



# THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

METHODOLOGICAL ISSUES  
IN EVALUATION OF IRISH  
INDUSTRIAL POLICY

**Patrick Honohan**

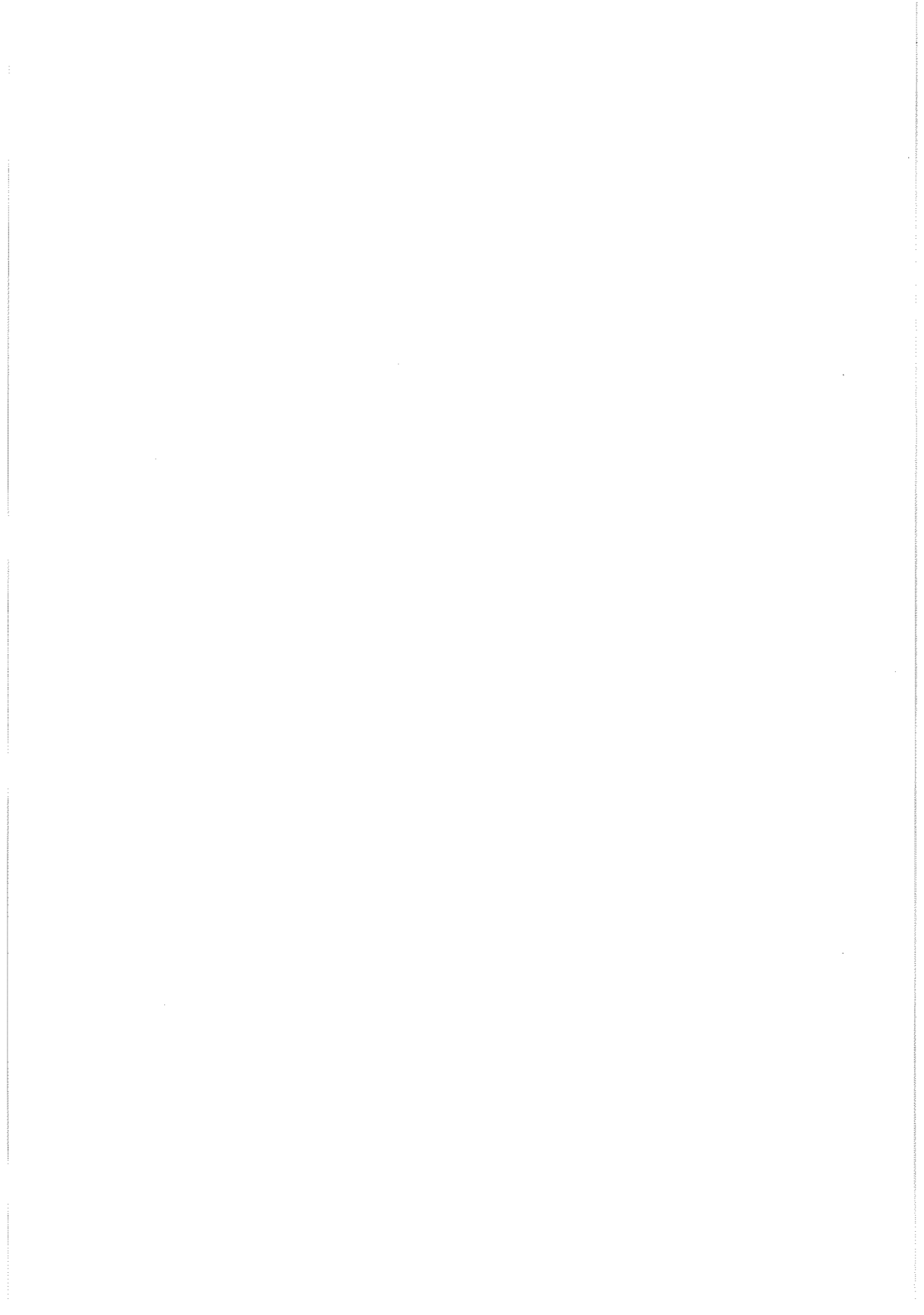
**January 1996**

**Working Paper No. 69**

---

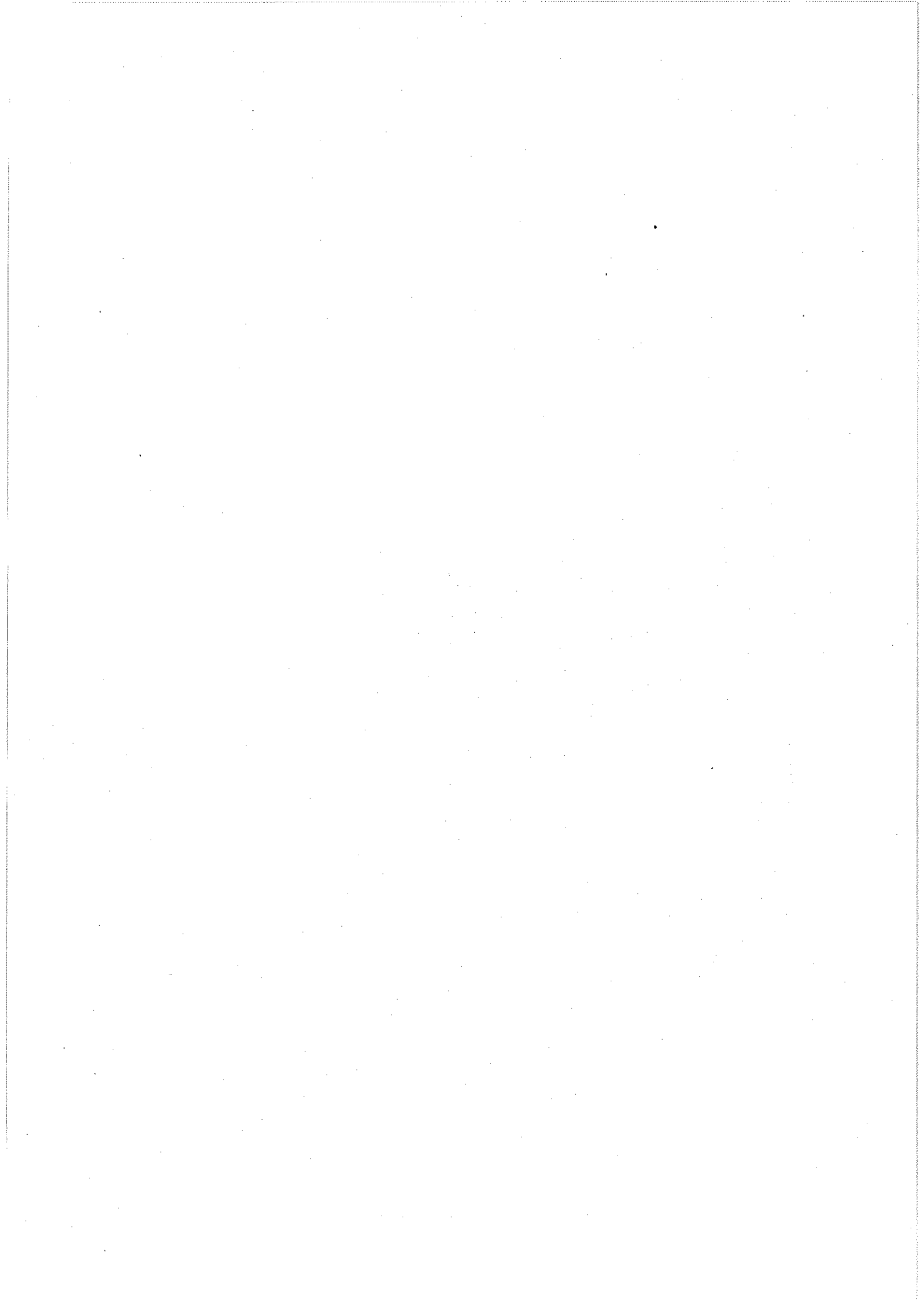
Working Papers are not for publication  
and should not be quoted without prior  
permission from the author(s).

---



### *Acknowledgments*

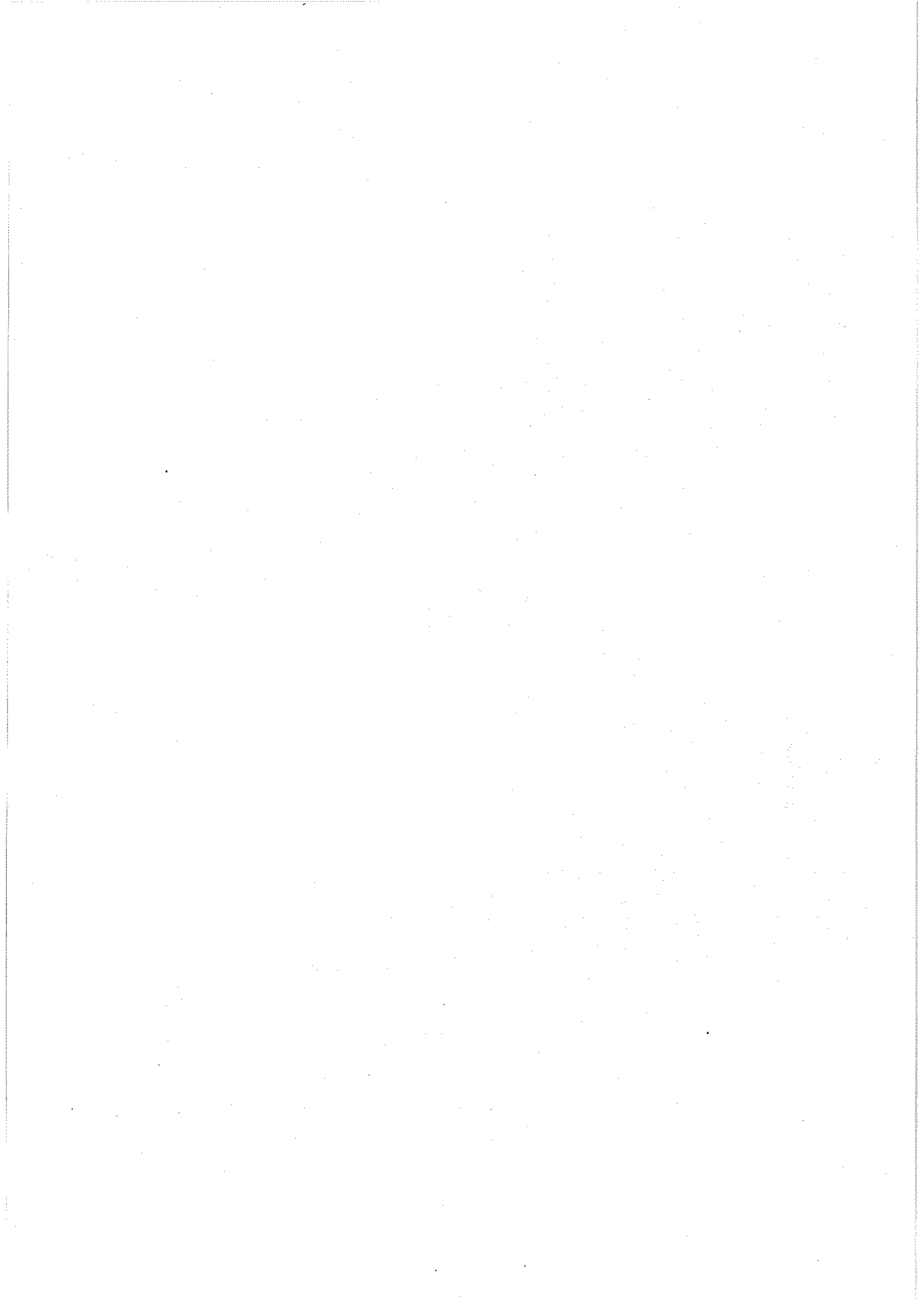
I am indebted to Tom Arnold, Frank Barry, Jim Bourke, Raymond Bowe, Michael Cunniffe, Paul Haran, Declan Hughes, Jane Kelly, Colm McCarthy, Tom McCarthy, Peter O'Brien, Philip O'Connell, Niall O'Donnellan, Eoin O'Malley, Feargal Ó Móráin, Frances Ruane, Richard Ryan, Finbarr Tumelty, Alan Wall and participants at an ESRI Seminar for helpful comments or assistance at various stages in this project.



# METHODOLOGICAL ISSUES IN EVALUATION OF IRISH INDUSTRIAL POLICY

Patrick Honohan

<b>1</b>	<b>Introduction and Summary</b> .....	<b>1</b>
<b>2</b>	<b>The Fall and Rise of Cost-Benefit</b> .....	<b>4</b>
2.1	<i>Role of Cost-benefit Analysis</i>	
2.2	<i>Reasons for the Decline in the Use of Cost-benefit</i>	
2.3	<i>The Come-back</i>	
2.4	<i>Layers of Government and System-wide Impact</i>	
2.5	<i>The Need for Simplicity</i>	
<b>3</b>	<b>Evaluation of Applications for Grant-aid: The Basic Formula</b> ..	<b>7</b>
<b>4</b>	<b>Migration and the Shadow Price of Labour</b> .....	<b>9</b>
4.1	<i>Current practice</i>	
4.2	<i>The Basic Theoretical Insight</i>	
4.3	<i>Qualifying the Basic Theory</i>	
4.4	<i>Some Possible Misconceptions</i>	
<b>5</b>	<b>Distorting Taxation and the Marginal Social Value of Public Funds</b> .....	<b>14</b>
5.1	<i>Interpreting Existing Policy</i>	
5.2	<i>The Shadow Price of Public Funds</i>	
5.3	<i>The Government as a Discriminating Monopolist</i>	
5.4	<i>Is Irish Industrial Policy Optimal?</i>	
<b>6</b>	<b>Deadweight and Bargaining</b> .....	<b>19</b>
6.1	<i>The Issue of Deadweight</i>	
6.2	<i>Simple Case</i>	
6.3	<i>Partial Leakage: Dividing the Surplus</i>	
6.4	<i>Different Deadweights for Different Categories of Project</i>	
<b>7</b>	<b>Concluding remarks</b> .....	<b>24</b>
<i>Annex 1</i>	<b>Choosing a Number for the Irish Shadow Wage</b>	
<i>Annex 2</i>	<b>A Formal Model of Discriminatory Taxation</b>	



# METHODOLOGICAL ISSUES IN EVALUATION OF IRISH INDUSTRIAL POLICY

Patrick Honohan

## 1 Introduction and Summary

### *Industrial policy incentives in Ireland*

Industrial development policy in Ireland has long been characterized by its reliance on both discretionary and non-discretionary incentives. The former includes a range of grants for new investment or expansion projects in manufacturing and certain internationally traded service sectors. The latter features a low (10 per cent) corporation profits tax rate applicable to essentially the same sectors. Although the regime does not discriminate between foreign-owned and indigenous firms, the large inward flows of foreign direct investment encouraged by the regime (notably, but not exclusively by the possibilities for tax-sheltering afforded by the 10 per cent tax rate) has resulted in a remarkably high share of foreign-owned companies in manufacturing whether measured by employment (45 per cent) or output (70 per cent).

While the benefits of the non-discretionary (tax) regime are thus evident, there are also costs to having a two-tier corporation tax system, whether one thinks in terms of lost revenue, or in terms of the higher tax burden borne by the remainder of the economy. In particular, the high rate of tax on labour has probably contributed to Ireland having a higher rate of unemployment than the EU average for the past two decades. The existence of the discretionary (grant) element also has benefits and costs. On the one hand, it allows the Irish authorities to compete with other possible destinations for internationally mobile investment projects, on the other hand, it encourages rent-seeking that may distract local entrepreneurs from productive activity.

### *Evaluation of applications for grant-aid*

Taking as given both the discretionary policy and the existence of grants, the Irish industrial development agencies still need a system of *ex ante* evaluation of specific applications for grant assistance. The Economic and Social Research Institute recently carried out a review of the evaluation model which had been in use by the agencies since the late 1970s and which was based on economic cost-benefit methodology.<sup>1</sup> Some aspects of our findings may be of more general methodological interest.

We started from the position that the evaluation model is essentially a management information system designed to improve decision-making in regard to grant approvals. As such, the model should be based on the policy-maker's understanding of the economic distortions to which policy is addressed, and employ a credible quantification of these distortions. It should, when employed, result in satisfactory policy decisions which are not themselves distorting.

---

<sup>1</sup>The review was carried out by the author and Eoin O'Malley, with a contribution by Philip O'Connell and the assistance of Jane Kelly, Siobhan Kenny and Alan Wall.

### *The old approach*

Essentially, the old cost-benefit model took the cost to be the grant outlay, and the benefit to be 85 per cent of the wages generated through jobs created.<sup>2</sup> This is equivalent to using a shadow wage rate of just 15 per cent, well below rates commonly reported in the literature. On the other hand, in order to be approved, projects had to satisfy a threshold benefit to cost ratio set arbitrarily at 4 to 1.

This old approach seems deficient both in the ranking of projects and in its approach to the cut-off or threshold. It failed to take account of system effects in arriving at a shadow wage and it neglected the problem of deadweight. Furthermore, there is no basis for ignoring (as the old method did) tax revenue generated by the project as an offset to the grant cost incurred.

### *Shadow wage*

Despite high unemployment in Ireland, a shadow wage as low as 15 per cent of market wage cannot be defended. The well-documented rapid and substantial migration responses to changes in the difference between Irish and UK unemployment levels imply that job creation in Ireland has a relatively weak impact on unemployment (Honohan, 1992). This is the major factor in our suggestion that the shadow wage for this kind of employment creation is about 80 per cent.

### *Tax revenue and the shadow-price of public funds*

While the treatment of tax revenues in appraisal can be controversial, the position here is clear. Inasmuch as the cost being considered (the grant) is a transfer, and not a resource cost, the whole situation is really more analogous to tax policy than to traditional project appraisal. Not only must tax revenue be included in the calculation, but, using public funds as the numeraire, the other (employment-related) benefits must be discounted by a factor reflecting the shadow-price of public funds, estimated in Ireland to be about 1.5 at present, down from over 2 in the mid-1980s (Honohan and Irvine, 1990). Because projects differ in their labour and tax intensity, including tax revenue in the calculation alters the ranking of projects.

### *Deadweight in grant assistance*

Considered in isolation, the projected cash-flows for most proposals envisage positive net revenue flow to the Exchequer in present value terms. But, as is clear when considering the matter from the tax policy point of view, account must be taken of leakage or deadweight in assessing the appropriate cut-off for grant assistance. After all, some of the projects might have proceeded with lower grant-aid or none at all. The maximum deadweight would occur if all projects were awarded the same rate of grant, and the size of this maximum deadweight can be approximated using empirical estimates of the aggregate elasticity of manufacturing activity with respect to the rate of grant.<sup>3</sup> On the other hand, grants are not uniform, but are the subject of bargaining between agency and entrepreneur. The agencies are required by

---

<sup>2</sup>Both directly in the project being grant-aided and indirectly from the project's sub-supply needs, cf. O'Malley, 1995.

<sup>3</sup>In practice we have inferred this from estimates of elasticity of demand for labour in manufacturing (cf. Bradley, FitzGerald and Kearney, 1993).



their statutes to negotiate the lowest possible grant rate. In order to infer the degree to which the agencies manage to reduce deadweight below the maximum, we have relied on bargaining theory (cf. Osborne and Rubinstein, 1992). Quantification here is somewhat tentative (we suggest 80 per cent deadweight), but the logic of the approach is clear and has a wider applicability.

*Organization of the paper*

The paper is organized as follows. We begin in Section 2 with a brief account of recent trends in Cost-Benefit analysis. Section 3 describes the basic criterion function for evaluating applications for industrial grant-aid. Section 4 explores the impact of migration flows on the shadow price of labour (Annex 1 assesses the empirical evidence for quantification in the Irish context). Section 5 looks at the interaction of tax policy and industrial policy in the Irish context, and suggests a possible framework (formalized in Annex 2) within which the rationale for existing policy can be assessed. Turning to the issue of how to evaluate individual applications for grants, Section 6 illustrates how the important issue of deadweight can be addressed. Section 7 contains concluding remarks.

## 2. The Fall and Rise of Cost-Benefit

Following something of a lull in the early to mid-1980s, there has been a very substantial recovery in academic interest in issues of cost-benefit analysis. The reasons for this evolution are informative and help pinpoint what was less useful about previous work and what is likely to be fruitful in the future.

The late 1970s and early 1980s trend towards the substitution of structural reform policies in preference to selective intervention by governments lies at the root of the decline in cost-benefit analysis around that time.

### 2.1 *Role of Cost-benefit Analysis*

Fundamentally, cost-benefit is designed to take account of market failures, i.e. of situations where market prices do not correspond to social value.<sup>4</sup> If there were no market failure, then optimising behaviour by profit-seeking enterprises and by individuals in households should result in a socially optimal outcome - no involuntary unemployment, no missed opportunities to get the most out of national economic resources, no unwarranted environmental degradation. But in the presence of market failure the prices prevailing in the market-place do not provide the signals and incentives that will lead to a good outcome. All of the major classical sources of market failure are relevant to the industrial policy problem:

Externalities: for example where my behaviour affects your opportunities, resulting in spillover costs or benefits not borne by me. If some of the costs or benefits of my actions are not internalized by me, I will tend to consume or produce too much, or too little (in the sense that others would be willing to subsidize me to produce more or consume less). The relevance to industrial or r&d linkages will be evident.

Absence of relevant property rights: for example if nobody owns the watercourses or the seafront, then I can degrade the water quality by discharging waste without cost; whereas if the watercourse had an owner, she would likely impose a fee that would induce me to curtail my discharges. This kind of situation is increasingly relevant in terms of the location decisions for heavy and other industry.

Monopoly power: for example I have so much influence over the price I can charge that I will restrict output though marginal cost is below price. This can be potentially relevant in the labour market, where centralized pricing decisions may contribute to unemployment.

---

<sup>4</sup> There is only a relatively small published literature on Irish cost-benefit, despite many unpublished studies. Gray's (1995) review of standard methodology contains some Irish case studies and references. Boyle (1993) describes the wider process of policy evaluation in an Irish context. There are many textbooks on cost-benefit analysis: a good recent one is Zerbe and Dively (1994). Dreze and Stern (1987) and Squire (1989) are fairly recent surveys at a more technical level. Layard and Glaister's (1994) updated book of readings surveys some of the unresolved or disputed issues. Finally, Department of Finance (1994) and HM Treasury (1991) are official appraisal manuals.

Taxation: it is not possible for the Government to raise enough revenue to meet various essential functions that it performs without introducing distortions to economic behaviour. Its high tax burden is a feature which Ireland shares with most modern industrial economies; and the distorting effects of taxation are so often perceived as a major source of economic inefficiency that they cannot be neglected in any list of market failures.

Since market-driven choices may lead to socially inferior outcomes, the cost-benefit analyst attempts to construct a set of "as if" or *shadow* prices, which represent the prices which, if they prevailed in the market, would lead enterprises and individuals to make economic choices that correspond to the optimal welfare of all.<sup>5</sup> The use of these shadow prices to guide public investment policy, the policy of state enterprises, and other public interventions is the goal of cost-benefit. By arranging that the public sector, in its direct economic interventions, behaves as if the shadow prices were in effect, the hope is that the economy as a whole will move closer to the optimum.<sup>6</sup>

## 2.2 *Reasons for the Decline in the Use of Cost-benefit*

Decline in the use of cost-benefit analysis in the 1970s may be traced to a wider disillusionment with piecemeal state intervention.<sup>7</sup> Why limit oneself to making allowance for market failure in deciding the behaviour of state enterprises and state agencies if the sources of market failure could themselves be eliminated? This was the theme of the structural reform and structural adjustment movements, which were popularly manifested in Thatcherism and Reaganomics, but have actually guided economic policy initiatives since the late 1970s in most countries in the world, to a greater or lesser extent.

These movements were also informed by the abandonment of the assumption that publicly-owned agencies or enterprises would always pursue social goals in a single-minded fashion. Once the relevance of this classic problem of principle and agent was recognized, the

---

<sup>5</sup>A large branch of cost-benefit analysis also considers the distribution of resources between individuals as a potential source of deviation from the social optimum. This branch recognizes that, even if the economy were producing at maximum efficiency, the optimum might not have been achieved if welfare is unevenly distributed among members of society. Our approach will, for the most part, assume that the problem of distribution is addressed somewhere else in the policy structure, and must be taken as given by those involved in industrial policy.

<sup>6</sup>One important issue here is that if certain segments of the economy are using shadow prices, while other parts of the economy are still responding to market prices, the outcome could be worse than if all were responding to market prices. More sophisticated applications make sure that these general equilibrium considerations are taken into account in computing shadow prices for guiding public sector decisions.

<sup>7</sup>In addition some self-serving applications of cost-benefit analysis helped discredit the technique in some quarters. The fact that choosing shadow-prices is by no means an exact science provided scope for the manipulation of cost-benefit techniques to become a potential source of distortion itself.

technocratic approach of cost-benefit lost some of its attraction.

This is not the place to adjudicate on the success of the attempt to eliminate monopolies, increase competition and lower tax distortions. It is certainly the case that freer trade, the progressive completion of the single market in Europe, and the weakening of trade union power, have lowered the importance of many of the distortions to which cost-benefit solutions had been addressed.

For example, with free trade and elimination of foreign exchange controls, the notion of a shadow price of foreign exchange has lost all relevance.

The development of the international capital market as the residual source of borrowed funds has meant that the world interest rate has largely displaced shadow discount rates based on national rates of time preference or intertemporal substitution.

Despite the higher levels of unemployment which have prevailed since the mid-1970s, and as will be examined in greater detail, even the shadow price of labour has been set close to or at the market wage in the cost-benefit practice of several industrial countries.

### 2.3 *The Come-back*

But cost-benefit has made a come-back. Why? Part of the reason is nothing more than a reaction to its comparative neglect in the mid 1980s. Not everything can be solved by structural adjustment, and Government inevitably remains heavily involved in influencing economic activity. The continuing role for Government and its agencies in project development and large-scale physical planning means a continuing need for consistent methods of evaluation which are not merely based on financial profitability. Thus issues of transport congestion and the value of time, safety regulation and the value of a life, and such like, continue to require a cost-benefit type approach. The more obvious reason for the return to cost-benefit is the increasing public awareness of environmental issues which have not found satisfactory market solutions, and which inherently call for public policy intervention.<sup>8</sup>

If the shadow price can be worked out analytically, would it not be best for public policy to attempt to push market prices in the direction of the shadow prices, for example, through taxation? This is the approach advocated in many environmental contexts, and it has much to recommend it. This solution does require a decision to be taken at the highest levels of government. In the context of a free-trade area such as the European Union, it may require supra-national authority, or at least a cooperative international arrangement. Indeed, a world

---

<sup>8</sup>The cutting-edge of applied cost-benefit analysis at present is in the evaluation of unmarketable environmental goods, such as clean air and water, biological diversity (e.g. preservation of wetlands) and future climate risk. Attempting to determine the social value of this kind of thing by survey techniques, asking a representative sample of people what value they place on it ("contingent valuation"), raises conceptual and practical problems which are very hotly debated at present (cf. the debate between Diamond and Hausman, 1994, Hanemann, 1994 and Portney, 1994). This area is likely to become increasingly important in industrial policy in Ireland in the future.

solution may be required for some large policies such as that relating to CO<sub>2</sub> emissions. It is the consideration that a higher layer of government may be required to achieve the best solution (equalizing the shadow and market prices) that ensures a continued role for traditional cost-benefit interventions, i.e. public bodies acting on the basis of shadow prices which differ from market prices.

#### *2.4 Layers of Government and System-wide Impact*

Theoreticians have made significant progress in advancing our understanding of how to analyze the economy-wide impact of a cost-benefit procedure.<sup>9</sup> This so-called "general equilibrium" approach will prove to be an essential component of our approach.

An important element of recent theoretical work has been designed to clarify the appropriate behaviour of different layers of government which have different instruments at their disposal. Although the full optimum may not be attainable, it is important, in determining the optimal behaviour of a particular layer of government, to decide in advance what externalities it should take into account in deciding its actions, and what externalities it should leave uncorrected as being the appropriate responsibility of another layer.

The relevance of this difficult question for the industrial promotion agencies is immediate. The national Government has established a regime of taxation: should the industrial policy agencies take this regime as a corrective one which moves market-prices close to the shadow price, or should the agencies attempt, through the policy of grants, to offset the effects of national taxation? This will prove to be the crucial question which our study will resolve. (To anticipate, our answer will be closer to the latter than the former).

#### *2.5 The Need for Simplicity*

Although the pendulum of political economy, and the emergence of environmental awareness, have been the main driving forces in the cycle of interest in cost-benefit in recent decades, there is another, more practical factor, which has proved to be important, namely the need for simplicity. Project appraisal techniques which had heavy data requirements, and required elaborate and opaque calculations to produce answers - many of which lacked intuitive appeal - were never likely to catch-on in practice. Reappraisal by some of the authors of the most widely used cost-benefit manuals has pointed towards the need for a drastic simplification of cost-benefit procedures if they are to be applied in routine situations (such as arise with the industrial development agencies).<sup>10</sup> This message must be taken seriously in the overhaul of our industrial policy appraisal procedures. In particular, and in response to guidance received from the agencies, we attach importance to ensuring that our proposals for the model impose as few operational innovations as possible.

### **3 Evaluation of Applications for Grant-aid: The Basic Formula**

The formal cost-benefit appraisal system operated up to now by the industrial development agencies has been based on a simple criterion function which expresses the discounted present value of the project benefits as a multiple of the grant paid. Retaining this approach, we need

---

<sup>9</sup>Notably in Drèze and Stern (1987, 1990), Hoehn and Randall (1985).

<sup>10</sup>Cf. Little and Mirrlees (1991).

to modify the formula in at least three major respects.<sup>11</sup> First, the shadow wage rate needs to be modified to take account of general equilibrium effects. This also has a knock-on effect on the shadow prices of other inputs, since they are linked to the shadow wage through the estimated labour content of the inputs. Second, there has to be a fuller treatment of taxation, including tax revenue as a benefit offsetting grant costs and also applying a weighting (the shadow prices of public funds) before adding revenue benefits to private benefits. Third, projected benefits must be reduced by a deadweight factor, designed to take account both of the response elasticity of projects and jobs to grant levels and the degree to which an increase in grants can be confined to those projects that are actually dependent on it. These three aspects are considered in the following three sections.

Although most of the discussion can be followed without recourse to mathematical notation, it is worth explicitly setting out the criterion function which underlies the discussion. Thus, for any given grant-aid application, the following function is calculated on the basis of projected flows:

$$(1-\theta)\{\sum_i x_i p_i [(1-v_i)/\phi + \tau_i] + \tau_0 \pi\}/g \quad (1)$$

where the  $p_i$  are market prices,  $v_i$  are the ratios of shadow to market prices, and  $x_i$  the volume of each input  $i$ ,  $\tau_i$  the tax rates (inclusive of a standard allowance for savings on social welfare payments resulting from a fall in unemployment) with  $\tau_0$  the tax rate on profits  $\pi$ .  $\theta$  is the deadweight and  $\phi$  is the shadow price of public funds. The grant cost is denoted by  $g$ . All of these elements are calculated in present value terms.

The elements of the formula can be seen more clearly by beginning with the term immediately after the summation sign:

$$x_i p_i [(1-v_i)/\phi + \tau_i] \quad (2)$$

Recalling that the social benefit of the use of an input is equal to the value of input use multiplied by one minus the ratio of the shadow price to market price of that input, this expression represents, for each input  $i$ , the sum of the social benefit of that input use plus the tax revenue.<sup>12</sup> In order to make it commensurate with the Exchequer revenue terms (as discussed in Section 4 below), the social benefit is reduced by the factor  $\phi$  representing the shadow price of public funds.

This term is summed over all the inputs, and the tax revenue from profits is added to obtain the part between parentheses:

---

<sup>11</sup>Several additional modifications are not discussed in the present paper.

<sup>12</sup>As will be described below, in the case of labour, the tax element includes savings on social welfare. Thus we can think of these two elements as being essentially (i) the private benefit obtained by those individuals who are no longer involuntarily unemployed and (ii) the net additional cash flow to the Exchequer resulting from the additional employment and reduction in unemployment.

$$\sum_i x_i p_i [(1-v_i)/\phi + \tau_i] + \tau_0 \pi \quad (3)$$

which represents the total "benefits". Finally, this is all premultiplied by the adjustment for deadweight  $(1-\theta)$ , before being divided by the grant "cost"  $g$

The parameters  $v$ ,  $\phi$ , and  $\theta$  are successively discussed in the next three sections of the paper.

## 4 Migration and the Shadow Price of Labour

One of the central parameters cost-benefit analysis of Irish industrial policy has been the shadow wage rate. In this section we review existing practice and explain why major changes are necessary.

### 4.1 Current practice

In practice, the low shadow price of labour has been the key variable in the agencies' cost-benefit methodology. McKeon (1979-80) stated that the figure used was computed on the basis of assumed opportunity costs applied to the actual profile of employees recruited. For those not previously employed a zero opportunity cost was assumed, while for those coming from employment in the agricultural, service and manufacturing sectors, the opportunity cost was set equal to the estimated market wage. McKeon also provides a table showing a sample distribution in 1980, from which one could infer that the shadow wage would be at least two-fifths of the market wage, since 47 per cent of the sample came from other employment.

At a subsequent stage the shadow price was fixed at a much lower figure, namely 15 per cent of the market wage. Both theoretical considerations applied to Ireland, and the example of other countries suggest that the 15 per cent figure is much too low.

On theoretical grounds, the partial equilibrium methodology of using a sample profile of recruits must be rejected in favour of a general equilibrium analysis which takes account of the overall system response. In our view, the major theoretical argument here relates to migration.<sup>13</sup> The rapid and substantial response of net migration to employment availability at home and abroad implies that job creation does not reduce unemployment one-for-one. As we will explain, the theoretical literature on the impact of migration on shadow wage rates shows that, even in the presence of involuntary unemployment, migration could fully eliminate any gap between shadow wage and market wage except to the extent that job creation does have an impact on unemployment.

International practice also argues against a major gap between market and shadow wage. In Canada, the shadow wage used is 95 per cent of the market wage; in the UK the shadow wage is set equal to the market wage. Even for developing countries, practice points in the same direction. According to Little and Mirrlees (1991) "there is a consensus that the shadow wage is probably not very different from the wage paid" for modern-sector urban wages in

---

<sup>13</sup>The migration aspect was also mentioned by Ruane (1979), though her (1980) paper focuses instead on distributional issues.

developing countries.<sup>14,15</sup> It is no longer credible to use as low a shadow wage as has been the practice to date in Ireland.

At this stage it may be desirable to recall that, as with most applications of cost-benefit analysis, we maintain the Utilitarian premise that what is to be optimized is an aggregate of the economic welfare of the individuals in society. The familiarity of this assumption to economists should not allow one to neglect the fact that it reflects a very focused philosophical and political position. Thus, the social decisions in relation to the level of unemployment which our method proposes are based on the impact of unemployment on individual welfare, and not on an independently determined employment goal for society.<sup>16</sup>

#### 4.2 *The Basic Theoretical Insight*

It has long been recognized in the literature that migration could affect the shadow price of labour. A quarter of a century ago, Harris and Todaro (1970) proposed a simple model of migration which displays the basic argument. They considered two regions between which labour is free to migrate. The first region relies on subsistence agriculture, the other is a modern urban economy whose wage rate  $w_m$  is pitched above market clearing levels and results in a rate of unemployment  $u$ . The agricultural region has full employment, but at a low and constant labour productivity  $w_a$ .

If potential migrants equate their expected earnings in the two regions,

$$w_a = (1-u)w_m, \quad (4)$$

the equilibrium unemployment rate will be:

$$u = 1 - \frac{w_a}{w_m}. \quad (5)$$

Since the creation of an extra job in the urban sector will induce  $1/(1-u)$  migrants (in order to restore the equilibrium unemployment rate, the shadow price of labour  $v$ , its opportunity cost, is

---

<sup>14</sup>A survey by MacArthur (1994) of shadow wage rates used in semi-input-output analyses of shadow prices reveals that the lowest of 33 shadow wages used was 0.26 times the market wage - and that was for unskilled labour in Ecuador. The unweighted mean of the shadow wages used was 0.67 and the maximum value was 1.13.

<sup>15</sup>Some apparent contradictions to this consensus turn out to have little relevance to the problem at issue. For example, a study for Northern Ireland by Kirkpatrick and MacArthur (1990) arrived at a very low shadow price for a worker leaving unemployment for a job. But the approach used in that study wholly neglected migration and other systemic responses and is mainly relevant to ring-fenced employment schemes targeted at the long-term unemployed.

<sup>16</sup>Sen (1975) discusses some alternatives.



$$v = \frac{w_a}{1-u} = w_m \quad (6)$$

The implication of this very simple model is that, despite the persistence of unemployment in the urban region (indeed, *because* of the persistence of unemployment) the shadow wage rate is not lower than the wage actually paid in the urban region.

Though quickly endorsed by Harberger, Stiglitz and other distinguished economists, this result did not immediately attract general acceptance because of the very strong assumptions on which it was based and also because observed unemployment rates in the urban areas of developing countries seemed much lower than would be implied by the relation (2) above.

As Sen (1975) put it, "the invisible hand strikes again" in a way that seems unduly reductionist, and a number of objections can be raised to the analysis.

But subsequent analysis has shown that some of these objections have less force against the high shadow wage conclusion than might have been expected. Much more elaborate and realistic models still lead the conclusion that the shadow wage rate should be close to the marginal product of labour in the urban sector.<sup>17</sup>

#### 4.3 *Qualifying the Basic Theory*

Although devised to account for rural-urban migration in developing countries, this literature has an obvious application to Ireland. In lieu of the agricultural region we have emigrant population working in the UK and elsewhere. In lieu of the fixed agricultural income, these emigrants receive a "utility package" which is insensitive to Irish labour market conditions. Irish wage rates are largely set by negotiation and are higher than would be necessary to clear the market.<sup>18</sup> The hypotheses that Irish unemployment adjusts fully to changes in the UK rate of unemployment and that fluctuations in domestic employment levels have only a transitory effect on domestic unemployment obtain some empirical support from econometric studies (Honohan, 1984, 1992, Bradley et al., 1995, Wright, 1993).<sup>19</sup> Ignoring, for a moment, the duration of this transition, we thus have the necessary components for an application in Ireland of the theories leading to a shadow-price of labour equal to the going wage rate. (Annex 1 elaborates on the question of quantification in the Irish context).

---

<sup>17</sup>These models assume that the objective of the social planner is to maximize a weighted average of individual *expected* utilities, i.e. the standard approach and one which is also adopted here. It is worth noting, however, that if the social planner were instead to take account of the *ex post* inequality in utilities resulting from the persistence of unemployment, this would tend to raise the shadow price of labour rather than lowering it, because the higher the shadow wage, the higher the urban population and so the higher the number of unemployed.

<sup>18</sup>Note that higher-than-market-clearing wage rates can be rationalized in a number of ways, including the efficiency wage theory, insider-outsider models, etc.

<sup>19</sup>This does not preclude a role for relative wage rates and relative unemployment benefit rates.

In order to escape the tyranny of the invisible hand, we must therefore closely scrutinise the key assumptions of these models to see what deviation may be justified. It seems that the result hinges on whether job creation in the city alters (i) living conditions in the rural area or (ii) the unemployment rate in the city. In the simple model above neither occurs.

At first sight it might seem that a different specification of the utility function whose optimization drives the behaviour of potential migrants might matter. But, as shown by Heady (1981), much more realistic utility functions still predict result that the rate of urban unemployment is insensitive to job creation in the city, and hence would not alter the condition  $v = w_m$ . Heady's model allows the migrant to consider the possibility of a number of different possible outcomes - perhaps a long wait before a job materialized, perhaps an immediate job, but then a layoff followed by return to the rural sector, and so on. In particular this allows for preferences such that potential migrants would require an earnings premium to induce them to travel. So long as the expected utility of these options can be expressed as a function of the wages and the numbers employed in both regions, the same type of reasoning can be applied. Expected utility will be equalized as between those who migrate and those who do not, and maintenance of this equilibrium will ensure that the urban unemployment rate will remain insensitive to job creation there.<sup>20</sup>

In a developing country context, it is quite likely that, by reducing population pressure on the land, urban job creation would impact rural incomes favourably, thereby upsetting the simple shadow price rule (6). But it is hard to see how emigration from the UK to Ireland could have much impact on the UK labour market, so the relevance of this generalization to the Irish case is doubtful.

Several other generalizations<sup>21</sup> seem to do little to convincingly reduce the shadow wage below the market wage. For example, Bell (1991) notes that the prices of goods might be different because of barriers to trade, and spending preferences may change for those who migrate. Likewise, the unearned income of migrants may differ from that of the host population. These factors can certainly cause the shadow price of labour to deviate from the wage rate, but there is no presumption as to which way the effect will go. Furthermore, several of these effects seem unlikely to be of quantitative significance in the Irish context. For example, price distortions due to barriers to trade seem negligible in the Irish context.

So far we have implicitly assumed that the urban wage has been set above the market clearing level by some autonomous process. A feed-back effect of job creation onto the urban wage could upset the relationship of equation (6) above. A tendency for increased employment to drive up the wage would increase the shadow wage rate. But such an effect is not

---

<sup>20</sup>This formulation does not deal with the possibilities that the subjective probabilities do not equal the objective probabilities, or that expected utility theory does not apply (cf. Sen, 1975). If the migration response is not necessarily tied to equalization of expected utility, then, as shown by Sah and Stiglitz (1985), the shadow wage rate is higher the more workers migrate, and *vice versa*.

<sup>21</sup>Particularly relevant papers not otherwise mentioned are Bell and Devarajan (1983), Burgess (1989), Dinwiddy and Teal (1987) and Gemmel and Papps (1991).

guaranteed. For example, as noted by Sah and Stiglitz (1985), efficiency wage theories which assume that the wage is above market-clearing level because of a link between wage rate and productivity, and because private firms are minimizing the labour cost per efficiency unit, predict no sensitivity of the market wage to employment levels.

Of the various assumptions whose relaxation would have a systematic impact on the shadow price, one of the most striking is the implicit idea that the pool of potential migrants is homogeneous. If we relax this condition, allowing segments of the population to differ in their propensity to migrate, then an expansion in domestic employment could have an impact on domestic unemployment. After all, if all of the most mobile immigrants have already arrived, then it will take a lower unemployment rate to induce further immigration. The marginal migrant will still be indifferent between staying abroad or coming home, but the lower unemployment will confer an external benefit on those who are at home. If so the shadow price of labour would be lower than the wage. As noted, this would require the unemployment rate to be sensitive to the level of domestic employment. In this context it has to be stressed that, while not inconsistent with a zero long-term response, the empirical evidence for Ireland referred to earlier cannot conclusively refute the hypothesis that there is some sensitivity.

#### *4.4 Some Possible Misconceptions*

Recognizing that the proposed increase in the shadow-wage could be controversial, it is worth summarizing the policy message that is being drawn from the analysis, and clarifying a few points on which there may be misconceptions.

First, it should be clear that the goal of reduction in unemployment is not at all being neglected in our analysis. On the contrary, we are making sure that credit is taken only for a realistic estimate of the unemployment impact of job creation.

Second, we are not saying that emigrants are indifferent between being at home and being abroad. What our approach does imply is that the marginal<sup>22</sup> emigrant is indifferent between the average package of benefits (employment and employment prospects, wages, etc.) at home and abroad. For example, the emigrant might be prepared to accept a big cut in wages to come home.

Third, we are not discriminating between emigrants and residents in counting benefits. The actual distinction that is being made is between the impact of a new job on the unemployment conditions at home and abroad. There is an impact on the domestic job market; but there is no impact on the foreign job market. So when an emigrant returns to take a job in Ireland, that does not improve the lot of the remaining emigrants.

#### *External benefits of reduced migration*

What our approach does omit is any account of the external benefits of reduced emigration, i.e. the benefits that accrue to persons other than the migrants. One could imagine, for example, that parents and relatives might wish that their relatives were living in Ireland.

---

<sup>22</sup>As usual in economic analysis, it is the marginal that matters for optimal pricing: it is the marginal unit that establishes the equilibrium price.

Return migration would benefit these relatives even if it did not reduce unemployment.<sup>23</sup> Depopulation can generate external costs also - as is graphically illustrated by the alleged difficulties of some rural football clubs in fielding a team following an exceptionally heavy wave of emigration. Depopulation is the obverse of congestion costs. (Our method ignores the alleviation of congestion costs also).

While these kinds of consideration could lead to looking at reduction in emigration or job creation *per se* as distinct objectives, and could be advanced as a justification for reducing the shadow wage, there are serious difficulties in quantifying such external benefits. The use of a questionnaire approach ("contingent valuation") is subject to the sorts of objections that have been raised in the context of attempts to place a value on ecological diversity through questionnaire methods (see above).

Furthermore, the policy importance of such external benefits may not be as large as is sometimes supposed. Because of the Government's budget constraint, additional public expenditure on job creation beyond the point where conventional benefits fell below cost would result in higher tax rates. This potential trade-off between higher employment and lower after-tax wages (Kennedy, 1992) may in turn be limited by the migration response. Resolving these large issues seems beyond the scope of the present study.

The labour market is often thought to be segmented, with most of the long-term unemployed unable to compete with other participants. The general migration argument does not apply to job creation that is successfully targeted on the long-term unemployed. A much lower shadow wage would therefore be assigned to sheltered or ring-fenced employment schemes designed for this special group (cf. Snower, 1994).

## **5 Distorting Taxation and the Marginal Social Value of Public Funds**

Just how does taxation enter the picture? This is one of the trickiest aspects of policy evaluation in a tax-distorted economy, yet it is an important one. Indeed, neglect of the impact of distorting taxation seems to be the most serious conceptual gap in the appraisal framework used to date. The main issues here is that the agencies are spending Exchequer funds in the form of grants: the activities generated also lead to a flow of Exchequer funds. How are these two flows to be integrated into the analysis? Should the agencies regard the flow of tax revenues as a benefit or not?<sup>24</sup>

### *5.1 Interpreting Existing Policy*

If we have a good system of economic cost-benefit analysis, we should be able to give a ready answer to two commonly asked questions about Irish industrial policy:

---

<sup>23</sup>This could already be taken account of to the extent that migrants internalize the preferences of their relatives.

<sup>24</sup>Hitherto, Exchequer flows are considered during project appraisal in a separate check, and are not integrated into the cost-benefit calculation.

(i) "The grant-cost per job approved rarely exceeds £30,000; the 1994 average was only £17,100. But the tax revenue - income tax, PRSI, VAT and excises - paid by an average industrial worker over seven years would alone approach £30,000 - and that does not count savings on social welfare payments. Why aren't the agencies prepared to pay more if there is no net Exchequer cost?"<sup>25</sup>

(ii) "Why can't a job-creating initiative in the non-traded sector get grants on the same scale as manufacturing?"

These are not easy questions to answer and, in attempting to do so, one must beware of the temptation to rationalize elements of existing policy which may be the matter of legitimate debate. But it is a serious weakness of the existing methodology that it cannot provide a satisfactory answer to either question.

The key to answering such questions is to take account of the fact that Government has revenue requirements for purposes outside the scope of industrial policy. These include covering the cost of various public and social services, and servicing its debt. As a result, distorting taxation is imposed on various forms of economic activity.<sup>26</sup> The puzzles implied by the above questions may simply reflect the tax distortion.

### 5.2 *The Shadow Price of Public Funds*

The analogy of a hypothetical would-be mineral water entrepreneur may illustrate the situation. Suppose the entrepreneur's main cost is a fixed initial cost which she covers by borrowing. Once this fixed cost is incurred, the mineral water can be supplied at essentially zero cost. But the entrepreneur will have to charge for the water if she is to service the initial debt. She prices above marginal cost, and some potential customers go thirsty.

Likewise the Government has to impose taxes which drive a wedge between cost and benefit at the margin, which leads to puzzles of the type we are considering. Taxation of factors of production discourages economic activity and its distorting effects are clear, especially where unemployment prevails.

This provides a possible answer to the first question. Economic activity must yield tax revenue. If the Government and its agencies reduce taxes or increase grants to the point where the "net Exchequer cost" is zero, the needed revenue will not be forthcoming.

A standard way of taking account of this revenue need is to build in to cost-benefit calculations a "shadow price of public funds". This is a factor (in this context greater than

---

<sup>25</sup>Note, however that cost-per-job approved has been increasing rather sharply in the last few years. For indigenous companies it averaged £10,400 in 1989-91, but has increased steadily since then through £13,300 in 1992 and £15,000 in 1993. The cost-per-job sustained over the period 1987-94 was £11,400.

<sup>26</sup>Some sources of taxation - such as some energy taxes, tobacco and alcohol taxes - both raise revenue and correct pre-existing distortions. However, the revenue yield of such corrective taxation is insufficient.

unity) by which non-Exchequer net revenues are divided in order to make them commensurate with grant and tax funds in the calculation. The purpose of the factor is to take account of the distortions that would be created (at the margin) by the extra taxation that would have to be imposed elsewhere in the economy in order to make good any loss of revenue arising from the project being evaluated.<sup>27</sup>

### 5.3 *The Government as a Discriminating Monopolist*

There is another twist to the story, and this is more specific to the case of Irish industrial policy. What we observe is a sharp differentiation between the tax-and-grant treatment of certain broad categories of productive activity. The precise structure of this differentiation is quite complex, but an important feature is that manufacturing and certain internationally traded services are eligible for a 10 per cent corporation profits tax and for grant-aid.

Let us return briefly to the mineral water producer. She may be able to charge a different price for the water in the city to that charged locally. Every microeconomics textbook provides the simple calculation that shows how such price discrimination will increase her profits if the elasticity of demand in the two segments of her market are different. As long as the two segments of the market can be segregated, she simply raises the price for the low-elasticity group, and lowers it for the high-elasticity group. The discriminating monopolist will then typically increase production, and thereby increase the total social benefit of the water source.

The interpretation which we would like to propose for this policy structure is that the Government (directly and through its agencies) is acting in just the same manner.

If every economic activity were to be eligible for a 10 per cent profits tax and a grant of £17,100 per job, the impact on the Exchequer would be catastrophic. Instead, such a regime is open only to a limited segment of the economy. Effectively, the preferred category is offered a more favourable tax (and grant) environment than the rest of the economy. Provided the elasticity of activity (with respect to the tax-and-grant rate) in the favoured sector is sufficiently greater than that in the other, the decline in the less favoured sector will be less than the expansion in the favoured sector. Sufficient Exchequer revenue will thereby be generated to pay for needed Government services, while at the same time a greater level of economic activity will be induced.<sup>28</sup>

By discriminating between categories of enterprise then, the Government is acting in a manner analogous to that of the textbook discriminating monopolist. Substitute "mobile or footloose

---

<sup>27</sup>Heady (1988). Honohan and Irvine (1987, 1990) provide estimates for this parameter appropriate to Ireland in the mid-1980s. They ranged from 1.75 to 2.44. Since 1984 top marginal tax rates have been falling, and bearing in mind the rule-of-thumb that deadweight costs of taxation are roughly proportional to the square of the tax rate, it would be necessary to revise the marginal cost of social funds estimate to, perhaps as low as 1.5.

<sup>28</sup>The consequences of discriminating between categories have recently been assessed by O'Rourke (1994) and by Barry and Hannan (1995). Note that the dividing line is not the same as that between "foreign-owned" and "indigenous".

investors" for "high elasticity group" and picture the Government, including its industrial promotion agencies, as the monopolist and we have a plausible first approximation to the design of industrial incentives.

Even if all other shadow prices were equal to market prices, this new approach could provide a possible reason for discriminating between categories in terms of tax rates and grants. Provided a sector or category of enterprises can be identified that has a more elastic response of economic activity with respect to the tax regime, and provided it can be ring-fenced away from other categories for the purposes of tax (and grant), then the total tax revenue required can be raised with lower distortion and lower social costs by presenting the high elasticity category with a more favourable tax regime.<sup>29</sup>

We thus also have a possible answer for the second question insofar as the non-traded sector may on average have a lower elasticity of response to tax-and-grant rates than does manufacturing. The discriminatory policy may be rationalized in this manner.<sup>30</sup>

The dividing lines chosen between different categories could be debated. At present, manufacturing and certain internationally traded services have a lower corporation tax rate, and may be eligible for grants; within this group, small firms appear to be separated by administrative practice and receive a lower rate of grant.<sup>31</sup> This ranking does seem to accord with *a priori* views as to the mobility or elasticity of these categories. As discussed in Section 6 below, in assessing whether the classifications could be improved, one would need to consider not only issues of elasticity, but also the inevitable leakages and other distortions caused at the margins of the identified categories.

#### 5.4 *Is Irish Industrial Policy Optimal?*

In order to verify the logical consistency of the argument, we have worked out a very simple algebraic model of optimal tax instruments in a constrained environment having the unemployment features in which we are interested. This model illustrates the verbal argument and is presented in Annex 2.<sup>32</sup> To have presented a possible rationalization of the existing

---

<sup>29</sup>This can be seen as a simple application of optimal Ramsey taxation, where taxes are imposed at rates that are inversely proportional to the elasticity of demand.

<sup>30</sup>It must be pointed out that, because it distorts the productive sector's input decisions, such a policy is not the optimal policy in the standard framework as proposed by Diamond and Mirrlees (1971). Only if the menu of taxes available to the government is restricted should taxes that distort production decisions be used. For present purposes we are taking it that some such restriction applies.

<sup>31</sup>New foreign industry typically used to receive the highest rates of grant, but in recent years the gap between the average grant-cost-per-job approved for foreign and indigenous industry has effectively been eliminated.

<sup>32</sup>This model can be seen as evolving from the approach proposed by Ruane (1979), though the emphasis here is rather different. In designing the model, we have had particular

policy framework is not the same as to have shown that it is optimal. For one thing, the parameter values would need to be scrutinized. But there are many other reasons why our model cannot answer the big question of policy optimality. Some examples:

First, the model does not address the question as to whether there may be different and better policy instruments that could supersede the mainly tax-and-grant based policy regime that is being used at present.

Second, the model does not address the optimality of the 10 per cent tax regime, though some of the intellectual framework which we propose could be adapted to that end.

Third, no account is taken of some overall negative consequences of the existence policy regime. For example, the very existence of a degree of discretion may lead to the rent-seeking behaviour and what the Culliton Group referred to as the "hand-out mentality". This provides a powerful argument against the whole policy approach, at least so far as the relatively immobile indigenous firms are concerned.

Fourth (on the other hand), no account is taken of some positive effects of the regime: including such aspects as the dynamizing role of the steady stream of new foreign investment on management quality, the signalling or band-wagon effect of the arrival of new foreign industry on the likelihood of other potential investors in the same sector reassessing Ireland as a possible location, and so on.

Fifth, the question of factor bias: does the low rate of corporation tax and the way in which grants are structured tend to discriminate against labour usage? This is a knotty question which has never been wholly resolved. Even when the statutory ceiling on grants is expressed in terms of a fraction of fixed capital investment, it is clear that this ceiling tends to be reached only for job-rich projects. Besides, in terms of inward direct investment, the main concern is the overall volume of jobs, not the capital-labour ratio. The influence of the low rate of corporation tax is not labour-saving in any simple way. The tax-bias against labour comes as much or more from the structure of income tax and social insurance contributions as from the low rate of corporation tax.

It is beyond the scope of the paper to assess whether the overall approach to industrial policy is the best possible one. Our objective is rather to formalize the logic of the present policy framework, and to provide a tool which will lead to correct grant-decisions within that framework.<sup>33</sup>

---

reference to the framework presented in Marchand et al. (1984).

<sup>33</sup>Other sectors, including building, tourism, sheltered professional services, and so on also benefit from privileges under other elements of the tax and legislative code; we would not wish to argue that all of these privileges form part of a consistent strategy along the lines here discussed for industrial incentive policy.



## 6 Deadweight and Bargaining

### 6.1 *The Issue of Deadweight*

Confining ourselves, therefore, to the narrower question of how to evaluate individual grant applications within the context of an existing policy structure, we must now consider how to take account of the problem of deadweight in the grant system (taking the tax system as a given).

The purpose of pre-multiplying the total project benefits (net-of-grant) by a deadweight factor (given in the formula of Section 3 as  $1-\theta$ ) is to ensure that the grant-level for the marginal project, i.e. the project which has a benefit-cost ratio of one, is pitched at the correct level. Increasing this maximum allowable grant-to-benefit ratio will induce further projects, but at a cost in additional aggregate grant outlay. The correct setting of the maximum allowable grant-to-benefit ratio will be such that any increase would yield benefits lower than the aggregate increase in grant outlay; any reduction would cut back benefits more than grant aggregate grants.

In order to estimate the correct value of the maximum grant-to-benefit ratio ( $1-\theta$ ) we need to know how responsive aggregate project benefits are to grant levels, and also by how much aggregate grant costs increase with an increase in the maximum allowable grant-to-benefit ratio. If every project were to receive the maximum grant, then the second part of this calculation would be relatively simple, and we could focus on the first, namely the degree to which higher grants will induce a certain additional volume of projects and of jobs created. Given an estimate of the elasticity - the proportional response of these benefits with respect to the level of grant - it would then be possible to calculate the maximal grant-to-benefit ratio ( $1-\theta$ ), i.e. the ratio beyond which the increase in benefits secured is less than the increase in the grant paid.

Of course, infra-marginal projects - those that do not require the maximal grant in order to go ahead - should not be given the maximal grant. For such projects there is a "rent" - the gap between the maximum grant that would still result in a net social benefit and the minimum grant required to ensure that the project goes ahead. The minimum grant is welfare maximizing, and should be the preferred option for the State. Legislation provides for this, and the agencies make their best efforts to capture as much of the "rent" as possible, given their information and given competition from foreign agencies. Nevertheless there will undoubtedly be some leakage and an increase in the maximal grant rate will tend to increase grants provided generally.

The two major components of the deadweight factor are thus (i) The remainder of this section considers how the two major components might be quantified, i.e. (i) the elasticity of response and (ii) the degree of leakage to infra-marginal projects.. We deal with these separately by first considering the case where there is full leakage: an increase in the maximal grant/benefit ratio is passed to all projects. This case is analyzed in Section 6.2. We then proceed in Section 6.3 to model the leakage, arriving at a modified deadweight factor leading to higher grants. Section 6.4 considers the issue of whether it is desirable to vary the deadweight by category of project. The discussion is necessarily somewhat technical.

### 6.2 *Simple Case*

In order to place a value on the parameter  $\theta$  then, we need to use information concerning the

response of additional projects, or larger projects, to a less onerous tax and grant regime. A generally higher grant will induce more benefits, chiefly through direct and indirect employment, as more projects are implemented. Quantification of this effect relies on macroeconomic models.

The most successful models of Irish economic growth have employed a two-stage decision process by firms. In the first stage, the location decision is taken on the basis of overall factor-price competitiveness. In a second stage, the capital-labour ratio is chosen on the basis of relative factor prices. When the consequential capital stock is put in place, actual labour will vary below full-capacity demand depending on demand conditions.

Within this framework, the role of grants may be two-fold. First, they improve aggregate factor price competitiveness by lowering the cost of locating in Ireland. Second, they may influence the capital-labour ratio. The second effect is controversial: early critiques that suggested a pro-capital bias have become muted (see Ruane, 1979, for references). It is probable that informal ceilings on grant-cost-per-job have had the effect of making grants closer to wage subsidies, though this bias may not be large.<sup>34,35</sup>

In order to estimate the magnitude of the employment response then, it is reasonable to begin with econometric estimates of the wage-sensitivity of the demand for labour. One useful source of such information is the table of elasticities of demand for labour estimated by Bradley, FitzGerald and Kearney (1993). For instance, we can use their estimate of -0.55 as the long-term elasticity of demand for labour in high-tech manufacturing with respect to the real (tax-inclusive) wage cost.

In terms of the location decision, the grant can be treated as fungible: only its total value matters, and not whether it is based on labour or other costs. When it comes to the factor intensity decision, it does matter whether the basis for awarding grants makes them more like labour subsidies or more like capital subsidies. But it only matters to the extent to which labour and capital are substitutable in each project - not likely to be high in most cases. If grants were simply a labour subsidy, and if all the economic benefits were proportional to employment, we could apply the labour demand elasticity directly to the purpose at hand. Neither assumption is exactly correct, but they should be adequate to give the correct order of magnitude.<sup>36</sup> Any alternative assumptions would hardly command more credibility.

---

<sup>34</sup>Even when statutory ceilings on grant-levels are expressed as a fraction of fixed capital formation, the ceilings are not often reached, and the grants paid do vary in accordance with many other conditions. It is no longer clear in what direction grants influence relative factor prices: the influence may be in different directions for different projects.

<sup>35</sup>One distinction between grants and wage subsidies is that the former come in a lump sum, and hence may help alleviate liquidity constraints.

<sup>36</sup>For example, the correlation between the wage-bill and total economic benefits in the sample projects discussed below is 0.96. This very high correlation conceals considerable variation in the wage-bill to total economic benefits ratio, and arises because wage-bill is a good indication of scale.

Accordingly we will proceed on the basis of these two assumptions.

In the "simple case", where an increase in the grant rate applies uniformly across all projects, the corresponding value of maximum grant/benefit ratio  $1-\theta$  is calculated as the ratio at which the marginal impact of grant-rate on benefits is equal to its marginal impact on costs. It is based, as explained above, on a simplified model of the grant process in which both benefits and grants are proportional to jobs.

Assume, then, that the social benefit  $B$  of the project is proportional to the employment created  $L$ .

$$B = \phi L.$$

The cost  $C$  is taken as equal to the product of the grant-cost per job  $g$  and the employment  $L$ . We write the net-of-grant wage as:

$$w = w_0 - g.$$

and deduce that the response of overall benefits and grant costs to a change in the grant rate  $g$  is:

$$\frac{dB}{dg} = \phi \frac{dL}{dg} = \phi \frac{L}{w} \frac{dw}{dg} = \phi \frac{L}{w} \eta \quad (7)$$

and

$$\frac{dC}{dg} = L + g \frac{dL}{dw} \frac{dw}{dg} = L \left( 1 + \frac{g}{w} \eta \right) \quad (8)$$

where  $\eta$  is the elasticity of demand for labour with respect to the wage.

At the maximal grant level  $\hat{g}$ , (i.e. the grant-level which is optimal for the category ignoring the possibility of improving on it through project-level negotiations)  $dB/dC = 1$ . Therefore,

$$1 = \frac{dB}{dC} = \frac{dB}{dg} \frac{dg}{dC} = \frac{\phi \eta}{w + \hat{g} \eta} \quad (9)$$

From which we deduce that, at the maximal grant level, the benefit to cost ratio is:

$$\frac{1}{1-\theta} = \frac{B}{C} = \frac{\phi}{\hat{g}} = 1 + \frac{w}{\hat{g} \eta}. \quad (10)$$

Substituting the value of the elasticity 0.55, and an average grant-to-wage ratio of 0.15<sup>37</sup>

---

<sup>37</sup>Using this figure implicitly assumes that the present grant levels are about right *on average*. If application of the new method led to greatly altered average grant levels, then (strictly speaking) this figure would have to be revised in the same direction leading to a slightly larger adjustment in average grant levels.

yields an estimate of  $1-\theta$  of 0.076.

Using the labour demand elasticity estimated by the same authors for traditional manufacturing, namely 0.15,  $1-\theta$  falls to 0.022. Thus low labour demand elasticities lead to very low deadweight factors and thus to low figures for the maximum grant.<sup>38</sup>

### 6.3 Partial Leakage: Dividing the Surplus

In order to take account of the fact that the agencies are in a bargaining position with project promoters, and will try to secure the project for the minimum grant, we need to modify the simple formula obtained above to take account of the fact that an increase in the maximum grant level is not fully passed on to infra-marginal projects.

Our approach to this problem is to recognize that each infra-marginal project involves a surplus which is shared in some proportion  $\lambda$  between the agencies and the promoter. The classic solution to how the surplus is divided is known as Nash's bargaining solution (Nash, 1953). According to this solution, the share will depend on the relative degree of risk aversion of the bargainers. Extensions to the Nash bargaining solution (Osborne and Rubinstein, 1990) also take into account possible differences in time preferences of the bargainers, or in the cost to them of a delay in arriving at a bargain.

An implication of this standard theory is that, if the bargainers are identical in the relevant respects (risk aversion, time preference), then they will split the surplus equally,  $\lambda=0.5$ .

As will be shown below, the sharing of benefits in the proportion  $\lambda$  (for the promoter),  $1-\lambda$  (for the agencies) results in a reduction in the leakage by a factor of

$$\frac{2}{(1+\mu)\lambda}$$

where  $\mu$  is the fraction of employment that would exist even if grants were zero. Taking both  $\mu$  and  $\lambda$  to be one-half gives a reduction in the leakage by a factor of 2.67, thereby raising  $1-\theta$  from 0.076 to 0.202. If  $\lambda$  were zero, leakage would be zero and  $1-\theta$  would converge to unity: in that case the full benefit of the specific project could be paid out in grants.

In order to explain the reduction in leakage, we refer to Figures A, B and C. Figure A illustrates the dependence of jobs on the grant rate  $g$ . At zero grants, the number of jobs is  $x_0$ ; at grant level  $g'$ , the number of jobs is  $x'$ . For each of the jobs to the left of  $x_0$ , there is a surplus equal to the grant  $g'$ . For jobs to the right of  $x_0$ , the surplus is lower by the height of the line  $x_0 A$ . The shaded area in Figure B shows the increase in the surplus if the maximum grant is increased from  $g'$  to  $g''=g'+\Delta g$ . Writing  $x_1 = 0.5(x' + x'')$ , this increase in surplus equals  $x_1 \Delta g$ . The shaded area in Figure C illustrates the increase in the promoters' surplus where the promoter obtains  $\lambda$  of the surplus for each job, the agencies  $1-\lambda$ . It is a straightforward calculation to show that this area is approximately equal to:

And if the number of jobs that would exist even in the absence of grants,  $x_0$  is a fraction  $\mu$  of  $x_1$ , then the above formula is established, considering that in the full leakage case, all of

---

<sup>38</sup>The parallel with the model of Annex 2 will be evident.

$$\frac{\lambda}{2}(x_0+x_1)\Delta g$$

the surplus goes to the promoter.

#### 6.4 *Different Deadweights for Different Categories of Project*

Even though the reasoning here relies on rather abstract theory, there seems to be no better approach to the key problem of deadweight. It is certainly more acceptable than the naive assumption that the agencies capture all of the surplus. The parameters  $\mu$  and  $\lambda$  have to be settled. They both lie between zero and one. Since there is no reason to think that the agencies or the government differ from large corporations in risk aversion, one-half seems appropriate for  $\lambda$  in that case. The more risk-averse the promoter, the lower her share of the surplus, so if one believed that small entrepreneurs were more risk averse (or more impatient) than the government, then one would have a lower value of  $\lambda$ , thus lower leakage and allowing higher grants.<sup>39</sup>

Since about three in every four manufacturing start-ups are actually grant-aided, it might seem difficult to argue for a very high value of  $\mu$ . On the other hand, applying the elasticity of 0.55 (hardly valid over such a wide range) would give a value of  $\mu$  at around 0.9 even if the ratio of grant to net-of-grant wages was as high as 20 per cent. Lower values of  $\mu$  lead to lower leakage and thus allow higher grants.

There may be a negative correlation between the value of  $\lambda$  and of the elasticity of labour demand  $\nu$ , with low values of  $\lambda$  for, say, small indigenous entrepreneurs being correlated with a relatively low grant-sensitivity of their labour demand, and hence a low absolute value of  $\nu$ . Ideally, we would have robust estimates of the labour demand elasticities for different categories of project (by size, ownership or product sector). This is not the case. In the absence of such information, and considering the supposed negative correlation between  $\lambda$  and  $\nu$ , there is an argument for not varying the deduced parameter  $\theta$  as between different categories of project.

It may be noted that this discussion of leakage and deadweight is very relevant to the question of which sectors should be eligible for grant-aid (and other preferential treatment). If a sector has a low labour demand elasticity, or if its inclusion would worsen the leakage parameter  $\mu$ , then it should not be added to the existing list.

The question of rescue and other forms of double-dipping must also be raised in this context. The threat of closure can be used by enterprises to lever a second round of grant-aid. There is a strong argument for dealing with such situations with a higher value of  $\theta$ . The reasoning here is that grants provided in a rescue situation are very prone to leakage, in the sense that conceding a rescue-type grant is likely to precipitate a number of "me too" claims.

---

<sup>39</sup>The discussion is in terms of a simple negotiation in a zero-sum game. We neglect the complications that may be caused by the fact that negotiations on a grant involve additional correlated aspects, and may not be zero sum.

## 7 Concluding remarks

The purpose of a formal appraisal system is to rank projects, and to identify a cut-off point in the ranking. The approach adopted in this paper is that these decisions should be based primarily on factors which are reasonably measurable: employment and taxation flows. Both of these have been incorporated in previous appraisal systems, but we propose a significant change in the weights to be attached to them, basing our proposal on a deeper interpretation of Irish economic structure and of the internal logic of Irish economic policy.

The importance of unemployment is recognized in our proposed calculation, but is tempered by a recognition that migration flows can substantially frustrate efforts to eliminate involuntary unemployment. The central role of tax and grant incentives in Irish industrial policy is also built in to our proposal, together with the Government's budget constraint which places a limit on the scale of these incentives.

In one sense, the approach suggested is old-fashioned, since it does not take account of positive externalities, clustering, increasing returns, dynamic learning effects and the like. These intangible results are captured neither in the existing cost-benefit framework or in the one which we propose. That does not mean that we do not consider these to be important. But for the present, no generally accepted framework exists for placing a value on such spin-offs. For that reason we have refrained from suggesting a formal procedure which would not command general acceptance, and whose inclusion would cast doubt on the whole procedure.

Instead, we propose what will appear to be a much more rigorous approach to the appropriate quantification of the important elements of benefit that are included.

The proposed appraisal method does not represent an overall evaluation of industrial development policy. That is not its intention: it is, as explained, intended as a tool of decision-making on a project-by-project basis. Nevertheless, there may be a tendency to assume that, if only projects with benefit-to-cost ratios in excess of one are funded, then industrial policy is optimal. This is not the case.

## *Annex 1*      **Choosing a Number for the Irish Shadow Wage**

### *The issue*

In deciding the shadow-price of labour, we need to balance simplicity with credibility. This is potentially an extremely complex area, and theoretical arguments could be provided for assessing shadow-wages separately for each major project. In practice we need a much more straightforward approach.

As discussed in Section 4, the shadow-price of labour which has hitherto been used is extremely low by international standards. On the other hand Irish unemployment is very high, and that might seem to justify a low shadow wage. For various reasons, including the relatively high labour mobility between Ireland and abroad, job creation in Ireland does not reduce unemployment one-for-one. Our conclusion is that, despite high rates of unemployment, it is inadmissible to use as low a shadow-wage as has been used up to now.

From this perspective, the crucial empirical quantity needed to determine the shadow wage rate is the sensitivity of unemployment to job creation. Basically the point is that if unemployment does not change (for example because as many migrants return as there are new jobs) then the conventional argument for lowering the shadow wage below the market wage, namely that some of the labour used was idle, fails.

In our main approach, we use the results of macroeconometric models to estimate the reduction in unemployment resulting from expansion in industrial employment. Most models predict that such an effect would vary in the first years following the job creation, with a higher initial impact of job creation on unemployment being eroded by subsequent migration. But in the interests of simplicity it is recommended that this dynamic feature should be largely ignored for the purposes of shadow pricing.

What we do is to compute the average reduction in unemployment over a seven-year period resulting from a sustained increase in industrial employment. As a refinement, future values are discounted at the rate of 5 per cent per annum before averaging in order to arrive at present values.

### *Calculating the response of unemployment to job creation*

What reduction in unemployment can be expected to result from an expansion in industrial employment? In choosing a new figure, we recommend reliance on the results of econometric analysis of unemployment dynamics, using sub-annual data.

Several econometric models of the Irish economy allow calculation of the response of unemployment to job creation. They all predict that the initial impact of job creation on unemployment is fully eroded by subsequent migration. Indeed, the long-term effect on unemployment is predicted to be negative in simulations where the initial job creation has come from an expansion of government expenditure; while this feature might superficially appear to be perverse, it results from the subsequent increase in taxation which is needed to re-balance the fiscal accounts. Despite general agreement on these qualitative features, recent econometric work does not provide an unambiguous guide to the speed of the adjustment of unemployment to the initial shock.

The reason for this ambiguity lies partly in the variety of model designs used, reflecting different approaches to the modelling of migration, and different degrees of complexity in the degree to which other relevant factors, such as taxation and wage determination, are taken into account explicitly. Another important distinction is between annual and quarterly models. There are more data series available at annual frequency, and this allows for a more elaborate modelling of the various linkage mechanisms in the economy. On the other hand, it is hard to capture the dynamic path of relatively quick responses in an analysis which is based on annual data only.

#### Evidence from Quarterly Data

The model in Honohan (1992) focuses directly on the link between Irish and UK unemployment<sup>40</sup>, thereby avoiding the need to employ unreliable migration data. It uses the assumption that the *long-term* sensitivity of the unemployment rate to job creation in Ireland is zero (an assumption which is not contradicted by the data). That model predicts a gradual convergence of unemployment rates in Ireland back to their equilibrium relation with those in the UK. The quarterly data employed allows a fairly precise estimate of the speed of convergence. There is an estimated transition period of about two years following a shock, during which unemployment, having been disturbed to a level below the equilibrium, is still in the process of converging back. Using the estimated model (for males<sup>41</sup>), and assuming that job creation had an initial one-for-one effect on the level of unemployment, we calculated the average impact on unemployment over thirty quarters. Taking account of time discounting, the result is that the reduction in unemployment averages only about 20 per cent of a sustained jump in the number of jobs.<sup>42</sup>

#### Evidence from Annual Data

Bradley, Whelan and Wright (1993), represents a recent version of the HERMIN econometric model of the macro-economy, based on annual data. Its approach is quite different, in that it assumes that migration flows (as opposed to the stock of unemployment) respond to relative employment conditions at home and abroad. Once migration gets under way, this model assumes that it will have its own momentum. As a result, it predicts a relatively slow build-

---

<sup>40</sup>Most of the analysis is based on registered male unemployment, adjusted for changes in data definition.

<sup>41</sup>Variations in registered female unemployment in recent years have not been as explained with the same degree of confidence.

<sup>42</sup>The exact number depends on the approximating assumptions made about the rate of job loss after creation (e.g. 0.10 per annum), the rate of discount (e.g. 0.05 per annum, Department of Finance, 1994), and the rate of convergence of unemployment rates (e.g. 0.2 per quarter, Honohan, 1992). If we know these parameters we can calculate the present value of the reduction in unemployment, and express it as a fraction of the present value of the increase in employment. One minus this fraction is then taken as the shadow wage, if the unemployed are assigned a zero opportunity cost. The indicated parameters yields a figure of 81 per cent; lower rates of job loss give higher figures. If we assume zero job loss and truncate the present value calculation at seven years, we obtain 79 per cent. (If the initial impact of job creation on unemployment is lower, then the percentage is higher.)



up of migration which eventually leads to unemployment over-shooting its final equilibrium. The model shows unemployment approaching its ultimate equilibrium through an oscillating path. In a simulation carried out on the effects of a sustained jump in the level of public employment, this model predicts net immigration over seven years of 2.6 times the increase in public employment. Although this includes immigrants who are not labour force participants, it confirms that the unemployment impact of job creation is severely eroded by immigration. The simulation report does not calculate the unemployment impact directly. If two-thirds of the net immigration represent labour force participants, and even if there were no change in the labour force participation rate, the reduction in unemployment would again be no more than 20 per cent of the overall job increase.<sup>43</sup>

The overshooting of migration predicted by this 1993 model has been regarded as an unrealistic and unsatisfactory feature. As a result of further econometric analysis, the migration equation has been revised in more recent versions of the HERMIN model. In a current version (unpublished) the momentum in the migration equation (Koyck lag) has been removed. This means that the simulated speed of convergence is much slower. Indeed, in a special simulation carried out for this study,<sup>44</sup> although the creation of 1000 permanent public sector jobs was projected to increase unemployment after 15 years, the early effects were favourable: reducing average unemployment over seven years by about 600.

While the annual model of the whole economy thus agreed with the quarterly unemployment model as recently as 1993, the latest overhaul of the former model has inconveniently introduced an element of disagreement.

In applying the results of the annual model's simulations to the effects of industrial employment creation, one must remain aware of the fact that the location and skill composition of public sector employment is quite different, and the unemployment response may also differ. Also, the migration data which it is designed to fit are generally considered unreliable. Finally, as mentioned, annual data is not the most suitable for capturing a response which is thought to be reasonably fast.

Accordingly, our judgment is that primary reliance should be placed on the results of the quarterly model.

---

<sup>43</sup>To arrive at this estimate we used the estimated net migration resulting from the creation of 1000 public service jobs. We subtracted 67 per cent of cumulative net migration from the 1000 jobs to arrive at an estimate of the unemployment change. While unemployment was estimated to fall by 892 in the first year, this fell below zero after four years and, with continuing immigration, the unemployment impact was actually minus 642 persons after seven years. The net discounted sum of the unemployment effect over seven years comes to just 15 per cent of the jobs created. This ignores spin-off jobs resulting from the public service job creation (to be consistent with our proposed cost-benefit methodology, which treats such spin-offs separately).

<sup>44</sup>Thanks to John Bradley and Frank Barry for these special simulations and for helpful discussions.

Although it is clear that a considerable margin of error inevitably surrounds these estimates, they confirm that it is not possible to support shadow prices as low as 15 per cent. Even if the social cost of employing an unemployed person were zero, the estimated impact of job creation on unemployment from the male quarterly data would not justify shadow prices much below 80 per cent.<sup>45</sup>

---

<sup>45</sup>Even if the magnitude of the migration effect were not accepted, there are other factors pointing to a large shadow wage, including taking account of the utility of leisure.

## Annex 2 A Formal Model of Discriminatory Taxation

To ensure the logical consistency of the argument of Section 5, it is worth setting out a formal model, the simplest which captures the features which we seek to describe.

Thus we assume that the economy is open, and that goods prices are fixed, and may thus be normalized at unity. There is a representative household maximizing an utility function  $u(x, l)$ , based on its consumption  $x$  and its labour supply  $l$ . The constraints faced by the household are that it can supply no more than a fixed ration of labour  $l^*$  and must stay within its budget constraint:

$$x \leq a + wl,$$

where  $w$  is the wage rate and  $a$  is lump-sum income (defined later).

Writing,

$$\begin{aligned} w(x, l) &= u(x, l) - \lambda(a + wl - x) - \mu(l^* - l) \\ \frac{\delta w}{\delta x} &= 0 \rightarrow u_1 = \lambda \\ \frac{\delta w}{\delta l} &= 0 \rightarrow u_2 - \lambda w = \mu. \end{aligned}$$

This defines the household optimum.

Two sectors of private production exist, each producing output  $y_i$ . Firms in each sector choose labour inputs  $l_i$  to maximize profits  $\pi_i$  subject to that sector's technology. Each sector's labour input is taxed at a sector-specific rate  $\tau_i$ . Thus profits for sector  $i$  are:

$$\pi_i = y_i - (w + \tau_i)l_i.$$

Profit maximizing choices of  $y_i$  and  $l_i$  depend only on the technology and on  $\tau_i$  and may be written:

$$\begin{aligned} y_i &= y_i(\tau_i) \\ l_i &= l_i(\tau_i) \end{aligned}$$

Let the semi-elasticity of demand for labour with respect to the tax in each sector be written as  $\eta_i$ , i.e.

$$\frac{1}{l_i} \frac{\delta l_i}{\delta \tau_i} = \eta_i.$$

The government uses the tax revenue from the tax on production inputs (these are the only taxes available) to purchase goods, and requires a total of  $T$  for essential public spending. Its budget constraint is:

$$T \leq \tau_1 l_1(\tau_1) + \tau_2 l_2(\tau_2) .$$

A fraction  $\theta_i$  of firm  $i$  is owned by nonresidents and this fraction of profits is repatriated abroad. The resource constraints (taking into account the fixed prices and open capital market which allows the goods to be treated as if they were perfect substitutes) are:

$$\begin{aligned} x_1 &\leq y_1 + y_2 - T - \theta_1 \pi_1(\tau_1) - \theta_2 \pi_2(\tau_2) \\ l^* &\leq l_1(\tau_1) + l_2(\tau_2) \end{aligned}$$

The household's lump sum income is that fraction of profits which are owned by the household:

$$a = (1 - \theta_1) \pi_1(\tau_1) + (1 - \theta_2) \pi_2(\tau_2) .$$

If we write the indirect utility function of the household as  $V(a, l)$ , then at the optimal (shadow) values of the tax rates, the Lagrangian  $L$  is at a stationary point with respect to the market adjustment variables  $a$  and  $l^*$  and the policy variables  $\tau_i$ , where

$$\begin{aligned} L = & V(a, l^*) - \rho_1 [x(a, l^*) - y_1(\tau_1) - y_2(\tau_2) + \theta_1 \pi_1(\tau_1) + \theta_2 \pi_2(\tau_2) + T] \\ & - \rho_2 [T - \tau_1 l_1(\tau_1) - \tau_2 l_2(\tau_2)] - \rho_3 [l^* - l_1(\tau_1) - l_2(\tau_2)] . \end{aligned}$$

with non-negative multipliers  $\rho$ . After some substitution, first order conditions give:

$$\begin{aligned} \rho_1 &= -\lambda \\ \rho_3 &= \mu \\ \frac{\tau_i(\rho_2 + \lambda) + (\mu + \lambda w)}{(\rho_2 + \theta_i \lambda)} &= -\frac{1}{\eta_i} . \end{aligned}$$

In the case where all profits are domestically owned, the last of these simplifies to:

$$(\tau_1 - \tau_2)(\lambda/\rho_2 + 1) = \frac{1}{\eta_2} - \frac{1}{\eta_1} .$$

In words, the difference in optimal tax rates is proportional to the difference between the reciprocal of the semi-elasticity of demand for labour in the two sectors.

## References

- Barry, F. and J. Bradley (1991), "On the Causes of Ireland's Unemployment," *Economic and Social Review*, 22, 253-286.
- Barry, F. and A. Hannan (1995), "Have Multinationals Crowded Out Indigenous Employment?", Presented at the Irish Economic Association Annual Conference, Ballyconnell, May.
- Bell, C. (1991), "Regional Heterogeneity, Migration and Shadow Prices", *Journal of Public Economics*, 46, 1-28.
- Bell, C. and S. Devarajan (1983), "Shadow Prices for Project Evaluation Under Alternative Macroeconomic Specifications", *Quarterly Journal of Economics*, 98, 457-78.
- Blackwell, J. F.J. Convery, B.M. Walsh and M. Walsh (1983), *Natural Resource Allocation and State Enterprise, NET as a Case Study*, (Dublin: UCD Resource and Environmental Policy Centre).
- Bliss, C.J. (1987), "Taxation, Cost-Benefit Analysis and Effective Protection", in D.M.G. Newbery and N.H. Stern, eds., *The Theory of Taxation for Developing Countries*, (Oxford University Press).
- Boadway R. and N. Bruce (1984), *Welfare Economics*, (Oxford: Basil Blackwell).
- Boyle, R. (1993), *Making Evaluation Relevant: A study of Policy and Programme Evaluation Practice in the Irish Public Sector*, (Dublin: Institute of Public Administration).
- Bradley, J., J. Fitz Gerald and I. Kearney (1993), "Modelling Supply in an Open Economy Using a Restricted Cost Function", *Economic Modelling*, 10, 11-21
- Bradley, J., K. Whelan and J. Wright (1993), *Stabilization and Growth in the EC Periphery: A Study of the Irish Economy*, (Aldershot: Avebury).
- Bradley, J., K. Whelan and J. Wright (1995), "HERMIN Ireland", *Economic Modelling*, 12.
- Browne F.X. and D. McGettigan (1993), "The Causes of Irish Unemployment: Trends and Explanations", Central Bank of Ireland, Technical Paper No. 6/RT/93.
- Burgess, D. (1989), "The Social Opportunity Cost of Capital in the Presence of Labour Market Distortions", *Canadian Journal of Economics*, 22, 245-262.
- Cantillon, S., J. Curtis and J. Fitz Gerald (1994), *Medium-Term Review: 1994-2000* (Dublin: ESRI).
- Department of Finance (1994), *Guidelines for the Appraisal and Management of Capital Expenditure Proposals in the Public Sector*, (Dublin).
- Diamond, P.A. and J. A. Hausman (1994), "Contingent Valuation: Is Some Number Better

than No Number?", *Journal of Economic Perspectives*, 8, 45-64.

Diamond, P.A. and J.A. Mirrlees (1971), "Optimal Taxation and Public Production I and II", *American Economic Review*, 61.

Dinwiddy, C. and F. Teal (1987), "Shadow Prices for Non-Traded Goods in a Tax-Distorted Economy: Formulae and Values", *Journal of Public Economics*, 33, 207-221.

Dougherty, C. (1994), The Economic Value of Education and Training, Pp. 235-248 in R. Latyard, K. Mayhew and G. Owen (eds.), *Britain's Training Deficit*. (Aldershot: Avebury).

Drèze, J. and N. Stern (1987), "The Theory of Cost-Benefit Analysis", in A.J. Auerbach and M. Feldstein, eds., *Handbook of Public Economics*, Vol. II, (Amsterdam: North Holland).

Drèze, J. and N. Stern (1990), "Policy Reform, Shadow Prices and Market Prices", *Journal of Public Economics*, 42, 1-47.

Farley, N.J. (1993), "The International Mobility of Highly Qualified Labour: The Case of Ireland in the Early 1980s", mimeo.

Gemmell, N. and I. Papps (1991), "The Shadow Wage in Economies with Migrant Labour: The Case of Labour as a Non-traded Good", *Manchester School*, 59, 45-63.

Gray, A.W. (1995), *EU Structural Funds and Other Public Sector Investments*, (Dublin: Gill and Macmillan).

Hanemann, W.M. (1994), "Valuing the Environment through Contingent Valuation", *Journal of Economic Perspectives*, 8, 19-44.

Harberger, A.C. (1994), "Notes on Some Issues in Social Project Evaluation", *Journal of International Development*, 6, 95-108.

Harris, J. and M.P. Todaro (1970), "Migration, Unemployment and Development: A Two-Sector Analysis", *American Economic Review*, 60, 126-142.

Heady, C.J. (1981), "Shadow Wages and Induced Migration", *Oxford Economic Papers*, 33, 108-121.

Heady, C.J. (1988), "Optimal Taxation with Fixed wages and Induced Migration", *Oxford Economic Papers*, 40, 560-574.

Henry, E.W. (1993), *Irish Input-Output 13-Sector Approximate Structures, with Derived Multipliers for Employment, GNP and Imports*, ESRI Technical Series Paper No. 9.

Hoehn, J.P. and A. Randall, (1989), "Too Many Proposals Pass the Benefit-Cost Test", *American Economic Review*, 79, 545-551.

Honohan, P. (1984), "The Evolution of the Rate of Unemployment in Ireland 1962-83", *Quarterly Economic Commentary*, May, 41-64.

- Honohan, P., (1986), "Traps in Appraising Public Projects", *Irish Banking Review*, 28-35.
- Honohan, P. (1992), "The Link Between Irish and UK Unemployment", *Quarterly Economic Commentary*, Spring, 33-44.
- Honohan, P. (1994), *A Review of the Cost-per-Job Methodology*, Report to the Department of Enterprise and Employment.
- Honohan, P. and I.J. Irvine (1987), "The Marginal Social Cost of Taxation in Ireland" *Economic and Social Review*, 19, 15-41.
- Honohan, P. and I.J. Irvine (1990), "Deadweight Loss Measurement with Generalized Gorman Polar Forms" *Public Finance*, 45, 260-267.
- HM Treasury (1991), *Economic Appraisal in Central Government: A Technical Guide for Government Departments*, (London: HMSO).
- Kennedy, K.A. (1992), "Real Convergence: The European Community and Ireland", *Journal of the Statistical and Social Inquiry Society of Ireland*, 26 (4), 213-247.
- Killen, L. (1992), "Job Creation in Grant-Aided Industries", paper to the Dublin Economic Workshop Economic Policy Conference, Kenmare.
- Kirkpatrick, C. (1994), "New Developments in Project Appraisal in Developing Countries", *Journal of International Development*, 6, 1-6.
- Kirkpatrick, C.H. and J.D. MacArthur (1990), "Shadow Pricing Unemployed Labour in Developed Economies: an Approach to Estimation", *Project Appraisal*, 5, 101-112.
- Layard, R. and S. Glaister, eds., (1994), *Cost Benefit Analysis*, 2nd. Edn. (Cambridge University Press).
- Layard, R. and S. Glaister, (1994), "Introduction" in their *Cost Benefit Analysis*, pp. 1-56.
- Little, I.M.D. and J.A. Mirrlees (1991), "Project Appraisal and Planning Twenty Years On", *World Bank Economic Review Proceedings of the World Bank Annual Conference on Development Economics*, 1990.
- Lucas, R. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, 22, 3-24.
- Mac Arthur, J.D. (1994), "Estimating Efficiency Prices Through Semi-input-output Methods - A Review of Practice in Available Studies", *Journal of International Development*, 6, 19-44.
- McCluskey, M. (1992), "Employment, Grants and Industrial Policy", paper to the Dublin Economic Workshop Economic Policy Conference, Kenmare.
- McKeon, J. (1979-80), "The Economic Appraisal of Industrial Projects in Ireland", *Journal of the Statistical and Social Inquiry Society of Ireland*, 24 (2), 119-143.

McMahon, J. (1985), "The IDA's Economic Appraisal System", Presented to the Industrial Studies Association, Dublin, mimeo.

Mankiw, N., D. Romer, and D. Weil, (1992), "A Contribution to the Empirics of Economic Growth". *Quarterly Journal of Economics*, CVII, 407-437.

Marchand, M., J. Mintz and P. Pestieau, (1984), "Shadow Pricing of Labour and Capital in an Economy with Unemployed Labour", *European Economic Review*, 25, 239-252.

Nash, J. (1953), "Two-Person Cooperative Games", *Econometrica*, 21, 128-140.

O'Donnellan, N. (1994), "The Economic Appraisal of Industrial Projects", EC Structural Funds Programme for Industrial Development Evaluation Unit, mimeo.

O'Malley, E. (1995), *An Analysis of Secondary Employment Associated with Manufacturing Industry* General Research Series No. 167, (Dublin: ESRI)

O'Malley, E., K.A. Kennedy and R. O'Donnell (1992), *The Impact of the Industrial Development Agencies*, A Report by the ESRI to the Industrial Policy Review Group, (Dublin: Stationery Office).

O'Rourke, K. (1994), "Industrial Policy, Employment Policy and the Non-Traded Sector", Presented to the Statistical and Social Inquiry Society of Ireland.

Osborne, M.J. and A. Rubinstein (1990), *Bargaining and Markets*, (San Diego, Ca.: Academic Press).

Pohl, G and D. Mihaljek, (1992), "Project Evaluation and Uncertainty in Practice - A Statistical Analysis of Rate-of-Return Divergences of 1,015 World Bank Projects", *World Bank Economic Review*, 6, 255-277.

Portney, P. (1994), "The Contingent Valuation Debate: Why Economists Should Care", *Journal of Economic Perspectives*, 8, 3-18.

Razin, A and E. Sadka (1995), "Resisting Migration: Wage Rigidity and Income Distribution", CEPR DP 1091.

Romer, P. (1986), "Increasing Returns and Long-Run Growth", *Journal of Political Economy*, 94, 1002-1037

Ruane, F. (1979), "Project Analysis and Industrial Employment in Ireland", *ESRI Quarterly Economic Commentary*, June, 17-34.

Ruane, F. (1980), "Optimal Labour Subsidies and Industrial Development in Ireland", *Economic and Social Review*, 11, 77-98.

Sah, R.J. and J.E. Stiglitz (1985), "The Social Cost of Labor and Project Evaluation: A General Approach", *Journal of Public Economics*, 28, 135-164.



Scott, S. and J. Lawlor (1994), *Waste Water Services: Charging Industry the Capital Cost*, Policy Research Series No. 22 (Dublin: ESRI).

Sen, A. (1975), *Employment, Technology and Development*; (Oxford: Clarendon).

Sexton, J.J., B.M. Walsh, D.F. Hannan and D. McMahon (1991), *The Economic and Social Implications of Emigration*, (Dublin: NESCI).

Snower, D.J. (1994), "Converting Unemployment Benefits into Employment Subsidies", *American Economic Review*, 84, Papers and Proceedings, 65-71.

Spackman, M. (undated) *Discount Rates and Rates of Return in the Public Sector: Economic Issues*, London: HM Treasury Working Paper no. 58.

Squire, L. (1989), "Project Evaluation in Theory and Practice", in H. Chenery and T.N. Srivasan, eds., *Handbook of Development Economics*, Vol. II, (Amsterdam: North Holland).

Steedman, H., and K. Wagner (1987), "A Second Look at Productivity, Machinery and Skills in Britain and Germany". *National Institute Economic Review*, November, 84-95

Stiglitz, J. (1975), "The Theory of Screening: Education and the Distribution of Income", *American Economic Review*, 65, 283-300.

Walsh, B. (1993), "The Contribution of Human Capital Formation to Post-War Economic Growth in Ireland". London: Centre for Economic Policy Research, Paper No. 819

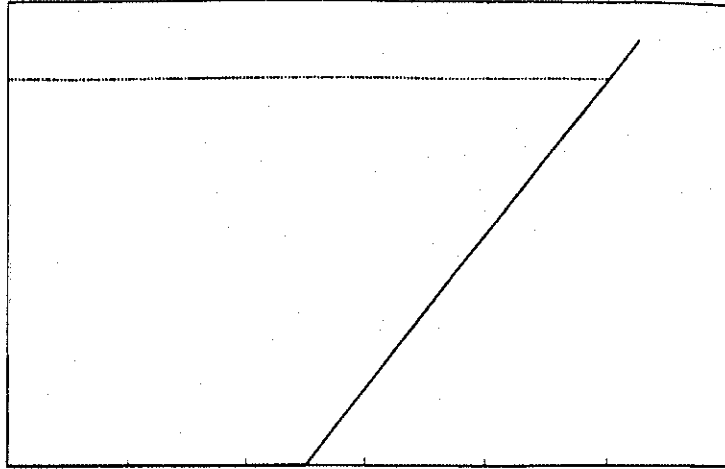
Ward, W.A. and B.J. Deren (1991), *The Economics of Project Analysis: A Practitioner's Guide* (Washington, D.C.: The World Bank).

Whelan, K. (1995), "Unemployment, Long-term Unemployment and Wages in Ireland", ESRI Seminar Paper.

Zerbe, R.O., Jr. and D.D. Dively (1994), *Benefit-Cost Analysis in Theory and Practice* (New York: Harper-Collins).

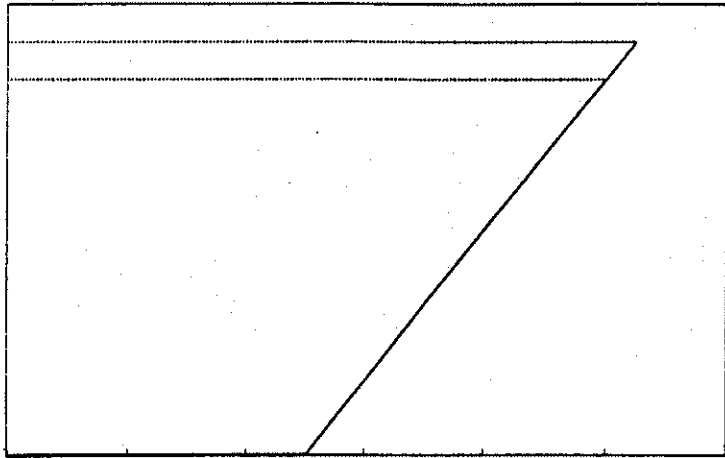
A

Grant level



B

Grant level



C

Grant level

