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Government Intervention and the Cost of Capital to Irish Manufacturing Industry*

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Abstract: This paper derives some general expressions for the debt cost of capital to the Irish manufacturing sector, incorporating the interaction between fiscal and financial policies. A range of estimates of the actual cost (per cent per annum) of fixed assets in manufacturing is presented for the period 1958–1982. The estimates reinforce the findings of earlier studies that government intervention designed to encourage industrial employment has dramatically reduced the relative cost of capital to labour over the past twenty-five years.

I INTRODUCTION

For some three decades past, the Irish government has used fiscal and financial policies to promote the growth of output and employment in the Irish manufacturing sector. The first systematic analysis of the effects of these policies on the cost of capital in Irish manufacturing was undertaken by Geary, Walsh and Copeland (1975) for the period 1953–1973; their estimates were subsequently revised and up-dated by Geary and McDonnell (1979). More recently, FitzGerald (1983) and Flynn and Honohan (1984) using a somewhat

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different approach have derived estimates of the cost of capital for the periods 1957–1980 and 1971–1982 respectively.[1] All of these studies suggest that the influence of government policy on the cost of capital in Ireland has been very significant, and has been partly responsible for the upward trend in the relative cost of labour to capital facing the manufacturing sector.

In this paper the analysis in Geary *et al* (1975) and Geary and McDonnell (1979) is extended theoretically, and estimates of the cost of capital to Irish industry, corresponding to the equations formulated, are presented. Their framework is developed in three directions. First, the analysis incorporates formally the effects of the interaction between fiscal policies (e.g., through the corporate tax system) and financial policies (e.g., through investment grants), on the cost of capital, as examined in Ruane (1982). Second, the analysis is extended to take account systematically of inflation, following the approach of Boadway, Bruce and Mintz (1982). Finally, the analysis treats explicitly the phenomenon of tax-based financing, which has had a dramatic effect on the cost of capital in Ireland over the past ten years.[2]

The paper is structured as follows. In the analysis in Section II a general expression for the cost of capital is derived which incorporates the effects of the corporate tax system, investment grants and inflation. This analysis is then extended to take account of export sales relief, whereby profits generated by export sales of manufactures are exempt from corporate income tax, and the preferential tax rate (10 per cent) on all manufacturing profits, which was introduced in 1981. In Section III, estimates of the unit cost of capital associated with debt finance are presented for the period 1958–1982, based on the equations derived in Section II. In addition, the impact of government policy on factor choice in the manufacturing sector is examined by comparing wage-rental ratios inclusive and exclusive of intervention. Finally, Section IV presents a summary of the results, and some conclusions for policy formulation.

II THE COST OF CAPITAL

Expressions for the cost of debt-financed capital can be derived either from explicit consideration of the constrained intertemporal profit-maximisation

[1]The results obtained by Flynn and Honohan (1984) and FitzGerald (1983) are discussed briefly in Section IV below.

[2]Following the earlier analyses, it is assumed that capital is financed by debt at the margin. In some recent studies (e.g. Auerbach (1983), Boadway *et al.* (1981)), estimates of the cost of capital under a combination of debt and equity finance are presented, on the assumption of a fixed debt-equity ratio. With discretionary grants and extensive tax-based financing in Ireland, it is implausible to assume a fixed debt-equity ratio at the margin, and it is beyond the scope of the present paper to examine exactly how the debt-equity ratio would be determined in this context. Since this paper is concerned with the cost of capital at the margin, and since the tax system favours debt rather than equity finance, it seems reasonable to concentrate on the cost of capital under debt finance.

problem facing the firm (as, for example, in Jorgenson (1963) and Boadway (1980)) or by consideration of a unit perturbation in the optimal path of the firm's capital stock (the method adopted by Stiglitz (1973), King (1975) and Ruane (1982)). The results of the two methods are formally equivalent. Both approaches show that, at the optimum, the post-tax profits on the marginal unit of capital are equated to the cost of that unit. The user cost of capital is defined, by convention, to be equal to the pre-tax change in profits at the equilibrium.

The model in each approach is basically neo-classical, in that the firm has a well-behaved profit function, expressing profit (Π) as a function only of capital (K) employed, which derives from a smooth production function in a world which is certain and frictionless. Further, unless explicitly stated, markets are assumed to be perfectly competitive and firms' financial policies are not subject to any legal or institutional constraints. As noted in Ruane (1979), and as will be evident in the following analysis, relaxation of any of these assumptions, implying additional constraints on firms and the possibility that all available allowances may not be utilised, may be expected to raise the effective cost of capital.

In the absence of taxes and tax allowances, the cost to the firm of a unit of capital has three components: a real finance cost, a physical depreciation cost,[3] and a capital gain or loss over the period.[4] This cost, which is referred to as the *market* cost of capital, is given by

$$C_{Mkt} = r + \delta - \dot{q}/q \qquad (1)$$

where r is the real rate of interest, δ is the depreciation cost and $\dot{q}/q$ is the proportionate change in the real price of investment goods (q). This equation, which is the starting point of the analysis, must be amended to take account of the provisions of the Irish tax and incentive system.

Consider a firm which faces a corporate tax rate, τ. Such a firm can set a proportion (γ) of *nominal* interest payments immediately against tax, thereby reducing its effective real interest rate to $r' = i(1 - \gamma\tau) - \pi$, where i is the nominal interest rate and π is the rate of inflation.[5] In addition to this interest deductibility allowance, a firm is also eligible for an investment grant from the Industrial Development Authority (IDA) and an initial depreciation allowance

[3]Depreciation is treated simply as an exogenous decline in the capital stock. In a richer analysis one might wish to take account of the fact that a firm can influence the rate of depreciation of its capital stock by varying its utilisation rate.

[4]It can be argued that this capital gain or loss should be ignored, on the grounds that its expected value is zero, and/or that firms would heavily discount any expected gain or loss. However, this paper follows the standard approach of including the real relative price change in the value of manufacturing assets.

[5]This is the interest rate at which the firm discounts the value of all future income flows, including tax allowances. Clearly the provision that nominal rather than real interest payments are tax deductible has an important impact on the real finance cost of investment in periods of high inflation.

against taxable profits.[6]. While the value of both incentives is in principle independent of the inflation rate (assuming that the firm can avail itself of them in the first year), the incentives differ in that the first is independent of, and the second dependent on, the firm's marginal tax rate.

If the firm is eligible for a grant at a rate (φ) and can offset a proportion (θ) of total (grant and non-grant) investment expenditure instantly, then the amount of the unit investment which it is effectively required to purchase is reduced by ($\varphi + \theta\tau$), and the immediate cost of obtaining a marginal unit of capital is therefore $(r' + \delta - \dot{q}/q)(1 - \varphi - \theta\tau)$[7]. This is the appropriate formulation for plant and machinery investment in Ireland; in the case of industrial buildings, allowances apply to the non-grant component only, and the cost of a marginal unit of capital is $(r' + \delta - \dot{q}/q)(1 - \varphi)(1 - \theta\tau)$. All of the equations derived below relate to plant and machinery and an analogous adjustment is required for industrial buildings.

Finally, an annual depreciation allowance (α), based on the historic cost of the asset, is allowable on that part of the investment not granted an initial depreciation allowance ($1 - \theta$). The value of these allowances to the firm is obtained by deflating their value (which is expressed in nominal terms) at the firm's effective nominal interest rate; denoting the present value equivalent of the stream of allowances by (v), the cost of the unit of capital is $(r' + \delta - \dot{q}/q)(1 - \varphi - \theta\tau - v(1 - \theta)\tau)$,[8] where $v = \int_0^T e^{-(r' + \pi)t} \alpha e^{-\alpha t}\, dt$.[9] This can also be written as $(i(1 - \gamma\tau) + \delta - \dot{Q}/Q)(1 - \varphi - \theta\tau - v(1 - \theta)\tau)$, where $\dot{Q}/Q$ is the proportionate rate of change in the *nominal* price of investment goods.

The additional post-tax profits of the optimising firm resulting from the unit investment $[(1 - \tau)\partial \Pi_t / \partial K_t]$ will, in equilibrium, equal the cost of the unit of capital just derived. The effective *minimum* user cost of capital for a firm subject to these taxes and allowances may therefore be written as:[10]

$$C_{Min} = \partial \Pi_t / \partial K_t = \frac{(r' + \delta - \dot{q}/q)(1 - \varphi - \theta\tau - v(1 - \theta)\tau)}{1 - \tau} \qquad (2)$$

[6]It is assumed here that grants are available on all fixed asset investment and that the prevailing rates are expected to persist. This assumption approximates to the Irish system where IDA grants effectively apply to gross investment (when New Industry and Re-equipment grants are taken in combination). Ruane (1979) presents formulae for the case where grants apply strictly to net investment.

[7]This derives from the expectation that the allowances, like the grants, are permanent, which means that the allowances effectively apply to the depreciation cost and capital gain.

[8]The equation for the cost of a unit of capital in the case of buildings is $(r' + \delta - \dot{q}/q)(1 - \varphi)(1 - \theta\tau - v(1 - \theta)\tau)$. Note that the present value of interest allowances is not immediately available to the firm; hence the proportion of investment *actually financed* by the firm is greater than that given here, and there is a correspondingly greater interest offset against tax.

[9]This expression for v assumes an institutionally-given depreciation allowance (α) based on historic cost. In the case where this allowance corresponds exactly to the true rate of economic depreciation, $\alpha = \delta$ (see Boadway (1980)). If the depreciation allowances are given over an infinite time horizon ($T = \infty$), as assumed by Boadway (1980), the expression simplifies to $v = \alpha/(r + \pi + \alpha)$.

[10]This equation for the cost of capital differs from that given in Geary *et al.* (1975) and Geary and McDonnell (1979) in that it adjusts explicitly for inflation, capital gains and capital grants. In particular, if $\alpha = \delta$, $\dot{q}/q = 0$, $\gamma = 1$, $\pi = 0$ and $\varphi = 0$, Equation (2) reduces to Equation (5) in Geary and McDonnell (1979), with the price of investment goods set equal to unity.

Comparing Equations (1) and (2), it is evident that, even in the absence of IDA grants, the effect of government intervention through the corporate tax system may be to reduce the relative cost of capital *below* the market cost; in other words the cost of capital with a positive tax rate may be *less* than the cost with a zero tax rate. This has in fact occurred in Ireland over the past twenty years, with the introduction of accelerated depreciation allowances. Since 1971, investment in plant and machinery has been eligible for free depreciation allowances ($\theta = 1$) and full interest deductibility allowances ($\gamma = 1$), so that the general expression for the cost of capital given by Equation (2) simplifies to

$$C'_{Min} = \frac{(r' + \delta - \dot{q}/q)(1 - \varphi - \tau)}{1 - \tau} \qquad (2')$$

Even if the capital grant is zero, this cost is unambiguously below the market cost since the allowances which can be set against the tax payable on profits generated by the new investment *exceed* the costs of the new investment, assuming that the firm has sufficient taxable profits to avail itself of all the allowances.[11] (To avail itself of all allowances, the firm needs profits in excess of those generated by the incremental change in the capital stock.) If the firm has insufficient taxable profits, its cost of capital at the margin rises to *at maximum* the market cost less the IDA grant in the case where it is permanently tax-exhausted, i.e., when it never succeeds in using the extra allowances:

$$C_{Max} = (r + \delta - \dot{q}/q)(1 - \varphi) \qquad (3)$$

The gap between the costs of capital given by Equations (2') and (3) explains why firms which find themselves with unused allowances have an incentive to enter leasing agreements with partners who can avail themselves of such allowances immediately.[12] These partners are typically banks,[13] which are attracted to leasing by the IDA grant and the reduction in their current tax liabilities through the use of depreciation and interest deductibility allowances.[14] Obviously there are considerable tax savings associated with leasing, as evidenced both by the rapid growth of the leasing market and the decline in taxes paid by banks engaging in leasing. The scale and distribution

[11]The corporate tax system would be neutral in its effects on the cost of capital either if free depreciation allowances alone were given ($\theta = 1$, $\gamma = 0$) or if interest deductibility allowances were combined with true economic depreciation, ($\theta = 0$, $\alpha = \delta$, $\gamma = 1$). See Ruane (1982). Note, also, that in certain regions designated for additional assistance, depreciation allowances actually exceed the cost of investment ($\theta > 1$), so that the corporate tax system lowers the cost of capital to an even greater extent.

[12]This incentive is particularly strong in periods of rapid inflation when the value of postponed allowances is drastically reduced.

[13]Other partners in leasing agreements include retailing and manufacturing enterprises, when the former have higher tax rates and negligible allowances, and manufacturing firms in contracting and expanding sectors, when the former have no tax offsets. Stewart (1982) argues that the transfer of tax allowances between companies has provided a strong incentive for mergers in the Irish corporate sector.

[14]The banks benefit by their immediate tax saving but incur a tax liability on the lease payments which they receive from the firm over the lease period (typically five years). In the Irish context the actual lease payments tend to be small. This is because the amount which the bank has to charge the firm to cover its costs is low, since the IDA grant, which it receives directly, is not subject to tax.

(between the lessor and lessee) of these savings via the terms of the lease depend upon the particular tax situations of both parties. Assuming that the banks face the same nominal tax rates as manufacturing firms, then the cost of capital at which they *can* finance manufacturing investment is given by Equation (2′). In practice, the cost of capital faced by a tax-exhausted manufacturing firm engaging in leasing will lie somewhere between that given by Equation (2′) (when the bank passes on all of the benefits of its tax saving) and Equation (3) (when the bank takes all of the benefits).

A further complication in the Irish system is Section 84 loans, which are finance loans whose interest payments are treated as untaxable dividends. The principle underlying their use to fund investment in manufacturing is analogous to that for leasing agreements. Here again, a shortfall in taxable profits may result in the inability of a manufacturing firm to avail itself of the tax allowances associated with interest payments, so that its effective real rate of interest is given by $r = i - \pi$. While interest deductibility allowances cannot be exactly transferred to tax-paying enterprises, the use of Section 84 loans is equivalent to such a transfer, as payments made on these loans may be treated as tax-free dividends by the lending enterprise.[15] The benefit to those using this method of finance arises from the reduced tax liability of the lender, which is shared between the borrower and the lender via the terms of the loan (for example, through a lower interest rate). The marginal cost of capital for a firm using a Section 84 loan is given by Equation (2′) when it can avail itself of all its depreciation allowances and by Equation (4) when it cannot avail itself of any extra depreciation allowances, assuming in both cases that the full benefits of Section 84 loans are passed on to the firm:

$$C_{84} = (r' + \delta - \dot{q}/q)(1 - \varphi) \tag{4}$$

So far, the framework which has been developed in this section does not allow explicit consideration of two key features of the incentive system for Irish manufacturing industry, namely, export sales relief (ESR), whereby firms pay no corporate income tax on that proportion of output which is exported, and the new preferential corporate tax rate of 10 per cent, which applies to all manufactured output.[16] The effects of these two schemes on the cost of capital are now examined in turn.

[15]Limits on the extent to which Section 84 loans can be used were introduced in the 1984 Budget. While these loans are still widely in use in the manufacturing sector, the tax savings resulting from them are relatively small, except where the manufacturing enterprise is a zero-tax company.

[16]At present, companies which established exporting manufacturing plants in Ireland before June 1981 are exempt from tax on export sales for 15 years or up to 1990. Firms which established manufacturing plants after that period are subject to a 10 per cent corporate tax rate. Prior to 1981, profits on manufactures sold domestically were subject to a corporate tax rate of approximately 45 per cent. Since 1981 a uniform tax rate of 10 per cent applies to profits from sales of manufactured goods on both foreign and domestic markets.

For a firm which is exporting all of its output, and receiving an IDA grant, the cost of capital at the margin is identical to that of the permanently tax-exhausted firm given by Equation (3) above, i.e., the market cost minus the grant. In other words, its marginal cost is actually higher than the cost to firms paying corporate taxes, since their allowances exceed their costs. However, under Irish legislation, firms are entitled to all of the tax allowances associated with capital purchases for export production if they can somehow avail themselves of them, even though they are not liable for any tax on the associated corporate profits. This feature of the tax system creates an obvious incentive to lease, as manufacturing firms can benefit through the tax provisions without incurring any costs through taxation, while banks benefit by using these allowances to defer tax liabilities. Again, leasing allows the cost of capital to fall to that given by Equation (2′), if the firm gets the full benefit from the lease. Obviously, fully exporting firms cannot lease all of their equipment, but typically they lease about one third, with the rest financed at a cost given by Equation (3)[17].

For manufacturing firms which sell on both domestic and export markets, the marginal cost of capital depends on the share of output exported (which is reflected in the denominator of the cost of capital equation) and the use of the tax allowances associated with this investment (which is reflected in the numerator).[18] If ε is the proportion of output which is exported, then the change in the firm's post-tax profits is equal to $\varepsilon \partial \Pi_t / \partial K_t + (1-\varepsilon)\partial \Pi_t / \partial K_t$ i.e., $[1-\tau(1-\varepsilon)]\partial \Pi_t / \partial K_t$. The denominator in the cost-of-capital equation is therefore $1-\tau(1-\varepsilon)$, while the numerator depends upon the allowances available to the firm. In the case where the firm receives *zero* allowances on the export component and full allowances (free depreciation and full interest deductibility) on the domestic component its cost of capital is given by:

$$C_x = \frac{\varepsilon(r+\delta-\dot{q}/q)(1-\varphi)+(1-\varepsilon)(r'+\delta-\dot{q}/q)(1-\varphi-\tau)}{1-\tau(1-\varepsilon)} \qquad (5)$$

If a firm which is exporting and selling domestically has taxable profits against which it can offset the allowances on the capital associated with export production, it will use these allowances as far as possible, and will only enter leasing agreements when it is tax-exhausted. In practice, firms use a combination of direct financing, leasing and Section 84 loans.

The effect of the new preferential tax rate of 10 per cent on all manufacturing profits creates an incentive for leasing similar to ESR (which is equivalent to a zero tax rate). However, with the 10 per cent rate, there is an incentive to lease induced even before tax-exhaustion occurs, because the allowances transferred

[17]The IDA imposes a limit of 35 per cent on the amount of grant-aided plant and machinery which may be leased. As mentioned above, such an institutional constraint clearly raises the firm's cost of capital.

[18]This assumes that the export share is independent of the cost of capital.

to a banking institution can be offset against the higher tax rate. Once again, it is possible to establish a minimum cost of capital for the leased component where the current allowances ($\theta = 1$, $\gamma = 1$) are attached to the bank's marginal tax rate. Assuming that the firm has sufficient profits to offset its lease payments against its own taxes at a rate τ, and that all of the bank's tax savings from leasing are transferred to the firm, the cost of capital with leasing is:

$$C_{LMin} = \frac{(r'' + \delta - \dot{q}/q)(1 - \varphi - \tau_b)}{1 - \tau_b} \qquad (2'')$$

when τ_b is the bank's marginal tax rate and $r'' = i(1 - \tau_b) - \pi$.

This analysis clearly indicates the wide range of variation in the marginal cost of capital (C_{Max} to C'_{Min}) which different firms in the manufacturing sector face, depending on their financial structure and their ability to engage in leasing agreements.[19] In the next section, these equations are used to estimate the range of effective costs of capital, which can be compared with the market cost of capital and with the effective cost of labour.

III ESTIMATES OF THE COST OF CAPITAL TO IRISH MANUFACTURING INDUSTRY, 1958–1982

In this section the model developed in Section II is used to examine the way in which government policy has influenced the cost of capital to the Irish manufacturing sector over the period 1958–1982. It is clear from the analysis that there is no single cost of capital to Irish manufacturing industry, as some of the parameters in the equations derived differ widely across firms, e.g., the percentage of output exported (ε), and the percentage capital grant received (φ). Accordingly, the time series presented here are chosen simply to illustrate the range of the costs of capital, and how this range has varied over time, as government policy has altered. In particular, attention is focused on the relative importance of financial allowances (grants) and fiscal allowances (depreciation and interest deductibility) on the cost of capital, and on the role of tax-based financing in potentially allowing the firm to benefit fully from all available allowances. In addition, the overall impact of government policy on the relative costs of capital and labour to the manufacturing sector are examined.

While the data used to calculate estimates of the cost of capital are discussed in detail in an appendix, some general comments are appropriate at this stage. First, the estimates presented in the tables refer to plant and machinery investment in Ireland's more developed regions, which are referred to as Non-Designated Areas. The cost of plant and machinery in Designated Areas (which receive more generous grants and tax allowances), and the cost of buildings in

[19] An individual firm's ability to engage in leasing may also be constrained by the suitability of its assets for leasing and by the IDA. See footnote 17.

all areas, are discussed in the text.[20] Second, as noted in Section II, the firm is assumed to have static expectations about government policies: this means that a parameter value applicable in a given year can be used to calculate the cost of capital in that year. While this assumption is both plausible and simple, it should be noted that alternative assumptions about expectations might be made, and that these would alter the estimates presented below. Third, as static expectations would be a very implausible assumption for the price variables (especially given the erratic year-to-year movement of the capital gains term), these variables were smoothed by means of a five-year moving average.[21] Finally, some reservation must be expressed about the quality of the data used in estimation. Rather than present a multitude of series for different data sets (which have individual merits and disadvantages), the procedure followed here is to present the authors' preferred series. While alternative data sets would obviously alter individual estimates, the trends in the series and the qualitative message of the analysis remain unchanged.

The data in Table 1 indicate the broad effects of government policies on the cost of plant and machinery to Irish manufacturing firms over the period 1958–1982. Column 1 shows the *market* cost of capital, i.e., the cost if there were no government intervention [Equation (1)]. While this series shows some year-to-year fluctuations, the market cost was generally lower in the mid-1970s than in either the 1960s or the late 1970s and early 1980s. Explanations for this include the higher inflation rates in the mid-1970s (which resulted in firms' paying low or negative real interest rates on debt-financed capital), and the high real capital gain on manufacturing investment goods.[22]

Column 2 shows the cost of capital net of the IDA grant, but with no fiscal allowances [Equation (3)]. This series, which assumes that the firm receives the average IDA grant approved in a given year, represents the *maximum* cost of capital it can face. From inspection of Column 2 it is evident that the average grant approved has varied considerably from year to year (reducing the cost of capital by between 16 and 37 per cent) and has tended to fall since the late 1960s.[23] Column 3 shows that the effect of the corporate tax system has been even more dramatic [Equation (2), $\varphi = 0$]. In the early years (1958–61), the allowances against tax were so low that the post-tax cost was higher than the market cost; throughout the 1960s, however (following the increase in depreciation allowances in 1962), the post-tax cost declined relative to the market cost and, in 1971, there was a further significant drop in the cost of

[20]A primary reason for concentrating on plant and machinery investment is that it constituted about 70 per cent of total investment in Irish manufacturing during the period under consideration.

[21]Because of data limitations, it was not possible to apply this procedure to the inflation and capital gains variables for 1981 and 1982.

[22]Since 1978, the real interest rate has been positive and high by historical standards.

[23]In 1970, the maximum grant payable in the Non-Designated Areas fell to its current rate of 35 per cent (it had been 50 per cent for most of the 1960s) and the average grant rate approved fell correspondingly.

capital as free depreciation was introduced.[24] It will be noted that no estimates are presented for 1975 and 1976 in Columns 3–5. In these years the estimates for the cost of capital with full tax allowances were *negative,* arising from the combination of negative real interest rates and the allowances which were attached to high nominal interest rates. It is obvious that the model set out in Section II is not fully defined in such cases, for a negative cost of capital suggests that firms would expand indefinitely.[25]

Table 1: *Cost (per cent per annum) of capital (plant and machinery) to the manufacturing sector in non-designated areas,* 1958–1982

	Market cost	*Grant cost*	*Full allowance cost*	*Full allowance and grant cost*	*Average export cost*
	(1)	(2)	(3)	(4)	(5)
1958	13.0	8.2	13.8	6.9	7.2
1959	13.6	8.6	14.4	7.3	7.6
1960	13.7	8.6	14.5	7.4	7.7
1961	13.3	8.5	14.0	7.2	7.6
1962	12.9	8.2	12.8	5.9	6.6
1963	12.7	9.8	12.4	8.3	8.8
1964	12.7	8.8	12.3	6.8	7.5
1965	12.9	8.9	12.6	6.8	7.5
1966	13.0	9.2	12.6	7.0	7.7
1967	12.5	8.0	11.3	4.9	6.1
1968	11.7	6.9	9.6	3.0	4.6
1969	10.4	6.7	7.9	3.3	4.7
1970	10.1	7.5	6.7	3.6	5.4
1971	10.2	7.5	4.3	1.6	4.5
1972	8.9	6.9	3.0	1.7	4.1
1973	7.9	5.6	1.4	0.6	2.9
1974	8.8	7.3	1.3	0.9	3.9
1975	7.0	5.7	*	*	*
1976	7.1	5.1	*	*	*
1977	9.9	8.3	2.7	1.9	5.2
1978	10.8	7.1	3.4	1.3	4.3
1979	13.1	8.6	5.3	2.0	5.4
1980	15.7	11.6	7.2	2.4	7.5
1981	15.1	11.2	6.6	2.3	7.4
1982	15.7	11.5	7.6	2.5	8.0

Notes: The equations corresponding to each of these series are given in the text, and the data used to estimate them are discussed in the appendix. No estimates are presented for years in which the cost of capital was negative. See text.

It is striking that, since the introduction of free depreciation in 1971, the corporate tax system has actually had a greater effect than the grant system in

[24]The results show the impact of free depreciation particularly clearly, because there was virtually no change in any of the other parameters between 1970 and 1971.

[25]See Flynn and Honohan (1984) for a succinct discussion of this issue.

reducing the cost of plant and machinery.[26] For example, in 1982 where capital grants lowered the market cost of capital by 27 per cent, the corporate tax system (assuming that the firm could benefit from all of the allowances available) reduced the cost by 52 per cent. Column 4 combines the effects of both grants and the corporate tax system on plant and machinery costs, assuming that the firm could benefit from all of the tax allowances [Equation (2)]. Here again there are year-to-year fluctuations in the series, but the trend has been clearly downward, with the effective cost averaging about 48 per cent of the market cost in the years prior to 1971 (when free depreciation was introduced) and only 15 per cent in the post-1971 period (excluding 1975 and 1976). The provision that firms may avail themselves of tax allowances on the component of their investment financed by the IDA grant explains why the combination of grant and fiscal allowances has such a dramatic effect on the cost of capital.

While Columns 2 and 4 indicate the maximum and minimum costs of capital which a firm with zero tax allowances and full tax allowances, respectively, would face, Column 5 shows the cost of capital for a firm which is approved an average IDA grant and has "average" exports, i.e., whose export-output ratio is equal to the average for the manufacturing sector [Equation (5)].[27] Assuming that the firm only obtains tax allowances on the component of output which is sold domestically, and zero allowances on the export component, its effective cost of capital naturally lies between C_{Max} and C_{Min}. As this gap has widened since 1971, the incentive for a firm engaged in exporting to attempt to benefit through leasing from unused tax allowances is clear from the data. For a given range of costs, leasing is a key determinant of the cost for a given firm in that range.

Before turning to examine the effects of leasing, induced by the widening gap between C_{Max} and C_{Min}, some brief discussion of the effects of government intervention on the cost of plant and machinery in the Designated Areas and on the cost of industrial buildings is appropriate. Since 1967, the Designated Areas have received more generous tax allowances for plant and machinery than the Non-Designated Areas, reinforcing the benefits of higher grant rates already available in those areas. In 1967, the introduction of free depreciation allowances (compared with a 50 per cent allowance in the Non-Designated Areas) reduced the average cost to about 77 per cent of the market cost. In 1971, free depreciation allowances were granted to the Non-Designated Areas and a greater incentive to invest in the Designated Areas was maintained by the payment of an additional 20 per cent initial allowance on all plant and

[26]In fact, in 1970, even before free depreciation was introduced, the combination of 60 per cent instant depreciation, 10 per cent annual allowance and full interest deductibility was sufficient to reduce the full allowance cost of capital below the net-of-grant cost.

[27]In practice there are few such "average" cases in Ireland, with the majority of manufacturing firms being either export-oriented or focused on the domestic market. None the less, this is a useful reference series.

machinery. As a result, the average cost of capital in the Designated Areas since 1971 was about 90 per cent of the cost in the Non-Designated Areas and 13 per cent of the market cost.

On the assumption of a depreciation rate of 2 per cent per annum, the market cost of buildings averaged 5.1 per cent during the 1960s and 1.8 per cent during the 1970s. As with plant and machinery, the main difference between the two decades is attributable to inflation.[28] The effect of government intervention on the cost of buildings was to drive down the cost to about 2.5 per cent per annum in the 1960s (about 50 per cent of the market cost) and to zero or below in the 1970s.[29]

Table 2: *Tax-Based financing and components of the cost of capital (per cent per annum)* 1978–1982

Year	*No allowances*	*Full allowances 45 per cent tax*	*Full allowances 10 per cent tax*	*Section* 84
	(1)	(2)	(3)	(4)
1978	7.1	1.3	–	2.1
1979	8.6	2.0	–	3.5
1980	11.6	2.4	–	5.3
1981	11.2	2.3	4.7	4.9
1982	11.5	2.5	5.3	5.5

Notes: The equation numbers corresponding to each of these series are given in the text and the data used to estimate them are discussed in the appendix.

Table 2 presents data for the five years during which the phenomenon of tax-based financing developed rapidly. Column 1 shows the cost of financing investment when there are IDA grants but no allowances are available [Equation (3)]. This is the effective cost of capital to a tax-exhausted or fully exporting firm at the margin. Column 2 shows the minimum level to which the cost of capital would fall if the firm received all the benefit from leasing [Equation (2″), $\tau_b = 0.45$]. It is obvious that even if half of the benefits from leasing went to the bank, the firm would significantly reduce its capital costs.[30] Column 3 shows the cost of capital if the firm used all of the allowances, applying these to the 10 per cent effective tax rate introduced in 1981 [Equation (2′), $\tau_b = 0.1$]. While this lowers the cost below the zero allowance cost, the effective cost is still about twice the cost under a 45 per cent tax regime. Thus, even if firms can avail themselves of their tax allowances immediately, or within

[28]Because of data limitations, the same capital gains estimate was used for plant and machinery and for buildings.

[29]The high proportion of vacant space in industrial buildings in the early 1980s is probably due to the combination of a low capital cost for privately-built industrial buildings and the extensive IDA Advance Factory Programme in the late 1970s.

[30]Note that if the marginal tax positions of lessor and lessee are different, the total benefit from tax saving depends on the terms of the lease.

a period of one or two years following the purchase of the asset, the margin between Columns 2 and 3 creates a strong incentive to lease.

Finally, Column 4 shows the cost of capital when the asset is financed by a Section 84 loan, with no depreciation allowances [Equation (4)]. For the tax-exhausted firm, this method of financing significantly reduces the cost of capital, and underlies the strong protests from industry groups following attempts to limit the use of this incentive in recent Budgets.

Indices of the costs of labour and capital to the Irish manufacturing sector for the period 1958–82 are presented in Table 3. There has been a steady increase (almost doubling in just 25 years) in the market cost of labour (w) to the sector, as measured by average nominal wages deflated by the price of output of the manufacturing sector.[31] The real market cost of capital index, corresponding to Column 1 in Table 1, shows a steady decline from 1966 until the mid-1970s, followed by a rapid increase to 1980. The real market cost of labour relative to capital rose steadily over the 1960s and early 1970s, reaching a peak in 1975–76, when it was over three times the 1958 level. While the market wage has continued to increase in the latter years of the 1970s, the increase in the market cost of capital has been far more dramatic, so that the cost of labour has fallen relative to capital. None the less, the ratio of labour to capital costs in 1982 was over one and one half times its 1958 level.

Columns 4 to 6 in Table 3 show the effective (post-intervention) costs of labour (market cost plus employers' social insurance contributions) and capital. Since there is some debate as to whether IDA grants operate as capital or labour subsidies,[32] and since this part of the analysis is concerned with substitution between capital and labour, the cost of capital index is based on the full allowance, zero grant case (Column 3 in Table 1).[33] Before examining the trends in the indices, it is useful to note that in the base year (1958), market and effective costs of both factors were very close together: employers' social insurance contributions increased wage costs by only 1.6 per cent, while the effective cost of capital was only 6.2 per cent higher than the market cost.[34] The effective labour cost index rose steadily over the period since 1958, at a slightly faster rate than the market cost, due to the increasing rate of employers' contributions. The effective zero-grant cost of capital declined from 1960 to 1974, as depreciation allowances increased and inflation enhanced the value of interest deductibility allowances, while since 1977 the effective cost has tended to rise, though it remains only about half of the 1958 cost. The net effect of

[31]The use of average earnings to measure marginal labour costs is not ideal, but is dictated by data availability.

[32]For a discussion of this issue, see O'Malley (1981), Conniffe and Kennedy (1984) and Ruane (1984).

[33]Inclusion of capital grants in these estimates would raise the labour to capital cost ratios and result in greater year-to-year fluctuations, because of the variablity in capital grant rates.

[34]To the extent that personal tax changes are "passed on" in market wage demands, market wages are influenced by government policy.

government intervention was to raise the cost of labour slowly but steadily while the cost of capital was reduced substantially, so that the labour-capital cost ratio peaked in the mid-1970s at a level more than eighteen times its 1958 level. Despite the relative decline in recent years, the ratio in 1982 was almost four times the 1958 level.

The overall impact of government policy on factor costs facing manufacturers is clearly visible from Column 7, which shows the ratio of

Table 3: *Market and effective factor (labour/capital) cost ratios,* 1958–1982

Year	*Market factor costs (Index:* 1958 = 1.00*)*			*Effective factor costs (Index:* 1958 = 1.00*)*			*Ratio of effective factor cost ratio to market factor cost ratio*
	Labour cost	*Capital cost*	*Factor cost ratio*	*Labour cost*	*Capital cost*	*Factor cost ratio*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1958	1.00	1.00	1.00	1.00	1.00	1.00	0.95
1959	1.02	1.05	0.97	1.02	1.04	0.98	0.96
1960	1.09	1.05	1.03	1.09	1.05	1.04	0.96
1961	1.11	1.02	1.08	1.12	1.01	1.10	0.97
1962	1.15	0.99	1.16	1.15	0.93	1.24	1.03
1963	1.16	0.98	1.18	1.16	0.90	1.30	1.04
1964	1.22	0.98	1.25	1.23	0.89	1.39	1.06
1965	1.24	0.99	1.25	1.25	0.91	1.36	1.05
1966	1.28	1.00	1.28	1.29	0.91	1.41	1.06
1967	1.26	0.96	1.31	1.28	0.82	1.56	1.14
1968	1.35	0.90	1.49	1.37	0.70	1.97	1.26
1969	1.35	0.80	1.68	1.37	0.57	2.40	1.36
1970	1.48	0.78	1.90	1.50	0.49	3.10	1.56
1971	1.57	0.78	2.00	1.60	0.31	5.14	2.46
1972	1.55	0.68	2.26	1.58	0.22	7.28	3.07
1973	1.63	0.61	2.69	1.68	0.10	16.54	5.87
1974	1.64	0.68	2.43	1.70	0.09	18.10	7.12
1975	1.71	0.54	3.17	1.79	*	*	*
1976	1.76	0.55	3.22	1.86	*	*	*
1977	1.84	0.76	2.41	1.93	0.20	9.88	3.92
1978	1.92	0.83	2.31	2.02	0.25	8.22	3.40
1979	1.92	1.01	1.91	2.05	0.38	5.33	2.67
1980	1.99	1.21	1.64	2.14	0.52	4.11	2.39
1981	1.98	1.16	1.70	2.14	0.48	4.49	2.52
1982	1.98	1.21	1.64	2.19	0.55	3.98	2.31

Notes: The series for market factor costs are based on the assumption of no government intervention; the series for effective factor costs are based on the assumption of full interest deductibility and depreciation allowances and zero grants. Thus Column 2 is an index of Column 1, Table 1, and Column 5 is an index of Column 3, Table 1. The labour cost variables are discussed in the Data Appendix. In all cases, factor cost ratios are the ratios of labour to capital costs. Column 7 gives the ratio of actual effective factor costs to market factor costs. Because the effective cost of capital using this framework is negative for 1975 and 1976, no figures are given in Columns 5, 6 and 7 for those two years.

effective to market labour-capital cost ratios. Before 1962, government intervention actually resulted in an effective ratio of factor costs which was lower than the market ratio and during the rest of the decade the divergence between the two ratios grew slowly. During the 1970s the rapid increase in the value of tax allowances, generated both by the introduction of free depreciation and by inflation, greatly increased the difference between the market and effective factor cost ratios, such that the effective labour-capital cost ratio was over twice the market ratio for all years since 1971. As long as there is some substitutibility between capital and labour in manufacturing production, such an increase in relative factor costs may be expected to lead to substitution in favour of more capital-intensive techniques of production. Even if there is no potential for factor substitution within any sector, this trend in relative factor costs may be expected to favour the expansion of capital-intensive sectors at the expense of labour-intensive sectors. Although the change in relative prices will also have an output effect (so that the overall impact of the policies could still be an increase in employment of labour as well as capital), if the government's aim is to increase employment of labour, then the factor-price change induced by these policies implies an inefficiency.[35] Furthermore, as pointed out in Ruane (1979), since the shadow factor price ratio is arguably much lower than the market factor price ratio, the bias towards capital resulting from government intervention is all the more inappropriate in the Irish context.[36]

IV SUMMARY AND CONCLUSION

The analysis presented in Section II of this paper indicated that, under the system of corporate taxes and incentives operating in Ireland, the real cost of capital may be expected to be less than the market cost and to vary considerably across firms. In other words, there is no single cost of capital, but a range within which all firms' costs of capital lie. The results presented in Section III show the range of effective costs of capital for all manufacturing firms and how government intervention has lowered these relative to the market cost (which itself exhibited a downward trend for most of the period under consideration). As effective labour costs have increased steadily over the period, the net effect on relative factor prices has been very marked. The series presented also reveal the significance of fiscal allowances in bringing about this result: since 1970, the tax saving from interest-deductibility and depreciation allowances combined had a greater effect than industrial grants on the cost of capital. An implication of this is the relative penalty imposed upon firms which cannot avail themselves

[35]It should be noted that, because of the output effect, an increase in labour costs would not have the same impact as an equivalent decrease in the cost of capital; the measure in Column 7, however, treats such changes symmetrically.

[36]This point is also made in McAleese (1984).

of these allowances and the consequent importance of tax-based financing to firms which are so constrained.

A major source of the increase in the value of the allowances to the manufacturing sector was the high rate of inflation during the 1970s. In general, the effects of inflation on allowances are ambiguous: the real value of interest allowances increase with inflation, because they attach to nominal interest payments, while the real value of depreciation allowances falls, because they are based on historic cost.[37] However, in Ireland the net effect on tax allowances has been unambiguously positive since the introduction of free depreciation (assuming that firms could benefit fully from these allowances).[38] Although the numerical values of the cost of capital estimates in this paper sometimes differ markedly from those in FitzGerald (1983) and Flynn and Honohan (1984), the trends in the series and their relative magnitudes are similar. While there are some differences in the equations specified and in the data sets used, the main differences in the estimates are that those presented here have greater within-series fluctuations, primarily due to the inclusion of the capital gains term. This difference is most marked in the comparison with Flynn and Honohan's estimates, as they assume a constant real interest rate throughout.[39]

Some policy conclusions are suggested by this analysis. While much of the focus in the recent public debate on industrial policy has been on the capital grants and other incentives administered by the IDA, the benefits transmitted to many firms in the manufacturing sector through the fiscal system have been at least as great, and will remain so as long as the two-tier tax system operates in the corporate sector, and tax-based financing is permitted. It seems undesirable that the extent of assistance to manufacturing should be determined arbitrarily by the inflation rate, and that the assistance to an individual firm should depend on its ability to benefit from tax-based financing. If it is accepted that discretionary industrial policy, as operated through the grant system, is desirable, then it is inconsistent that a large portion of the benefit to manufacturing should be determined in such an arbitrary manner.[40]

[37]This issue is discussed in detail in Feldstein (1982).

[38]Even in the case of buildings, which have not been granted free depreciation, the depreciation allowances given exceed true economic depreciation, so that with full interest deductibility allowances available, the effect of inflation on the cost of buildings is still unambiguously negative.

[39]In fact, in Flynn and Honohan, the *market* cost of capital is always constant, since they assume that the real interest and depreciation rates are constant, and that there is no capital gain. Their choice of a constant real interest rate also explains why their estimates do not show any upward trend in recent years when real interest rates have been high by historical standards.

[40]However, it should be noted that, although the absolute level of assistance to the manufacturing sector is very generous (as illustrated by the difference between estimates of market and effective capital costs in this paper), it is not possible to conclude from the analysis that the manufacturing sector is favoured relative to other sectors in the economy. In particular, many manufacturing firms are operating in very competitive markets with high risks, where net profitability, allowing for capital subsidies, may be relatively low. To determine whether or not the current levels of subsidy are sufficient to encourage the expansion of the manufacturing sector relative to the rest of the economy requires a comparison of effective rates of return across all sectors.

Furthermore, there seems to be an inconsistency between government policy statements on job creation in the industrial sector, and current industrial incentives, most of which tend to encourage the use of capital relative to labour. Even if the degree of substitutibility between capital and labour in production is low, there is a loss in efficiency from a policy which taxes labour (a factor in excess supply) and subsidises capital (a relatively scarce factor). While there are undoubtedly output effects associated with the present subsidies which generate additional employment, the net effect of the system is to subsidise capital in use rather than labour in use.[41] Finally, in the light of the recent emphasis on the desirability of promoting indigenous industry, it is perhaps ironic that the incentives offered are of more benefit to foreign entrepreneurs than to Irish entrepreneurs. This arises because, although corporate taxes in Ireland are low, the high level of personal taxation drastically reduces the net benefits to private industrialists investing in the manufacturing sector.[42]

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[41]It is worth noting that the bias in the present system is towards *fixed-asset* capital. In particular, a firm which has a high ratio of working to fixed-asset capital (e.g., heavy marketing expenditures) is relatively discriminated against by the present system.

[42]This is particularly important for *new* exporting firms because while under ESR profits were deemed to have been taxed at the standard (45 per cent) rate, under the new 10 per cent corporate tax dividends are effectively liable for very high rates of income tax. For a general discussion of the effects of policies on indigenous and foreign industry, see National Economic and Social Council (1982) and Ruane (1984).

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DATA APPENDIX

The time period of analysis selected was 1958–1982, i.e., from the First Programme for Economic Expansion to the most recent year for which data are available. The data used can be sub-divided into five types:

I variables for which there is only one series, identical for all firms (τ, γ, w);
II variables for which there is only one series which varies across assets or regions (θ, α);
III variables for which there exist a number of alternative series, indentical for all firms (i, π, $\dot{q}/q$);
IV variables for which there exist a number of alternative series which vary across asset types (T, δ);
V variables for which there exist a number of alternative series which vary across firms (φ, ε).

Type I

τ: The time series for the corporate tax rates was derived from the Reports of the Revenue Commissioners. The special 25 per cent rate for employment-creating firms in the late 1970s was ignored, as were the special rates applying to small firms. In years where the tax rate changed, the rate applicable during most of the year was chosen (in preference to the averaging approach which has been used in other Irish studies of the cost of capital) in order to highlight the impact of a given change in the corporate tax rate.

γ: Throughout the period, all interest payments on debt financing were tax deductible, i.e., $\gamma = 1$; in other words, the marginal real cost of borrowing was $i(1 - \tau) - \pi$.

w: The market cost of labour series chosen was the average earnings of males in manufacturing industry (annual average) from 1969 onwards, and the average earnings in a week in October of males over 18 years in the transportable goods industries prior to 1969. The effective cost of labour series was calculated by adding employers' social insurance contributions to the market cost for labour series. Both series were converted into real product labour costs using the output price in manufacturing as a deflator. The earnings data were obtained from the *Irish Statistical Bulletin* and the series on employers' contributions from the Department of Social Welfare.

Type II

θ: The time series for initial allowances were derived from the Reports of the Revenue Commissioners. There are three different series: two for plant and machinery (for the Designated and Non-Designated Areas) and one for buildings.

α: The time series for annual depreciation allowances for both plant and machinery (in Designated and Non-Designated Areas) and buildings, are available in FitzGerald *et al.* (1983), who derived them from the Reports of the Revenue Commissioners.

Type III

i: The choice of data to measure the nominal interest rate poses difficult problems, since it is necessary to make specific assumptions about the rates of interest which manufacturers actually face and their expectations about those rates. The nominal interest rate chosen was the mid-point of the range of interest rates on 1–5 year term loans from the non-associated banks (given in the Central Bank of Ireland Annual Reports) as it was considered that firms seeking investment loans would face interest rates in this range. Data for this series were not available before 1972. Prior to this date the rate of interest on long-term government securities was used; the limited movement in interest rates in the 1960s makes this an acceptable if not ideal series. Finally, since the selection of the actual rate prevailing in a year gives rise to marked fluctuations in the real rate of interest series it is unrealistic to assume that firms expect the actual rate to persist. As noted in the text, the solution adopted was to smooth all the price variables by means of a five-year moving average.

π: Since the purpose of the cost of capital series is to find the price of capital to a producer, the appropriate deflator is the price at which that producer can sell his output. (This is preferable to more general price deflators, such as Wholesale or Consumer Price Indices.) The best source available is the deflator for Gross Domestic Product arising in manufacturing (taken from FitzGerald *et al.* (1983)). Like the interest rate, this series was smoothed using a five-year moving average.

$\dot{q}/q$: Because of data limitations, the capital gains series used is a general series for manufacturing investment, and does not distinguish between plant and machinery and industrial buildings. The series in FitzGerald *et al.* (1983) was used, and converted to real terms using the manufacturing output deflator; this series was also smoothed using a five-year moving average. Some authors, e.g., Flynn and Honohan (1984), have assumed that there is no real capital gain, i.e., $\dot{q}/q = 0$, which implies that the rate of change in the price of manufacturing output is not expected to differ from the rate of change in the price of investment goods in the long run. However, the data suggest that this assumption is inappropriate in the Irish case, where differences between the two series have persisted over the whole period. Similar results were reported for the Canadian economy in Boadway *et al* (1982).

Type IV

T: In the absence of any data, the asset life of plant and machinery was assumed to be 10 years, and that of buildings, 40 years.

δ: There are a number of approaches to estimating the true rate of economic depreciation, depending on assumptions made about the lifetime of a particular capital good (which varies widely across industries) and the way in which it deteriorates over time. In this analysis the approach of Flynn and Honohan (1984) is followed, assuming the asset durations given above and a real interest rate of 1 per cent. This results in an annual real depreciation of 9.5 per cent per annum for plant and machinery (which is much higher than that assumed by Geary and McDonnell (1979)) and an annual real depreciation rate of 2 per cent per annum for buildings.

Type V

φ: Grants towards the cost of fixed-asset investment are available to Irish manufacturing firms on a discretionary basis from the Industrial Development Authority. The grant rates paid vary widely, depending on, among other things, the factor intensity of the project and its export-sales ratio. Thus the use of average data masks a huge variance in the figures. The IDA are currently preparing estimates of the actual grant rates offered under different programmes, but in their absence, grant-approval figures are used. (As a proportion of fixed assets, the gap between actual and approved rates is likely to be fairly small.) Alternative series for the cost of capital with zero and maximum grants were also estimated and these are available from the authors on request.

ε: The series for the export-sales ratio of the manufacturing sector was taken from FitzGerald *et al.* (1983). Again, as with grant rates, these ratios differ widely across firms, with many of the new foreign grant-aided firms exporting all of their output to subsidiaries ($\varepsilon = 1$), while many domestic firms sell completely on the domestic market ($\varepsilon = 0$). The magnitude of the variation is evident from the estimates computed for both of these extremes, which correspond to the zero and full allowances estimates in Section III.