropriate economic policy target). A key – and debatable – assumption of this analysis is that lower emigration is not counted as a benefit. This reasoning was used to justify a shadow wage close to the market wage even in the presence of high unemployment and emigration.

The experience of the 1980s seemed to support this view of the Irish labour market. Early in the decade the traditional gap between Irish and British unemployment rates narrowed as unemployment rose sharply in both countries but it re-emerged later in the decade as the Irish unemployment rate again rose above the British rate. However, the link between unemployment rates in the two countries seemed to weaken in the late 1990s, when rapid employment growth brought the Irish unemployment rate below the British rate (see Figure 2). It remains to be seen whether this new pattern will endure, but it seems that the assumption that immigration would maintain a relatively high unemployment rate in Ireland is no longer valid.

Figure 1: Irish UK Unemployment Differential (19961 – 2000)



Given the dependence of Irish economic growth on immigration, it is important to consider how to treat immigration in a CBA. The relevant criterion is the economic welfare of the existing indigenous population. Raising the rate of growth of the population and/or labour force is not of itself a benefit. The increased income of the immigrants is a private gain and is not included in this criterion.

We acknowledge that our criterion – maximising the welfare of the existing population by averting involuntary emigration and unemployment and raising living standards through the growth of wages and salaries is a narrow one. It focuses on income per capita rather than the overall growth rate and does not, for example, take into account the possible benefits that might accrue over the longer run from maximising the growth of the economy through a policy of encouraging immigration. In the absence of a clear national consensus to the contrary we believe that it is appropriate that the economic appraisal system should reflect a relatively conservative perspective on this issue.

The issue of the impact of immigration on the welfare of the indigenous population is complex. The main conclusion of the academic literature on the subject is that the adverse effects,

particularly for congestion in the housing market and in public infrastructure, are obvious while potential benefits are rather more nebulous; these depend on the importance of agglomeration effects and positive spillovers from the industries dependent on the immigration of skilled labour (Borjas, 1995). Immigrants with skills that complement those of the native workforce tend to raise the latter's wages, and might be regarded as a benefit, while those who compete with the native workforce are less beneficial or even harmful. In view of the uncertainty surrounding these effects – and the evidence from US studies that the net effects are not large – we believe that increased immigration should not be counted as a benefit in the model, even though there may be wider benefits to society. While the wages paid to these workers are what is required to induce them to live and work in Ireland and the resultant gain is a private one – the increased consumption of the immigrants – some of the additional taxes paid by immigrants are a relevant benefit. How they should be brought into the appraisal model is discussed below.

6.3.2 Tax deadweight and the social cost of public funds

Higher taxes impose distortions on the economy, while additional taxes raised from industrial projects lead to a reduced requirement to raise taxes elsewhere in the economy. This 'tax deadweight' has to be taken into account in the appraisal system. This is done by attaching a 'shadow price' greater than one to public funds. Honohan (1998) argued that the tax deadweight amounted to at least 50% so that the marginal cost of public funds should be set at 1.50 – every €1 of additional expenditure must bestow benefits of at least €1.50 to be deemed worthwhile. This shadow price was based on estimates obtained from the international and Irish literature on the distorting effects of Irish taxes on economic behaviour, especially Honohan and Irvine (1987). The existing economic appraisal model incorporates these assumptions regarding tax deadweight.

6.3.3 Treatment of tax receipts

Any net additional direct and indirect tax revenue generated by a project should be counted as a benefit. Just as each additional tax €1 required to finance grants is valued at €1.50, each additional €1 tax revenue and social welfare saving is valued at €1.50.

6.3.4 Grant deadweight

Many grant-aided projects would probably have developed in Ireland on some scale even if they were not aided. Honohan (1998) outlines a very simple theoretical model of the relationship

between grants and employment latched on to a Nash bargaining framework. He suggests that “even though the reasoning here relies on rather abstract theory, there seems to be no better approach to the key problem of deadweight” (Honohan, 1998, p31). The main problem in estimating the deadweight effect of assisting a project is calculating what would have happened to the project if it had not been assisted.

Various approaches have been used including interview studies, econometric modelling and using control/comparison groups. The drawback with interview studies is that executives generally have no particular incentive to truthfully reveal what they would have done if their project had not received assistance or had received a lower level of assistance. Econometric studies are more sophisticated but they do require a lot of data. A good deal of variation in the level of assistance provided etc. is required in order to pin down the likely deadweight effects of various levels and types of assistance. Surprisingly many studies appear to find that direct financial assistance has only a small effect on the location of FDI (Bergsman 1996, 2000).

Control/ comparison group studies are probably the most convincing. These studies look at differences over time in the performance of assisted firms in one area relative to the performance of similar non-assisted firms in another area. The control group approach is also called the “differences in differences” approach and is related to the concept of a controlled experiment. The problem is finding a suitable control group. In the Irish case, the majority of start-up firms are assisted and the non-assisted firms are likely to differ significantly from assisted firms in terms of observed or unobserved characteristics. Research carried out at the Northern Ireland Economic Research Centre (NIERC) for LEDU (Local Enterprise Development Unit) compared the performance of assisted small and medium sized firms or enterprises (SMEs) in Northern Ireland with the performance of similar, non-assisted firms in the North of England (Hart and Gudgin, 1999). This research suggests that the level of deadweight was about 50%, considerably lower than the 80% figure suggested by Honohan (1998).

The present appraisal system assumes that 80% of the benefits attributable to grant-aided projects would have happened anyway, so that only 20% should be attributed to the grant expenditure.

This estimate was based on a review of the Irish and international evidence and takes account of the fact that the Irish grant-aiding authorities behave like discriminating monopolists in offering the highest rate of subsidy to the projects whose benefits are most elastic with respect to the subsidy. While it may seem extreme to believe that only 20% of grant expenditure has any impact on the location of investment, this figure reflects two factors, namely, the possibility that a firm would have located here without any grant-aid, and the possibility that some grant aid is required but not as much as is actually given by the Agencies. A figure of this magnitude is also supported by a recent study of grants awarded to indigenous firms by SFADCO (Shannon Free Airport Development Company) (Lenihan, 1999). We believe, however, that it is appropriate to differentiate the assumption regarding grant deadweight to take account of the varying sensitivity of different types of projects to the package offered. We make specific proposals to take this consideration into account in our recommendations concerning the appropriate level of grant deadweight to be incorporated in the revised economic appraisal model.

In short, the existing model incorporates three key parameters, namely:

- The shadow wage;
- Tax deadweight and the shadow price of public funds; and,
- Grant deadweight.

In 1996 the direct and indirect employment creation consequences of projects were important. In a fully employed economy this is no longer the case. We believe however that employment creation remains important for at least four reasons because:

- (1) of natural job turnover and the continuing phenomenon of job losses even in a booming economy;
- (2) of labour-market dualism, that is the tendency for some sectors to pay low wages to employees who would be more highly paid in other, more modern sectors;
- (3) the economy is unlikely to remain forever at the present low rate of unemployment; and,
- (4) of the need to upgrade the quality of jobs in the Irish economy. The recent repercussions on the Irish economy of the slow-down in the US and world economy serve to illustrate the last point.

Project appraisal becomes more rather than less important at full employment. Most projects that create jobs are likely to yield net benefits when unemployment is high, but at full employment any new project will almost inevitably lead to the decline of an existing one. Selectivity between projects therefore becomes more important. Full employment also brings more complex industrial development issues such as the evaluation of externalities to the fore. Externalities are much more difficult to identify and measure than is the gap between prevailing and shadow wages and furthermore externalities are project-specific. Thus cost benefit analysis, while more important than ever when the economy is at full employment, also becomes far more difficult.

7.0 The Revised Cost Benefit Appraisal (CBA) Model

In this section we describe the revised model we propose for use in future cost benefit appraisals. The changes we propose take account of the changes in the economic situation since the mid-1990s, especially the growing tightness of the labour market and rising levels of congestion in the main urban centres. It also incorporates some methodological improvements on the original model. We believe that our revised model generally errs on the conservative side by proposing values for the key parameters that will increase the burden of proof on grant-seekers, as is appropriate under present circumstances.

We first list the principal benefits and costs to be included in the analysis. The manner in which these benefits and costs enter the model are then discussed one by one. The model as a whole is then set out. We further explore how sensitive the Benefit to Cost (B/C) ratio is to plausible changes in the model's parameters.

The parameters we propose for the key elements of the model are not graven in stone. They represent the consultants' best judgement of the appropriate levels taking into account the issues raised by the Steering Committee in the course of the finalisation of the Report. We believe that it is particularly important to keep the values of the parameters under review and to alter them in line with changing economic circumstances.

7.1 Benefits

The following are the magnitudes that need to be considered on the benefit side of the cost benefit model:

- The direct wage bill;
- The indirect wage bill;
- Irish profits, direct and indirect;
- The tax on foreign profits; and,
- The tax on Irish profits.

We discuss how each of these enters the CBA in the following sub-sections.

7.1.1 The Direct and Indirect Wage Bill

A proportion of the direct and indirect wage bills are treated as the principal benefits arising from projects. This proportion is determined by the appropriate shadow wage, the derivation of which is discussed in detail below.

7.1.2 Taxes on Wages

Earnings by employees generate tax revenue through both direct and indirect taxes. The current treatment is to count 35 per cent of the wage bill as the net exchequer impact of the project. This comprises an estimate of 40 per cent as potential revenue yield through direct and indirect taxes, less 10 per cent for additional public expenditure on public services plus an estimate of 5 per cent for social welfare savings. It is not proposed to change this parameter. However, in the existing version of the model all taxes on the wages associated with a project were counted as a benefit, the assumption being that all the additional employment was met through reduced emigration and that none of the associated tax revenue would have accrued in the absence of the project.

We propose a somewhat different treatment to take account of the changed labour market situation. We propose to count only a proportion of the tax on wages as a benefit. This proportion should reflect our belief about the proportion of the wage bill that is attributable to reduced emigration or increased immigration and hence of the taxes paid that are a net gain to the Exchequer that would not occur if the project did not go ahead. We discuss this parameter below.

7.1.3 Irish Profits

We propose to treat Irish profits somewhat differently from the procedure incorporated in the existing model. Previously a shadow price or opportunity cost of 100% was used. This meant that Irish profits were not counted as a direct benefit. We propose using the same shadow price for wages and Irish profits so some proportion of Irish profits will be counted as a benefit. In the absence of any alternative plausible approach, it is proposed to set the shadow price of Irish profits equal to the shadow wage to the extent to which highly profitable projects pay relatively high wages, their profits will be given a greater weight in the CBA.

7.1.4 Taxes on Profits

All of the tax revenue from foreign profits is treated as a net benefit to the Irish economy. However, the tax revenue from Irish profits is regarded as having the same opportunity cost as the project's wages and only the non-opportunity proportion of these profits is brought into the model as a benefit.

7.2 Recommended Parameter Values

In this sub-section we propose values for the key parameters based on the available evidence and our judgement of what is appropriate under prevailing Irish circumstances. As emphasised above, the model has been constructed in a manner that facilitates easy input of alternative parameter values. As circumstances change and/or additional relevant information becomes available we recommend altering the parameter values appropriately.

7.2.1 Grant Deadweight

All the presumed benefits of a project have to be modified by a parameter, θ , that reflects the extent to which the firms receiving grant-aid would have developed in Ireland in any event with a grant or if they had received a lower grant. This parameter should also take account of the possibility that aid to one firm reduces the profitability of other firms in the same sector and, in light of the present high level of economic activity, the possibility that a grant-aided project may displace other, non-grant aided, projects.

These issues have been widely discussed but unfortunately the available empirical evidence on their importance is limited. In particular since the vast majority of industrial projects are grant-aided in Ireland, we lack a control group of non-grant-aided firms that could be used to assess the impact of grants. However, we accept the argument that underpins the existing appraisal model that the grants offered are the result of a bargaining process between the applicants and the Agencies. It is also plausible to argue that the Agencies have gained in experience and sophistication in dealing with applicants with the result that the deadweight component of the grants has been reduced. There is a trade-off between the amounts offered to prospective investors and their eagerness or reluctance to undertake particular projects in particular regions. Taking these considerations into account and the different assumptions regarding grant

deadweights that are used at present, we recommend that the following grant deadweights be incorporated in the model.

Table 5: Grant Deadweight, θ

| | Start-up | Expansion | High Potential Start-up |
|-----------------------|-----------------|------------------|--------------------------------|
| Greater Dublin region | 80% | 80% | 60% |
| Rest of Ireland | 70% | 75% | 60% |
| BMW regions | 65% | 70% | 60% |

The low deadweight assigned to start-up projects in the BMW region is an acknowledgement of the difficulty of attracting desirable projects to remoter regions where the labour supply is relatively small and the infrastructure deficit is in some cases quite marked. The special High Potential Start-up (HPSU) category to which the lowest assumed grant deadweight applies refers to Start-up companies that have the following characteristics:

- starting in a growth product market (defined as markets with sales growing in the previous year at least 7% for food and consumer products, at least 10% for industry and at least 20% for international services)
- are based on technological innovation or the exploitation of an identified rapidly developing market niche;
- are founded and promoted by experienced managers, entrepreneurs, academics or highly skilled technical graduates, either from within Ireland or returning from abroad;
- which have the potential (a) to grow to have annual sales of EUR1.3 million or more, and (b) 10 people, within two years of starting operations and have demonstrable capability to trade internationally and whose business plans are based on exports; and
- Show clear evidence of being able to continue to substantially grow and of being in a position to fund such growth.

7.2.2 Tax Deadweight and the Shadow Price of Public Funds

Account has to be taken of the fact that grants are paid out of public funds raised through the tax system. It is an accepted principle of public finance theory that additional taxes impose costs on the economy in the form of distortions/disincentives and therefore every €1 of additional public spending has to generate more than €1 benefit to be deemed worthwhile. The same logic implies that every additional €1 tax revenue attributable to a project should be treated as worth more than €1 on the benefit side of the calculation.

These points are incorporated in the model through the tax deadweight parameter, ϕ . This is an estimate of the extra burden on the economy associated with raising €1 in additional tax revenue. The marginal cost of public funds is therefore $1 + \phi$. The present appraisal system uses a shadow price of public funds of €1.50 based on the value of $\phi = 50\%$.

The choice of this parameter was based on an academic literature applied to the Irish situation as it was in the 1980s (see Honohan and Irvine, 1987, Table 2). The range of deadweight proposed in this source, based on the situation in 1986, was £0.75 - £1.44. It was acknowledged that this was high by comparison with international practice, but argued that a high figure was justified for Ireland on the grounds of the high marginal tax rates prevailing here. The ESRI's 1996 review recognised that the fall in marginal tax rates since 1986 implied that a lower tax deadweight and proposed the range proposed was £0.50 - £1.00. Reference was made to 'the rule of thumb that deadweight costs of taxation are roughly equivalent to the square of the [marginal] tax rate'. Even though the lower end of this proposed range is used in the present model, the reduction in marginal tax rates since the early 1990s makes a value of $\phi = 50\%$ seem too high.

Between 1995 and 2001 the higher rate of income tax has fallen from 48% to 42% and the threshold for this tax rate has been raised from £11,400 to £23,740 in current prices or from £11,400 to £21,000 in 1995 prices. The standard rate of taxation has fallen from 27% to 20% and the tax threshold has risen from £2,500 to £5,500 in current prices or from £2,500 to £4,865 in 1995 prices. Moreover, the income tax changes in recent budgets have resulted in the substantial reductions in the marginal tax rates applied to groups whose behaviour is most sensitive to high marginal tax rates – specifically, people on low incomes and second income earners in

households. These changes are likely to have had a relatively large effect on labour supply and lead to a correspondingly large reduction in the shadow price of public funds. Moreover, the view that economists in general tend to exaggerate the deadweight costs of tax has recently gained ground (Ng, Yew-Kwang, 2000).

Taking these considerations into account, we believe it is appropriate to reduce the tax deadweight parameter ϕ to 25% and hence to treat the marginal cost of €1 of public funds as €1.25.

7.2.3 Shadow Wages Differentiated by Region and by Project

The main justification for grant-aiding industrial projects is the belief that they will generate new and higher quality employment, and contribute to the reduction of involuntary emigration and unemployment. Consequently by far the most important benefit associated with grant-aided projects is the associated direct and indirect wage bill. However, to include all of these wages as a benefit would imply that all of the persons employed would otherwise remain unemployed or be forced to emigrate. We have seen that the existing model relied heavily on the belief that the main impact of job creation was not on the Irish unemployment rate but on the size of the Irish labour force. It was argued that a larger labour force was not of itself an economic benefit and so only a small proportion of a project's wage bill should be treated as a benefit. However, because much of the additional employment generated by a project would be filled by a reduction in emigration (or returning emigrants) most of the extra taxes paid by these workers were treated as a benefit.

Under present Irish conditions the basic rationale for using a shadow wage that is close to the market wage is different from that advanced in Honohan (1998). The low unemployment rate and high net *immigration* rate now imply that the opportunity cost of an additional employee is close to the market wage. There simply are no significant reservoirs of involuntarily unemployed people in the economy at present. Our choice of shadow wage should therefore reflect the belief that in most situations the market wage – or something very close to it - is necessary to elicit additional labour supply.

The shadow wage enters the model as a parameter ν , where ν = the shadow wage, as a percentage of the actual average wage. The entire wage bill and some of the other benefits attributed to a project are pre-multiplied by $(1 - \nu)$. If $\nu = 1$ no benefits are attributed to a project on the strength

of the employment it generates. This would happen if the shadow wage equals the market wage, implying that all of the wage payment is required to elicit the work effort required by the project. This is the appropriate way to treat the wage bill in any sector or region that is at full employment.

In the existing model, the shadow wage is set equal to 80% of the market wage nation-wide, $v = 0.80$, and 20% of a project's wage bill is regarded as a benefit. The implication of the fall in unemployment since 1996 is that a higher shadow wage is now appropriate. Under present circumstances the case can be made that the shadow wage should generally be set equal to the market wage ($v = 1$). We believe that this should be the new benchmark for the Dublin region where full employment can be deemed to exist in the local labour market. This would also be appropriate for projects in certain sectors where shortages of suitable workers have become severe. However, we believe that the evidence of regional imbalances in labour market conditions discussed in a previous section warrants a regional differentiation of the shadow wage and retaining lower shadow wages in the regions still characterised by relatively high unemployment. The following *reference shadow wages* would achieve this objective:⁷

Table 6: Reference or Benchmark Shadow Wages, v_i

| Dublin | Rest of Ireland | BMW |
|-------------|-----------------|------------|
| $v = 100\%$ | $v = 95\%$ | $v = 90\%$ |

This implies that the benefits attributed to a project should vary from 0% of its wage bill in the Dublin region to 10% in the BMW regions.

We advocate a further refinement of the shadow wage used in the evaluation. We believe that additional benefits should be attributed to projects that are characterised by above average wage levels relative to the region in which they propose to locate. In doing so we are using above average wage as an easily observable proxy for high quality jobs and the belief that even at full employment benefits arise from attracting projects that raise average income in a region. This is

⁷ The revision to the shadow wage is based approximately on a formula that increases the opportunity cost of labour ($1 - v$) by two percentage points for every one percentage point fall in the unemployment rate.

the main way in which we implement the declared policy objective of ‘moving up the value-added chain’, as set out in *Enterprise 2010* and summarised in Section 2.0 above.

To give effect to this consideration we advocate adjusting the reference shadow wages in the regions to reflect the average wage rate in a project relative to the average wage rate in a region. To clarify this issue, let

w = the average wage associated with a project
 W_i = the average industrial wage in the region in which the project plans to locate
($i = 1, 2, 3$ for the three regions).

The adjusted shadow wage v' as a percentage of the actual wage is calculated by adjusting the reference or baseline shadow wage v_i in line with the ratio W_i/w .

If a project’s average wage level is the same as the average for the region in which it is proposed to locate, the reference v applies:

$$w = W_i, v'_i = v_i .$$

If a project’s average wage level is greater than the average for the region in which it is proposed to locate then a lower shadow wage is applied and larger benefits attributed to the wage bill:

$$w > W_i, v'_i < v_i .$$

If a project’s average wage is lower than the average for the region in which it is proposed to locate then a higher shadow wage is applied and smaller benefits attributed to the wage bill:

$$w < W_i, v'_i > v_i .$$

In Greater Dublin, since the reference shadow wage is 1, no benefits would be attributed to a project’s wage bill unless its average wage is above the Greater Dublin average.

Consideration needs to be given to the appropriate definition of the average wage in the region, W_i . It is desired to use a wage rate that would reflect the opportunity cost of recruiting an additional employee to an industrial project in a region. We have argued above that the labour market is heterogeneous and even segmented, with comparable skills being rewarded differently in different regions and sectors. The appropriate shadow wage for use in the economic appraisal should reflect the earnings of those likely to be drawn into new high-quality industrial projects. Unfortunately, the range of data available to guide us on this point is limited. The Central Statistics Office does not publish regional wage data for any sector other than industry, and for industry the only regional series is that published in the annual Census of Industrial Production (CIP) for industrial local units. The most recent data are for 1998, already three years out of date. The figures for 1997 and 1998 are summarised in Table 7.

Table 7: Regional Wage Patterns in Industry

| Wages and Salaries per Employee, £000 | | | | |
|---------------------------------------|-------|----------------|---------------|------|
| | State | Greater Dublin | Rest of State | BMW |
| 1998 | | | | |
| Industrial workers | 15.5 | 16.3 | 16.0 | 12.9 |
| Others | 24.5 | 24.6 | 24.5 | 22.2 |
| Total employees | 18.1 | 19.3 | 18.3 | 14.9 |
| 1997 | | | | |
| Industrial workers | 14.7 | 15.8 | 14.7 | 12.1 |
| Others | 22.8 | 23.0 | 22.9 | 21.2 |
| Total employees | 16.9 | 18.2 | 16.8 | 14.0 |

Source: Census of Industrial Production, Table 2, Industrial Local Units by region

Two wage series are available: one for ‘industrial workers’ the other for ‘other workers’.⁸ The latter refers to managerial and supervisory employees. It may be argued that lower wage rates applying to industrial workers are a better guide to the opportunity cost of an additional employee in new firms than the rates that apply to all workers, including salaried employees. On the other hand desirable projects are likely to contain a high portion of salaried employment. From Table 7 it may be seen that in general the highest wage rates are in the Dublin, and the lowest in the BMW region. The ‘rest of the state’ generally occupies an intermediate position, but in 1998 there was very little difference between Dublin and the rest of the state.

⁸ The earnings figures are gross of taxes (including employee’s PRSI) and include overtime and bonus payments but not employer’s PRSI, share options and other benefits.

The absence of regional wage data for sectors other than industry is a limitation, but Table 8 summarises *national* wage levels in distribution and business services and construction. The industrial earnings data in Table 7 for 1998 should be increased by 12.5% for comparison with the data for mid-2000 in Table 8. Such a comparison clearly shows that the only sector in which full-time employees are paid significantly less than those in industry is ‘accommodation and catering’, that is the hotel and restaurant trade, where increasingly acute labour shortages in this sector especially during the tourist season are likely to result in very rapid wage inflation.

Table 8: Earnings in Distribution and Business Services and Construction, 2000

| NACE code | | Numbers engaged (total) | Full-time employees in Enterprises with more than 5 persons engaged | Average full-time yearly earnings |
|-----------|--------------------------|-------------------------|---|-----------------------------------|
| | | <i>Thousands</i> | | £000 |
| 50 | Motor trade | 39.3 | 18.6 | 17.8 |
| 51 | Wholesale trade | 53.9 | 33.7 | 21.8 |
| 52 | Retail trade | 160.2 | 62.3 | 20.4 |
| 55 | Accommodation & Catering | 118.3 | 48.6 | 13.5 |
| 60 | Land transport | 40.6 | 19.2 | 20.4 |
| 60-63 | Other transport | 30.3 | 24.9 | 21.7 |
| 64 | Post & Telecoms | 35.0 | 29.3 | 27.5 |
| 70-71 | Real estate | 12.9 | 4.6 | 20.5 |
| 72-73 | Computing activity, R&D | 35.0 | 26.5 | 25.3 |
| 71 | Other businesses | 99.5 | 50.8 | 22.1 |
| | Construction industry | | | |
| | Skilled operatives | | | 25.5 |
| | Unskilled operatives | | | 21.0 |

Source: Quarterly Survey of Earnings in Distribution and Business Services, September 2000
Quarterly Survey of Earnings and Hours Worked in Construction, June 2000

Finally, the data on non-agricultural income, remuneration of employees - ‘wages, salaries, and pension’ - contained in National Income and Expenditure may be considered. In 1999 this wage bill is recorded as £26,304 million. The estimated numbers employed in non-agricultural activities (full-time equivalent) was 1,398,000. This figure included employers and other non-employees, and its use in the denominator leads to an overestimate of employee income per person. Nonetheless, the figure obtained is £18,800 which may be compared with the national average of £18,100 for all employees in industry in 1998.

Finally, the CSO's Regional Accounts – latest available for 1997 – reveal even higher average earned incomes.⁹ The following figures have been derived for the regions from this source:

- State - £20,300;
- Greater Dublin – £22,300;
- Rest of State - £19,500; and,
- BMW - £18,000.

This evidence leads us to conclude there are no reservoirs of labour currently employed at wage rates that are significantly below those reported in the CIP.

We therefore recommend that the appropriate reference wage for a CBA of job creation in the industrial sector is the average earnings of all employees in industry. The use of the higher figures for all employees in industry – as distinct from the lower earnings figure for industrial workers – is warranted in light of the desire to upgrade the quality of the industrial jobs supported by the Agencies. There is no statistical evidence that a significant pool of labour is employed in non-industrial sectors in Ireland at wage rates that are markedly lower than those paid to workers in industry.

Updating the 1998 Census of Industrial Production earnings data by the national trend in industrial earning in 1999 and 2000 (+12.5%) we obtain the following estimates of average industrial earnings by region for 2001:

Table 9: Industrial Earnings Estimates for 2001

| | |
|----------------|---------|
| Greater Dublin | £21,700 |
| Rest of State | £20,600 |
| BMW | £16,800 |

⁹ Earned income consists of the income of the self-employed plus the compensation of employees (wages and salaries, benefits in kind, and social insurance contributions).

Limits should be placed on the range of the adjusted shadow wage v'_i . In view of the congestion and other negative spillovers associated with the growth of the Dublin region, we believe that the adjusted v should never fall below 90%, regardless of how high the project's average wage is. We advocate a lower limit of 85% in the 'rest of the state' and 80% in the BMW region. This implies that in Dublin a maximum of 10% of the wage bill of a high wage project should be regarded as a benefit, while in the BMW region the maximum would be 20%. Thus the benefits at present attributed to the wage bill of all projects will henceforward be attributed only to a high-wage project that proposes to locate in the BMW region. The benefits from all other projects will be scaled back.

We recommend that the adjusted shadow wage rate be calculated as follows:

- In the BMW region a maximum of 20% of a project's wage bill should be treated as benefit. This would occur only if the project's average wage bill were 10% above the average wage in the region;
- In the 'Rest of Ireland' (that is the state excluding the Greater Dublin and the BMW regions) region a maximum of 15% of a project's wage bill should be treated as a benefit. This would occur only if the project's average wage bill were 15% above the average wage in the region; and,
- In the Greater Dublin region, a maximum of 10% of a project's wage bill should be treated as benefit. This would occur only if the project's average wage bill were 30% above the average wage in the region.

We believe that these values of the shadow wage strike a balance between the need to take into account the benefits of attracting relatively high-wage firms to relatively depressed regions of the country, on the one hand, and the full-employment/increasing congestion situation that prevails in the Greater Dublin region. The same project would be deemed to have higher benefit if it located in a low wage region, while within a region the higher a project's average wage, the greater the benefit attributed to it.

We summarise the recommended method of calculating adjusted shadow wages in Box 1 on the next page.

Box 1: Summary of the Adjusted Shadow Wage

The baseline shadow wage (opportunity cost of labour) and adjusted shadow wage vary by region. The baseline shadow wage applies to projects, which pay the average industrial wage in the region. Within limits, the shadow wage is increased if projects pay above the average wage and reduced if projects pay below the average wage.

Baseline Shadow Wages and Ranges for Adjusted Shadow Wage:

Greater Dublin - Baseline 100%, Range 90% to 100%

Rest of State - Baseline 95%, Range 85% to 100%

Border, Midlands & West (BMW) - Baseline 90%, Range 80% to 100%

Calculation of Adjusted Shadow Wage:

Greater Dublin Region - Reduce baseline shadow wage of 100% by 1/3 of a percentage point for every percentage point by which average wage in the project exceeds the average industrial wage in the region, subject to a lower bound of 90%.

Rest of State - Reduce baseline shadow wage of 95% by one percentage point for every percentage point by which the average wage in the project exceeds the average industrial wage in the region, subject to the lower bound of 80%.

Border, Midlands and West Regions - Reduce baseline shadow wage of 90% by one percentage point for every percentage point by which the average wage in the project exceeds the average industrial wage in the region, subject to the lower bound of 80%.

7.2.4 *The Immigrant Component of the Wage Bill*

As mentioned above it is valid to regard some of the employment generated by projects as a net addition to the level of employment in Ireland, filled by higher net immigration and/or increased labour force participation. It is therefore valid to regard a fraction λ of the opportunity cost part of the wage bill as a net addition to GDP. Even though the wages are an opportunity cost and should not be treated as an economic benefit in the model, the taxes paid on this proportion of the wage bill (grossed up by the shadow price of public funds) should be included as a benefit. Had the project not been implemented, tax revenue in Ireland would have been that much lower. On the basis of the evidence presented in Section 3.0, and particularly the fact that approximately half the growth of the labour force is now due to net immigration, we believe that the appropriate benchmark value for λ is 50% (in the existing model $\lambda = 100\%$). This implies that one half of the taxes on the opportunity cost component v of the wage bill should be treated as net additional tax revenue. However, we acknowledge that higher values of λ are appropriate in other regions. While our criterion is *national* economic welfare, there is a case that can be made for weighting the gains outside Dublin more heavily than gains in Dublin due to the growing congestion in the Dublin region. On these grounds we recommend the following set of λ 's:

Table 10: Immigration Component of Wage Bill.

| Region | Value of λ |
|----------------|--------------------|
| Greater Dublin | 50% |
| Rest of state | 55% |
| BMW region | 60% |

These values have to be combined with the appropriate levels of v to see the proportion of taxes on the opportunity cost of the wage bill that is treated as a benefit. A further $(1-v)\%$ of the tax on the wage bill (that is the non-opportunity cost portion) is also treated as a benefit. Because a further $(1-v)\%$ of the tax on the wage bill (that is the non-opportunity cost portion) is also treated as a benefit, this means that, overall, between 50% and 60% of the taxes on wages are treated as a benefit.

Since v and λ vary regionally, the result is that the following proportions of the tax bill are attributed as a benefit of the project:

Table 11: Tax Benefits from Wage Bill

| | Immigration | Adjusted shadow wage | Proportion of tax on the opportunity cost portion of the wage bill treated as a benefit | Proportion of tax on the non-opportunity cost portion of the wage bill treated as a benefit |
|----------------|-------------|----------------------|---|---|
| | λ | V' | $\lambda v'$ | $I - v'$ |
| Greater Dublin | 50% | 90% - 100% | 50% - 45% | 0% - 10% |
| Rest of State | 55% | 85% - 95% | 52% - 47% | 5% - 15% |
| BMW | 60% | 80% -90% | 54% - 48% | 10% - 20% |

7.2.5 *The Discount Rate and Risk*

The costs and benefits that enter the CBA are spread over time. They must therefore be reduced to a present value (PV) by applying an appropriate discount rate. The time horizon used is seven years, after which the PV of any further benefits would in any event be very low. In a world of certainty, it is usually advocated that the interest rate on government bonds of the same term length as the project in question is the appropriate shadow interest rate (Zerbe and Dively, 1994).

While the concept of the real interest rate appropriate for risk-free (or low-risk) projects is clear enough, there is no agreement on what this rate actually is. In the US the government issues inflation-protected treasury securities (TIPS) that pay a return of 4% above the rate of inflation and this would be an appropriate rate to apply to risk-free projects. No comparable instruments are available to the Irish investor. In fact, in recent years in Ireland the real return on government

securities has been very low and actually negative in the course of 2000. However, in line with recommended practice in Irish public project appraisal, we recommend that the risk-free component of the discount rate be set at 5% although we believe that this errs on the conservative side¹⁰.

The projects of interest to the Agencies are not risk free. It is difficult to decide on the premium that should be added to the risk free discount rate to take their riskiness into account. Some guidance is provided by the rates of job loss for the type of projects supported by the Agencies in the past, although the experience of the past ten years was particularly favourable due to the prolonged boom in the US economy. Account has also to be taken of the fact that risk increases as the Irish economy becomes more exposed to certain sectors such as electronics and computers. These factors are referred to in the finance literature as ‘covariance risk’. This risk does not apply uniformly to projects. Factors that reduce the covariance risk should be taken into account in the wider appraisal process.

We explored the survival rates of projects classified by various characteristics such as sector, size, and ownership. We concluded that the differences between various categories of firms were small and did not warrant adjusting the risk premium between projects. Our proposal therefore is to incorporate a uniform 5% discount to allow for the uncertainty surrounding the projects. This 5% risk premium captures both idiosyncratic risk associated with individual projects and covariance risk associated with the mix of projects that the Agencies support. The total discount rate to be applied is therefore 10%¹¹.

7.3 Costs

The principal costs that have to be taken into account are:

- Grants to fixed assets;
- Grants to training, R&D and Employment; and,

¹⁰ See *Proposed Working Rules for Cost Benefit Analysis*, Department of Finance, CSF Evaluation Unit, June 1999.

¹¹ The procedure involves disregarding all benefits after seven years. If the net benefits build up linearly to full production over the first four years this combination of discount rate and cut-off is approximately equivalent in present value terms to discounting at 5% and allowing for a uniform job decay rate of 20% per annum after full production, or to discounting at 12% (allowance for risk aversion) and a uniform job decay rate also of 12%.

- Equity injections.

7.3.1 Equity injections

The 1996 Report approached the calculation of the grant-equivalence of equity injections (typically preference share investments) by estimating a formula for the market value of the Agency's equity claim. Using illustrative assumptions about projects' success rates, the cost of risk free capital, and the coupon paid, it was suggested that the market value of an injection of £1 would be about £0.33. This implies that the grant-equivalent of a £1 injection would be £0.66.

A higher success rate, and the growing option value of conversion rights, suggests that the market value of equity claims would have risen over the past five years and hence the grant equivalent fallen.

Plausible values of the parameters now point to a market value of €0.50 per €1 of injection, and correspondingly a grant equivalent of €0.50.

7.3.2 Environmental Impacts

The major environmental consideration arising from the type of new industries being attracted to Ireland relates to their demand for electricity. Ireland's rapid economic growth in the 1990s has increased the demand for electricity very sharply and cast a doubt over our ability to meet our commitment to abating greenhouse gas emissions in line with the Kyoto Protocol. These considerations might provide a justification for attaching a penalty to energy-intensive projects by applying a shadow price higher than the market price to electricity costs.

Shadow prices for energy consumption are subject to a wide margin of error. Faced with this uncertainty we do not advocate the use of a shadow price for energy consumption and continue to believe that this issue is best dealt with through the appropriate pricing of energy rather than by attaching a penalty to the industrial use of energy.

Alternatively, it may be more appropriate to deal with the relevant environmental issues at the level of the generation and transmission industries, so that they are reflected in the costs facing industries contemplating an Irish location. Of particular significance is the recently announced

intention to include tradable permits in the package of measures designed to meet Ireland's commitment to reducing its greenhouse gas emissions. This could be an attractive way for new, energy efficient projects to meet their obligations in this area. It is also relevant that the growth in electricity demand is increasingly being met from natural gas, which is more environmentally benign than coal or oil as a feedstock. Taking these considerations into account we do not advocate any special treatment of energy inputs at this stage, but we believe that this aspect of the model should be reviewed in light of developments in environmental policy.

A second problem that is now openly acknowledged is that Irish electricity supplies are severely constrained. There is risk of brown- or blackouts during periods of peak load. A related issue is that the inadequacies of the distribution network present problems for energy-intensive industries in parts of the BMW region. However, we believe that the supply-side problems will be relatively short-lived. Capacity can be expanded and distribution networks improved within the seven-year time horizon adopted in the appraisal model. We therefore do not consider that explicit consideration should be taken of this issue in the model, although the adequacy of energy supplies will obviously influence the location decisions of potential investors. The degree to which a project does or does not contribute to the achievement of the objectives in Ireland's National Climate Change Strategy should be explicitly included in the Quality Ranking Matrices of each of the development agencies.

7.3.3 R&D and Training Grants

In Ireland, the bulk of state support for human resources is allocated to initial education and training prior to entry to the labour force and to the training of the unemployed. Enterprise related training has generally been regarded as the responsibility of the private sector. However due to externalities and market failure, the state may encourage and assist investment by the private sector in training. OECD statistics suggest that Ireland ranks relatively poorly on numerous measures of employee training including 'mean number of course hours per employee in job-related continuing education and training'. The European Council, at its meeting in Helsinki in December 1999, issued three Employment Policy Recommendations to Ireland, one of which urged an:

"Intensification of efforts to expand and increase the in-house training of employees".

The standard neo-classical model argues that the human capital of the workforce should lead directly to increased economic growth, as a more educated or trained workforce have a greater ability to adopt and develop new technologies, and highly skilled workers are more productive (Barro 1991). At a macro-economic level, most empirical studies have found a positive relationship between educational level and GDP growth rates per capita (Mankiw, Romer and Weil, 1992; Barro 1991). Research by Booth and Snower (1996), found evidence that the skill gap between the UK and Germany has a significant influence on their relative levels of exports. Closing the relative skill gap between the UK and Germany by 1% would increase the volume of UK exports to the US and the Netherlands by about 4% and 6% respectively. Closing the skill gap completely (30% gap) would lead to a massive rise in UK exports.

Research by Walsh (1997-98) in Ireland found a weaker link in this relationship between skills and GDP growth, due to the ineffective utilisation of human capital. However, as labour has become relatively scarce (and expensive) over the last decade, it is likely that the relationship between education and training levels and growth in GDP per capita has become stronger. A productivity study by Barrow (1991) compared productivity in enterprises of similar sizes and product market sectors in different countries. Controlling for differences in physical size, raw materials, and organisation of work, this study attributed productivity differentials between British and German firms to workforce training, qualifications and skills. Similar studies (OECD 1998) between “matched plants” which compared Irish firms to those in Northern Ireland, Britain, and Germany concluded that Ireland suffers a significant skill gap when compared to best practice abroad.

A large literature exists that explores the extent to which the benefits from R&D and training expenditures are not fully captured by firms. We discuss this literature in some detail in *Appendix II*. The various studies we cite show that it is likely that from an industrial policy perspective that there will be sub-optimal investment in training from a national point of view. Similarly, while the social returns to R&D are difficult to quantify they are likely to be significant. Given the range of positive externalities, it seems plausible to assume that positive spillovers amount to at least half the grant outlay. We propose therefore following consideration of the views of the Steering Group to include only 50% of the grants for R&D and 75% of grants for Training (including management development grants) in the costs attributable to a project. An alternative

treatment would be to include total costs and treat 50% and 25% of the R&D and Training costs respectively as a benefit.

7.3.4 Indirect inputs

We have updated the Input-Output (I-O) Table used to calculate the indirect benefits resulting from the purchase of materials and services by project firms in line with the CSO's 1993 I- O Table. The I-O weights used are set out in Appendix I.

The correct valuation of purchasing of materials from the Meat and Meat Products and Dairy Products sectors, as well as the Timber part of the Timber and Wooden Furniture sector is important. The Meat and Dairy sectors are largely engaged in basic processing of Irish primary products, with more than 90 per cent of their material inputs being sourced in Ireland, and value-added to their material inputs being less than 20 per cent of the value of their sales. Their level of output is thus largely driven by the level of supply of Irish primary products available to them. Basic processing of Timber is similar in this respect. Consequently, if a new project creates additional demand for the products of these sectors this does little more to generate net additional economic activity than does the creation of new demand directly for agricultural or forest products. Therefore, as a general rule, one should not count the value of meat, dairy or timber products which are purchased as inputs for a project as additional economic activities stimulated by the purchasing project.

Some exceptions to this general rule are permitted. Consider an agency sectoral restructuring programme. In this case, one could argue that purchasing of a particular type of meat, dairy or timber product stimulates more value-added in the meat, dairy or timber product sectors than would otherwise occur, and the additional value-added in excess of the norm might then be counted.

7.4 Summary of the Revised Model

We can summarise our proposals by presenting a revised cost benefit formula. Box 2 summarises the model formulae, while Table 12 contains an overview of the recommended values of the parameters.

We draw attention to the following features of the model:

- All benefits are modified by the grant deadweight. This means that at most 40% and at least 20% of a project's benefits are attributed to the grant outlay;
- The most important potential benefit of a project – its direct wage bill – is further reduced by a factor representing the ratio of the wages paid to the opportunity cost of the labour employed. This consideration allows at most 20% of the wage bill to be included as a benefit. In some cases, none of it is treated as a benefit;
- Only half of the taxes paid on the opportunity cost component of the wage bill are treated as a benefit. This implies that at most 50% and at least 40% of these taxes are treated as a benefit;
- All of the taxes paid by foreign companies are treated as a benefit;
- A proportion of the taxes on the opportunity cost proportion of the project's wage bill is treated as a benefit, reflecting the belief that some of the employment generated is additional and would not otherwise materialise. This proportion is deemed to vary from 50% in the Greater Dublin region to 60% in the BMW region. All of the tax on the non-opportunity is included as a benefit;
- Any tax-financed costs associated with the project are grossed up by 25% to take account of the tax deadweight; and,
- Similarly, the taxes included as benefits are grossed up by 25% to take account of the tax deadweight.

The model summarised in Box 2 may be compared with the model described in ESRI (1996) and Honohan (1998). The principal changes in the model – as distinct from the changes recommended in the parameter values – are:

- The regional differentiation of the shadow wage, v ;
- The regional differentiation of the ‘immigrant additionality’, λ ;
- The regional differentiation of the grant deadweight, θ ;
- The adjustment of the shadow wage to take account of the quality of the job generated by the project as reflected in its average wage rate; and,
- A more detailed treatment of Irish profits.

The most important proposed changes in parameter values are:

- The higher shadow price of labour, v ;
- The reduction in the immigrant component of the additional employment λ from 100% to between 50% and 60%;
- An increase in the discount rate from 8% to 10%;
- The reduction in the tax deadweight from 50% to 25%; and,
- A reduction in the grant deadweight from a range of 70% - 80% to the range 65% to 80%.

The regional dimension to the model is now reflected in three ways:

- The shadow wage is lower outside Dublin;
- The grant deadweight is lower outside Dublin; and,
- The additionality of tax revenue is higher outside Dublin.

Box 2: The Revised Model

Let

θ = Grant deadweight φ = Tax deadweight

ν' = Adjusted shadow wage ν = Average shadow wage

λ = Increase in net immigration as a proportion of increase in employment

Benefits

$$B = [1 - \theta] [(1 - \nu') B_1 + (1 - \nu) B_2 + B_3]$$

B_1 = Direct wage bill + Direct Irish profits (both inclusive of taxes)

B_2 = Indirect wage bill + Indirect Irish profits (both inclusive of taxes)

B_3 = Taxes on direct and indirect foreign profits + $\lambda \nu'$ (taxes on direct wage bill) + $\lambda \nu$ (taxes on indirect wage bill) + Reduction in deadweight burden of taxation

Reduction in deadweight burden of taxation =

$$\varphi [(1 - \nu') T_1 + (1 - \nu) T_2 + T_3]$$

T_1 = taxes on direct wage bill and on Irish component of direct profits,

T_2 = taxes on indirect wage bill and on Irish component of indirect profits, and

T_3 = Taxes on direct and indirect foreign profits + $\lambda \nu'$ (taxes on direct wage bill) + $\lambda \nu$ (taxes on indirect wage bill)

Costs

$$C = (1 + \varphi) \text{ Grant}$$

Benefit/Cost Ratio = PVB/PVC

$$\text{PVB} = \text{present value of benefits} = \sum_1^7 (B_t / (I + r)^t)$$

$$\text{PVC} = \text{present value of costs} = \sum_1^7 (C_t / (I + r)^t)$$

r = discount rate

Table 12: Summary of Proposed Parameter Values

| | | | | | | |
|--|--|--|------|--------------|--|---|
| Shadow wage, v_i (%) | Greater Dublin | 100% | | | For high wage projects the adjusted shadow wage may fall to the lower limits – 90% for Dublin, 85% in the ‘rest of country’, and 80% in the BMW. | |
| | Rest of State | 95% | | | | |
| | BMW | 90% | | | | |
| Adjusted shadow wage, v' (%) | Greater Dublin | $90\% \leq$ | v' | $\leq 100\%$ | | |
| | Rest of State | $85\% \leq$ | v' | $\leq 100\%$ | | |
| | BMW | $80\% \leq$ | v' | $\leq 100\%$ | | |
| Indirect wages etc v_{avg} = Average shadow wage | 95% | | | | | This reflects the belief that indirect employment is evenly spread across the state |
| Shadow price of direct Irish profits | Same as adjusted shadow wage | | | | | To reflect opportunity cost of project |
| Shadow price of indirect Irish profits | 95% | | | | | To reflect opportunity cost of project |
| Proportion of opportunity cost of net additional employment attributable to immigration, λ | Greater Dublin = 50% Rest of state = 55% BMW = 60% | | | | | Determines the proportion of taxes on the direct and indirect wage bill that is regarded as a benefit |
| Grant deadweight, θ | Expansions | Greater Dublin = 80% Rest of state = 75% BMW = 70% | | | Differentiated according to region | |
| | Start-ups | Greater Dublin = 80% Rest of state = 70% BMW = 65% HPSU = 60% | | | | |
| Tax deadweight, ϕ Shadow price of funds, $1 + \phi$ | 25% | | | | Reduced from 50% | |
| Marginal tax rate (wage bill) | 35% | | | | Includes reduction in social welfare transfers and reflects the relatively high wages paid in industrial projects | |
| Corporation Tax rate | 12.5% | | | | Updated | |
| Discount rate | 5% ‘Risk free’ + 5% for risk | | | | Risk free rate in line with the Dept of Finance recommendation | |
| I/O weights | 1993 CSO I-O Table | | | | Updated | |

8.0 Future Revisions and Conclusions

This report contains the results of a review of the existing appraisal system for projects seeking grant-assistance from the industrial development agencies and recommendations for a modified system to be used in the future. Building on the theoretical framework of the existing model, the proposed new model contains significant changes. These are due to some methodological refinements to the original model and several changes in the parameter values that are designed to reflect the dramatic changes that have taken place in the Irish labour market since the earlier model was formulated.

We believe the new model is sensitive to the prevailing economic situation in Ireland, to national industrial development policy and to the aims and strategies of the Agencies. However, we advocate flexibility in the implementation of the model, which has been redesigned specifically to facilitate changing the parameter values in light of changing economic circumstances.

Just as the present review of the Agencies' economic appraisal system has been undertaken to update the existing model and bring it into line with current conditions, it may be appropriate to review and adjust the recommended parameter values over time to take account of cyclical economic fluctuations.

The values of parameters such as the shadow wage v and the immigrant component of wages λ need to be varied over time as Irish labour market conditions change. The following variables need to be monitored in order to assess whether the parameter values recommended in this Review continue to be appropriate:

- The national unemployment rate;
- Regional differentials in unemployment;
- The rate of net immigration;
- The level of vacancies;
- The rate of wage inflation in industry and other sectors; and,
- Industrial earnings data.

Significant changes in these variables would warrant a decision to change the parameters of the model.

However, most of the parameters and features of the model – the discount rate, tax and grant deadweights, the immigrant proportion of the wage bill, the treatment of indirect inputs, and so on– should not be changed in response to *cyclical* changes in labour market conditions. It would only be appropriate to adjust them if evidence becomes available of *structural* changes in the economy.

Moreover, it is not appropriate to use the industrial promotion system as an instrument of short-term economic management or as a substitute for conventional stabilisation policy. The methodology would lose credibility if the parameters were altered frequently in response to short-lived fluctuations in the unemployment rate. But a sustained increase in the unemployment rate could justify a reduction in the opportunity cost of labour (or the shadow wage) in the model. Therefore it is recommended that only the shadow wage and reference wage rates be regularly reviewed.

We recommend that the benchmark or reference shadow price of labour v should be changed in response to a rise in unemployment that has persisted for some time. Specifically our recommendation is that:

The reference shadow price of labour in the model should be reduced if the unemployment rate (as reported according to ILO conventions in the Quarterly National Household Survey) has risen to 6% and remained at or above that level for a minimum of four consecutive quarters. When this occurs the values of v should be reduced by two percentage points for every percentage point by which the unemployment exceeds 6%.

As an illustration, if the unemployment rate were to rise to 7% and remain at that level for four consecutive quarters, then the value of v should be reduced to 98%, 93%, and 88% in the three regions, respectively.

When the unemployment rate falls below 6% again, the values of v should be restored to the original levels.

In applying the model, the regional reference wage rates should be regularly updated so that they reflect current labour market trends. The procedure we recommend is to make the adjustment be made annually when new annual Census of Industrial Production earnings data become available. As they tend to lag by two years, they should be inflated by the national trend in industrial earnings (published quarterly).

Only if the model is updated in light of changing economic trends will it truly reflect the benefits and costs of assisting new projects.

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Appendices

Appendix I

The Input - Output weights

| INDUSTRY | Wage Multiplier % | Profits Multiplier % | Irish Turnover % |
|-------------------------------|----------------------|-------------------------|---------------------|
| Agric/Forestry/Fishing | 15.21 | 58.25 | 100.00 |
| Coal/Lignite/Briquettes | 1.51 | 0.40 | 80.00 |
| Petrol Products /Natural Gas | 2.12 | 7.17 | 10.00 |
| Electricity/Gas/Water | 39.83 | 22.87 | 100.00 |
| Metals and Ores | 12.67 | 0.86 | 82.20 |
| Non-Metallic Mineral Products | 35.86 | 16.26 | 62.20 |
| Chemical Products | 12.80 | 43.83 | 5.10 |
| Metal Products (excl. mach.) | 25.31 | 11.16 | 62.20 |
| Agric./Industrial Machinery | 16.28 | 5.91 | 43.10 |
| Office Machines | 16.53 | 13.81 | 7.90 |
| Electrical Goods | 15.74 | 17.02 | 7.90 |
| Motor Vehicles | 6.21 | 1.00 | 38.70 |
| Other Transport Equipment | 22.45 | 2.93 | 38.70 |
| Meat/Meat Products | 22.86 | 45.23 | 52.80 |
| Milk & Dairy Products | 24.83 | 44.11 | 52.80 |
| Other Food Products | 22.68 | 26.86 | 52.80 |
| Beverages | 23.34 | 40.54 | 52.80 |
| Tobacco Products | 30.61 | 28.19 | 52.80 |
| Textiles/Clothing | 20.89 | 7.28 | 51.20 |
| Leather/Footwear | 8.49 | 5.01 | 57.20 |
| Wooden Products/Furniture | 26.40 | 15.95 | 51.20 |
| Paper/Printing Products | 30.90 | 12.83 | 24.70 |
| Rubber/Plastic Products | 19.58 | 7.99 | 50.80 |
| Other Manufacturing Products | 15.56 | 11.24 | 57.20 |
| Building & Construction | 48.95 | 18.71 | 90.00 |
| Repair/Recovery Services | 30.03 | 31.62 | 80.00 |
| Wholesale/Retail Trade | 52.76 | 30.15 | 80.00 |
| Lodging/Catering Services | 53.97 | 23.77 | 80.00 |
| Inland Transport | 42.87 | 21.01 | 80.00 |
| Maritime/Air Transport | 40.05 | 8.57 | 80.00 |
| Auxiliary Transport | 40.91 | 11.05 | 90.00 |
| Communication Services | 42.22 | 21.28 | 90.00 |
| Credit & Insurance | 86.90 | -34.49 | 80.00 |
| Business Services | 25.78 | 18.18 | 80.00 |
| Renting of Immovable Goods | 10.47 | 53.83 | 80.00 |
| Other Market Services | 43.28 | 21.66 | 80.00 |
| General Public Services | 74.48 | 4.12 | 100.00 |
| Non-Market Health Services | 62.75 | 10.34 | 100.00 |
| Other Non-Market Services | 84.97 | 2.56 | 100.00 |

Source: CSO Input – Output Tables 1993

Appendix II

The Benefits of R&D and Training Expenditures

A large literature shows that the benefits from training expenditures incurred by a firm are not fully captured by it. There are positive spillovers to the rest of the economy. At a macro-level, O'Connell and McGinnity (1997) noted that training provided by the state Agency FÁS could affect employment and unemployment in three ways:

- Training programmes lead to efficiencies in the matching process, reducing the number of job searchers associated with a given number of job vacancies;
- Training, by enhancing the skills, competencies and flexibility of the labour force, should give rise to increased productivity, and thus improve national competitiveness; and,
- Training should help to raise labour force participation rates and thus the effective supply of labour. In the present Irish situation, this may be regarded as beneficial in view of the slowing rate of increase in the Irish labour supply.

The finding that State training programmes with strong linkages to the labour market in Ireland have positive effects on subsequent employment chances may be used to support subsidising firm-level investment in training. It is widely believed that firms invest less in training than is justified by the returns to training, which can be attributed to market failure. Bartel (1992) found that training leads to productivity increases in the order of 17. Baron et al (1989) found that training resulted in productivity gains that were about twice as large as wage gains. However, employers are likely to invest less in training because of the difficulty in capturing the return on that investment. It has been argued that workers will not pay for general training because they realise that employers will appropriate a large part of the resulting productivity gain, while firms wishing to attract workers to their apprenticeship schemes also have to pay the cost of these schemes and offer training wages above the trainees' initial productivity (Acemoglu and Pischke, 1998). It is

reported in Britain that employer provided training courses (EPTCs) yield high rates of return. The return to doing an off-the-job EPTC with a person's current employer is around 6.6% compared with 3.6% for an on-the-job EPTC. If this employer-provided training also results in higher vocational qualifications being obtained, then the return is close to 15% for an off-the-job EPTC and around 12% for an on-the-job EPTC, compared with 8.5% for a person who obtained this qualification on a non-employer-provided course. (Blundell, Dearden and Meghir, 1996, p. 54).

However, the finding of greatest relevance to the present subject is that 'The returns were more or less the same whether it [the training] took place in the current or a previous job'. This implies that EPTCs provide relatively general skills. (Ibid, p. 55)

Turning to the case for subsidies to firms' expenditure on R&D, the point of departure is to recognise that all advanced economies have policies in place designed to promote R&D, whether by encouraging and partly funding research projects within firms, or by undertaking research in public funded agencies, or both (Porter. 1990.p.631). While this does not create an automatic case for Ireland to pursue similar policies, it does highlight the importance attached to R&D expenditures by governments, even those professing a dedication to a free market philosophy. The large amount of public and private sector expenditure on R&D has generated a considerable literature on the evaluation of its benefits. Both quantitative and qualitative evaluations have been used. In general qualitative evaluations are used for basic/ pure R&D research where the benefits and cost are difficult to project, e.g., a simple rating scheme. For projects at the late development end of the cycle in existing businesses, if the costs and benefits are relatively well known and the risk can be quantified with low uncertainty using past experience, quantitative economic methods can be used.

One approach has been to investigate whether R&D performing firms have performed more strongly than other firms. A study of British firms by the Small Business Research Centre (1992) found that over 70% of fast growing firms had introduced major innovations during the past five years, compared with just 50% of stable or declining firms. Geroski and Machin (1992) also point to clear differences in terms of performance between R&D performing firms, which had introduced major innovations and non-innovative firms, among a group of 500 manufacturing

companies in the UK. The innovators were more profitable and had faster growth rates than the non-innovators. The profitability and growth rates of the innovators also proved to be to be much less vulnerable in times of recession. The 'OECD Small and Medium Enterprise Outlook 2000'¹² provided further evidence on the link between R&D and the occurrence of fast growth in SME's. All the existing evidence points in the same direction: high-growth firms are more R&D/technology intensive than the average firm.

A Spanish study compared the distribution of all firms and high-growth firms by R&D intensity (OECD 2000)¹³. About half of the overall population of firms undertakes R&D in Spain, but more than 70% of the high-growth group does. Moreover, for given R&D intensities, the high-growth group always comes out as that with the highest share of R&D firms. Thus, high-growth units are more technology- intensive than firms on average or than growing firms.

German panel data sets yield similar results, although in a somewhat different presentation: the share of firms that qualify as high growers rises with the intensity of R&D activity.¹⁴

A French country study reported that 13% of all firms in the sample carry out formal R&D efforts. This contrasts with a figure of 33% for the group of fast growers that is nearly three times higher.¹⁵

Findings from a Dutch study are similar: high-growth firms focus more frequently than other firms on product and market innovation, and devote considerable attention to the positioning of their products and product lines (Dutch Ministry of Economic Affairs, 1999).

There do not appear to be similar studies in Ireland inquiring whether R&D performing firms have performed more strongly than other firms. However a survey by Lansdowne Market Research (1995) of 62 companies in Ireland with an annual expenditure of at least £100,000 on R&D found that just over half of them reported that they had increased turnover between 1992 and 1994, specifically as a result of their R&D investment in Ireland.

¹² OECD, Small and Medium Enterprise Outlook 2000, Enterprise, Industry and Services

¹³ Ibid.

¹⁴ Ibid.

Finally, other research has shown that R&D active firms make a larger contribution to the economy than R&D inactive firms, both in terms of the length of time they are likely to survive and in terms of the quality of the employment they provide (Kearns and Ruane, 2001). R&D performing plants also pay higher wages than non-performers (Barry, Bradley and O'Malley, 1997)

However, as many of the benefits above accrue directly to the firms, there is an argument that the private sector should not need State aid to invest in R&D. According to this view market signals should encourage private firms to undertake R&D. The argument for State assistance for private R&D has to be based on either the existence of market failure, or externalities such as spillover effects, that do not enter the firm's calculations. As will be outlined below, many international studies have found that there is generally a positive social return on private R&D investment, which is greater than the private return, commonly about twice as great. This gives justification for governments to provide incentives for private R&D.

A large empirical literature has sought to measure the rate of return to R&D.

The Office of Technology Assessment (1986) has summarised the results of such studies in the US. They conclude that the private productivity return on investment is generally estimated to be in excess of 20% per year, and that the social rate of return is estimated to be in excess of 40% per year on private sector R&D investments. The social returns exceed the private returns because companies undertaking R&D are not the only ones to reap the benefits. Capron (1992) reviews the results of econometric studies on the rate of return on investment in R&D. He cites results showing private rates of return amounting on average to 25%, with the social return varying considerably across industries and sometimes being twice or three times as great as the private rate of return. Capron notes that knowledge in terms of human capital, produced by R&D investments performed by firms is a public good, which allows other firms in the same industry and other industries to develop new innovations, which cause the social rate of return to be higher than the private rate of return.

¹⁵ Ibid.

Recently, Jones and Williams (1998)¹⁶ have summarised the results of numerous studies which found that the social return for R&D averaged at around 100%, based on data for the manufacturing sector, (see table 13).

Table 13: Estimates of the Social Return to R&D in Manufacturing, Industry Level

| Study | (1) Own R&D | (2) Used R&D | (1)+(2) | Years | Observations. |
|----------------------------------|----------------|-----------------|---------|---------|---------------|
| Terleckyi, 1980 | 0.25 | 0.82 | 1.07 | 1948-66 | 20 |
| Scherer, 1982 | 0.29 | 0.74 | 1.03 | 1973-78 | 87 |
| Griliches and Lichtenberg, 1984b | 0.30 | 0.41 | 0.71 | 1969-78 | 193 |

Source: Jones and Williams 1998, 'Measuring the Social Rate of Return to R&D', *Quarterly Journal of Economics*, vol. 73, pp. 61-6.

Column (1) 'Own R&D' shows the social rate of return to industry from R&D conducted by firms within the same industry. Column (2) 'Used R&D' shows that social rate of return attributable to R&D conducted in one industry but used by another (for example, R&D carried out in an upstream industry). Adding the two together implies a social rate of return of around 100%. The return is likely to be higher in Ireland as Griffith (2000) notes that the further a country lies behind the technological frontier, the greater the estimated likely return. Griffith (2000) also emphasises the role that R&D plays, not only in leading to new innovations but also in enhancing a firm's ability to imitate R&D.

It has been found that the social returns from R&D come from the positive spillovers of private investment by firms in R&D. Given that Ireland is a small open economy, it could be likely that Ireland can reap the benefits of R&D research undertaken by firms and Government in other countries and that the positive spillovers from R&D in Ireland will be gained by foreigners. A large literature shows that in practice, while there are many international spillovers from R&D, the benefits tend to disproportionately go to the country undertaking the research. Coe and Helpman (1993) examined the relationship between domestic R&D and productivity. They found that a 1% increase in a Group of 7 (G7) country's own cumulative R&D stock increased its own total factor productivity (TFP) by 0.23, while a 1% increase in foreign R&D increased its TFP by a considerable smaller 0.06. The impact of domestic R&D is considerably greater. Thus countries

¹⁶ Jones, C and Williams, J. (1998), 'Measuring the Social Rate of Return to R&D', *Quarterly Journal of Economics*, vol. 73, pp. 61-6. See also Kevin J. Stiroh 'What Drives Productivity Growth?', FRBNY Economic Policy Review, forthcoming 2001.

(especially smaller countries) can benefit from international spillovers in R&D from other countries, but their own R&D efforts have proportionally a much greater benefit.

While expenditure on training and R&D should tend to be reflected in higher projected revenues, wages, and profits, these positive spillovers are not factored into the firm's investment decisions, and thus provide ground for State assistance. To summarise, the rationale for State assistance is as follows:

- Research and Development undertaken in Ireland will have a training effect whereby learning and experience is gained on the job by R&D staff. As the literature quoted on training indicates that training increases employment possibilities, and as these employees move around and make their expertise available to other, their R&D experience to innovate and to imitate becomes a social benefit, which is not all appropriated by their original employer;
- R&D undertaken by private sector firms in Ireland can provide direct positive spillovers. Technological progress made by one firm can at least partly be transmitted to other firms and be of value in improving efficiency and productivity. While the literature on international spillovers noted that mostly the benefits of R&D apply to the firms and countries undertaking the R&D, the literature recognised that firms which undertake their own R&D will also be in a more advantageous position to capture the benefits of other firms investment in R&D; and,
- A further advantage of R&D relates to R&D undertaken specifically by foreign owned multinationals in Ireland. When a multinational engages in R&D in Ireland, the Irish operation becomes more embedded in Ireland as the multinational becomes more dependent on skilled R&D staff in Ireland than it would be in the case of for example, a lower skilled manufacturing operation. As highlighted above, studies (Kearns and Ruane, 2001) have noted that foreign R&D performing firms in Ireland tend to pay higher salaries and to have a lower rate of attrition.

The analysis above notes that education and training are vital for long term economic growth, the functioning of the labour market, and the productivity and competitiveness of firms. Given that

firms investing in training and R&D will only capture a proportion of the return on that investment, they are likely to invest sub-optimal amounts in these activities. Given range of positive externalities, it seems plausible to assume that positive spillovers amount to at least half the investment outlay. We propose therefore to reduce to 50% of the pro rata R&D investment and 75% of the investment in Training as the costs attributable to a project.