<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>The relationship between tax rates, grant rates and local costs in the location decisions of multinationals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Authors(s)</strong></td>
<td>Durkan, Joe</td>
</tr>
<tr>
<td><strong>Publication date</strong></td>
<td>1996</td>
</tr>
<tr>
<td><strong>Series</strong></td>
<td>UCD Centre for Economic Research Policy Papers; 96/23</td>
</tr>
<tr>
<td><strong>Publisher</strong></td>
<td>University College Dublin. School of Economics</td>
</tr>
<tr>
<td><strong>Item record/more information</strong></td>
<td><a href="http://hdl.handle.net/10197/1085">http://hdl.handle.net/10197/1085</a></td>
</tr>
<tr>
<td><strong>Notes</strong></td>
<td>Highlighting in this item renders some text unreadable. A hard copy is available in UCD Library at GEN 330.08 IR/UNI</td>
</tr>
</tbody>
</table>
CENTRE FOR ECONOMIC RESEARCH

WORKING PAPER SERIES 1996

"The Relationship Between Tax Rates, Grant Rates And Local Costs In The Location Decisions Of Multinationals"

Joe Durkan,
University College Dublin

WP96/23
October 1996

MAIN LIBRARY,
BELFIELD
UNIVERSITY COLLEGE DUBLIN

This book must be returned to the above library by the latest date stamped below. Otherwise a fine will be imposed.

27 MAY 1999
30 NOV 2001
21 FEB
The relationship between tax rates, grant rates and local costs in the location decisions of multinationals

Introduction

Ireland offers multinationals an incentive package consisting of grants and tax holidays on profits. For firms that are already situated in Ireland, it is easy to show that the tax advantage compared to, for instance, location in the US, far outweighs the value of the grant. As a consequence this has led to the role of the grant being downplayed. Indeed, as long ago as when the Telesis Report was published by NESC it was believed...

(At the time of Telesis, there was a zero rate on exports, and curiosities in the tax code led to tax-based leasing that made the cost of capital extremely low.)

Yet, in discussions with overseas companies it is claimed that grants in other countries are better, and domestic costs are lower, so that the lower tax rate is needed to "compensate" for these two factors. As these companies are very profitable these claims have always looked suspect in a purely Irish context. The purpose of this paper is to examine the relationship between these three variables—the grant rate, the tax rate and the relative price of local costs, and to establish the trade-offs between these variables.

A simple model

One approach to this issue would be to replicate the exercise undertaken by a firm faced with several alternative overseas locations for a new plant. Differences in the availability of grants, in capital grants, and lower subsidies. Not only do corporate tax rates differ, but there are differences in capital allowances, and the timing of capital allowances between locations. In addition, the tax regime may create possibilities for tax-based lending, as with Section 84 loans available in Ireland until recently. Investing can also be of differential benefit, depending on the tax rate. Finally, locations can differ in relation to local costs—in some, operatives are relatively cheap, electricity costs can vary wildly and so on. Other things...
being equal e.g. access to markets, political stability, the firm must choose between these alternative locations. It would be difficult to replicate the exercise that a firm undertakes, not least because the grant rate, and in some case even the tax rate, are negotiable. However, the difficulty of replication, need not preclude an analysis based on some simplifying assumptions.

In order to make simplifying assumptions it is necessary to understand the financial criteria a firm will use in order to choose between different locations where tax rates, grant levels, local costs and the timing of each can differ between location. Ultimately the firm will be looking at a project which gives the greatest return on the capital employed perhaps estimating the internal rate of return on the project in different locations, or comparing the discounted revenue stream with the discounted cost stream. These techniques abstract from the issue of time and allow a consistent valuation of projects. This suggests that it is possible to simplify the issue by considering the project life as a single time period. Within this single time period the firm will, other things being equal, choose the location where the return on capital is greatest, subject to preserving capital intact.

Given this framework it is possible to set up a simple model which can be simulated to capture the impact of differences in locations indicated above. The following notation is used:

| Capital Cost | C |
| Grant Rate   | G_t |
| Revenue      | R |
| Costs        | |
| Capital      | C |
| Operating    | O |
| Operating Cost Factor | O_t |
| Gross profits | R - (C - C.G_t + O O_t) |
| Tax Rate     | t |
| Return on Capital | \frac{[R - (C - C.G_t + O O_t)](1+t)}{C - C.G_t} |

The target for a company is to maximise the rate of post-tax return, i.e. to maximise the following:

\[ LR = (C - C.G_t - O O_t) (1 + t) \]
\[ C - C.G_t \]

In simulating the above expression the following illustrative revenue and cost figures have been selected:

\[ C = 400 \]
\[ R = 1,000 \]
\[ O = 500 \]

Initial values of \( G_t, O_t \) and \( t \) are 0, 1.0, 0.1 respectively so that the one period finances of the project are as follows:

- **Capital Cost**: 400
- **Revenue**: 1,000
- **Costs - Capital**: 400
- **Operation**: 500
- **Gross Profits**: 100
- **Tax at 10%**: 10
- **Net Profit**: 90
- **Return on Capital**: \( \frac{90}{400} = 22.5\% \)

While these figures are illustrative, they, with the exception of the tax rate, are representative of a typical project, where all values are converted to present values.
Model Simulations

Tables 1 and 2 and Charts I and II show the impact on net rates of return of differences in the grant rate, when the tax rate is 10 per cent and 35 per cent, when costs are (i) the same as in other locations (graphs B & D), and (ii) 10 per cent higher (graphs A & C).

Table 1. Return on Capital - 10 per cent tax rate

<table>
<thead>
<tr>
<th>Grant rate</th>
<th>Competitive Costs (A)</th>
<th>Costs 10% Higher (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>28.42</td>
<td>16.58</td>
</tr>
<tr>
<td>0.1</td>
<td>35.00</td>
<td>22.50</td>
</tr>
<tr>
<td>0.15</td>
<td>42.35</td>
<td>29.12</td>
</tr>
<tr>
<td>0.2</td>
<td>50.63</td>
<td>36.56</td>
</tr>
<tr>
<td>0.25</td>
<td>60.00</td>
<td>45.00</td>
</tr>
<tr>
<td>0.35</td>
<td>83.08</td>
<td>65.77</td>
</tr>
<tr>
<td>0.3</td>
<td>70.71</td>
<td>54.64</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grant rate</th>
<th>Competitive Costs (C)</th>
<th>Costs 10% Higher (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>20.53</td>
<td>11.97</td>
</tr>
<tr>
<td>0.1</td>
<td>25.28</td>
<td>16.25</td>
</tr>
<tr>
<td>0.15</td>
<td>30.59</td>
<td>21.03</td>
</tr>
<tr>
<td>0.2</td>
<td>36.56</td>
<td>26.41</td>
</tr>
<tr>
<td>0.25</td>
<td>43.33</td>
<td>32.50</td>
</tr>
<tr>
<td>0.35</td>
<td>51.07</td>
<td>39.46</td>
</tr>
<tr>
<td>0.3</td>
<td>60.00</td>
<td>47.50</td>
</tr>
</tbody>
</table>
What these Tables make clear is that for a given tax rate, the grant rate is important in determining the return on capital for a project. Costs are also important, and higher costs can influence the rate of return significantly.

In one sense we can see from Table I that where costs are higher, a higher grant rate is necessary to "compensate" for these higher costs. For instance, the return is very similar with a grant rate of 5 per cent of the capital cost, and a 15 per cent grant rate with costs 10 per cent higher.

Comparing Tables I and II it is clear that differences in the tax rate impact significantly on the net rate of return. For comparable costs we can see that a 5 per cent grant rate provides a similar rate on net post-tax return when the tax rate is 10 per cent, and when it is 35 per cent. At higher grant levels the gap is somewhat greater. Again, it is possible to see from this that higher grant rates are necessary to "compensate" for a higher tax rate. For instance, with a 15 per cent grant rate, and a 10 per cent tax rate, the net return on net capital is 42.35 per cent, and this compares with a net return of 43.33 per cent when the tax rate is 35 per cent, and the grant rate is 25 per cent. In other words it is possible to consider the grant rate and the tax rate as offsetting each other. It is also possible to see the impact of higher costs. The general relationship between these three variables can also be seen in Chart III, which combines Chart I and Chart II.

Graph A refers to a situation where the tax rate is 10 per cent, and costs are competitive.  
Graph B 10 per cent higher than graph A.  
Graph C " competitive  
Graph D " competitive 10 per cent higher

From this chart it is possible to read off the combinations of tax rates, grant rates and cost disadvantages that preserves a given rate of return. The grid lines make this possible, but they mainly illustrate the point. For instance, the 4 points where the grid line at a 40 per cent rate of return intersects the four graphs, gives those combinations of a 10 or 35 per cent tax rate, and the associated grant rates which with differences in costs of 10 per cent, equalizes the net rate of return on net capital.

The above result can be derived more formally. In the Appendix it is shown that it is possible to derive a tax rate that is consistent with any grant rate and conversely a grant rate that is consistent with any tax rate, to preserve a target rate of return on a project. In the case of the
example above, if the intention is to maintain a 25 per cent rate of return, the appropriate tax rate in the cases where (i) costs are competitive and (ii) costs are 10 per cent higher are shown below:

(i) \[ t = \frac{5G_t}{1+4G_t} \]

(ii) \[ t = \frac{10G_t - 1}{1+8G_t} \]

Table 3 shows the tax rates that would be necessary to provide a 25 per cent rate of return for various levels of grant in the two cases.

<table>
<thead>
<tr>
<th>Grant Rate</th>
<th>Costs: Competitive</th>
<th>Costs: 10% ↑</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required tax rate (i)</td>
<td>Required tax rate (ii)</td>
<td></td>
</tr>
<tr>
<td>0.01</td>
<td>0.48</td>
<td>0.833</td>
</tr>
<tr>
<td>0.05</td>
<td>0.208</td>
<td>0.357</td>
</tr>
<tr>
<td>0.10</td>
<td>0.357</td>
<td>0</td>
</tr>
<tr>
<td>0.15</td>
<td>0.469</td>
<td>0.227</td>
</tr>
<tr>
<td>0.20</td>
<td>0.555</td>
<td>0.385</td>
</tr>
<tr>
<td>0.25</td>
<td>0.625</td>
<td>0.50</td>
</tr>
<tr>
<td>0.30</td>
<td>0.682</td>
<td>0.588</td>
</tr>
<tr>
<td>0.35</td>
<td>0.729</td>
<td>0.658</td>
</tr>
</tbody>
</table>

From Table 3 it is evident that if the grant rate is relatively low there must also be a relatively low tax rate if a project is to proceed in a particular location, and that the tax rate and the grant rate are effectively substitutes. It is also clear that if costs are relatively high the for any given grant rate the tax rate must be correspondingly low to preserve a target rate of return. In fact in the latter case the authorities may have to provide negative rates of returns to preserve a target rate of return if the grant rate is too low. Chart IV contains the two cases where A refers to case (i) and B refers to case (ii).

Conclusion and Implications for Policy

1. While the tax rate is important in determining post-tax rates of return it is not the only factor. The grant rate and the degree to which costs differ also matters.

2. There are trade-offs between the tax rate and the grant rate, and these can be determined for any given project.

These conclusions have been established using a very simple model. The conclusions are inherently plausible, but perhaps have been obscured in Ireland by the fact that overseas firms are very profitable, and that measures of the tax benefit to the firm in Ireland has outweighed the grant by a very large amount. However, firms are choosing between locations and may be
expected as profitable in several, so that the location decision, (other things being equal), is motivated by the greatest post-tax return on net assets. This involves a consideration, not just of the tax rate, but also of the grant rate and the extent to which the costs differ between locations.

From a policy point of view this analysis is very important. While the 10% tax is the major incentive for most overseas companies the benefits can be outweighed by more favourable grants elsewhere or by a more favourable cost environment. In fact this is a very real possibility as other governments and regions can, and do, offer incentive packages that are very effective in increasing the effective return on net capital. For instance, Israel can give up to 35 per cent of the capital by way of grant, the Netherlands is willing to negotiate the tax rate, as the official posted tax rate is very high, while Singapore provides grants and in addition has costs that are relatively low. The location decisions of firms thus involves a comparative analysis of incentives and costs, not just the tax rate.

It has often been suggested that the low rate in Ireland could be raised without significantly affecting investment. The above analysis indicates that while this is true Implicit in that view is the notion that since the profits of multinational companies are so large they will be unaffected by a change in the tax rate. This is clearly not the case. If, for instance, the tax rate were raised to 15 per cent, the net of tax return would fall, and the grant rate would need to be raised to 47 per cent of the capital cost, compared with just under 36 per cent with the tax rate at 10 per cent to maintain a 23 per cent rate of return. This indicates the trade-offs that are needed in the incentive structure.

It has also been suggested that raising the tax rate will generate more revenue immediately for government, and that it would take a very high level of additional overseas investment to generate the same level of tax revenue. However, while this might appear attractive it ignores the fact that many products have a very short life cycle, and that there would be an immediate impact on investment decisions by existing companies. Nor is it clear that the recovery time would be long since existing projects generate very significant tax revenues. Finally, raising the tax rate also provides a negative signal to overseas companies, even where the grant rate is increased to compensate.

This analysis also suggests that if the intention is to maintain the competitive nature of incentives more information is needed about relative costs, grants and the effective tax regime in different countries. This could easily indicate a lower tax rate, or a greater grant grant rate. This is quite at odds with current practice in Ireland where the rate of grant is being reduced. The average level of grant per job has been reduced by two thirds over the past decade. Over this period of course there has been a very high level of overseas investment, so that the policy may look effective. There may have been special factors behind this - the fear of "Fortress Europe" for instance. What the analysis of this paper shows is that the question of the grant and the tax rate cannot be taken for granted. Given that the relative attractiveness of investment in Ireland has been reducing - both because of the lower level of grant, and because of changes in incentives elsewhere there could easily be a shift away from location in Ireland. This could be compounded by differences in costs: wages and salaries rates are high in Ireland relative to many potential overseas locations.

The analysis of this paper could be extended by information on the actual costs, grants and tax rates faced by firms in different locations. If this information were available, both for firms who located here, and for those who went elsewhere it might be possible to see the extent to which the competitive advantage of the 10 per cent tax has been eroded.
Appendix: The trade off between taxes and grants

The post-tax rate of return on net capital is defined as

\[
\frac{[R - (C + G_f - Q_0) \alpha_t]}{C - C \cdot G_f}
\]

In this Appendix it is proposed to examine, in the framework of the numeric example introduced in the paper, the extent to which there are combinations of the grant rate \((G_f)\) and the tax rate \((t)\) where the above expression is constant i.e. there are combinations of the grant rate and the tax rate where the return is constant. Initially we will assume that costs are competitive i.e. that \(Q_0 = 1\).

With values of \(R = 1000\), \(C = 400\), \(O = 500\) the above expression, which we will call \(K\) becomes

\[
K = \frac{[1000 - (400 - 400G_f) - 500]}{400 - 400G_f}
\]

\[
= \frac{1+4G_f}{1+4G_f} \alpha_t
\]

Thus for any value of \(K\) the value of \(t\) can be expressed as a function of \(K\) as follows:

\[
4(1-G_f)K = (1+4G_f)/(1-t)
\]

\[
= (1+4G_f) - t(1+4G_f)
\]

\[
t(1+4G_f) = (1+4G_f) - 4(1-G_f)K
\]

Hence \( t = (1+4G_f) - 4(1-G_f)K \)

From this we can estimate the values of \(t\) consistent with values of the grant rate to maintain a net post tax return of 0.25 (25 per cent) on net capital i.e.

\[
t = \frac{5G_f}{1+4G_f}
\]

\[
\begin{array}{cc}
G_f & t \\
0.01 & 0.048 \\
0.05 & 0.208 \\
0.10 & 0.357 \\
0.15 & 0.469 \\
0.20 & 0.555 \\
0.25 & 0.625 \\
0.30 & 0.682 \\
0.35 & 0.729 \\
\end{array}
\]

It is relatively easy to incorporate the effect of a higher cost environment. If \(Q_0 = 1.1\) then clearly the gross margin is reduced significantly and it will require relatively high grants or negative taxes to maintain a given rate of return such as 25 per cent. Taking \(Q_0 = 1.1\)

\[
K = \frac{1000 - (400 - 400G_f) - 500(1.1)}{400 - 400G_f}
\]

and with \(K = 0.25\)

\[
t = \frac{10G_f}{1+8G_f}
\]

\[
\begin{array}{cc}
G_f & t \\
0.01 & -0.833 \\
0.05 & -0.357 \\
0.1 & 0 \\
0.15 & -0.227 \\
0.2 & -0.185 \\
0.25 & 0.50 \\
0.3 & 0.588 \\
0.35 & 0.658 \\
\end{array}
\]
The above exercise can be reversed and the grant shown as a function of the tax rate

\[ G_t = 4k-1 - 1 \]
\[ 4(1+k-1) \]

and can be used to find the associate of grant rate for any given tax rate for a desired net post
tax return on net capital.

Centre for Economic Research Papers

Working Papers represent preliminary reports on research in progress and should not be cited
without permission from the authors. Policy Papers represent preliminary reports on
policy-oriented research carried out by members or associates of the Department of
Economics, University College Dublin. The following is a comprehensive list of the last year's
working and policy papers issued by the Centre. A complete list of other publications of the
Centre is available on request.

Working Papers 1994

WP94/1: Dermot Leahy: "Export Enhancing Tariff Protection with Strategic
WP94/2: Rodney Thom: "A (Weak) Exogeneity Test of the German Leadership
Hypothesis." March 1994
Market Performance in the EU Periphery: Lessons and Implications" March
1994.
WP94/4: David Madden: "How does Unemployment Affect Marginal Direct and Indirect
Tax Reform?" April 1994
WP94/5: Dermot Leahy and J. Peter Neary: "Learning by Doing, Precommitment and
Infant-Industry Protection." April 1994
WP94/6: Brendan Walsh. "Wage Convergence and Integrated Labour Markets: Ireland
and Britain, 1841-1991." May 1994
WP94/7: Cormac Ó Gráda "Anthropometric History. What's in it for Ireland?" June
1994.
WP94/8: Joel Mokyr and Cormac Ó Gráda: "Height and Health in the United Kingdom
WP94/9: J. Peter Neary: "Factor Mobility and International Trade" June 1994
WP94/10: Cormac Ó Gráda and Brendan Walsh: "Recent Trends in Fertility and Population
in Ireland, North and South." July 1994.
WP94/11: James Bergin and B L Lipman, Queen's University Ontario: "Evolution with
WP94/12: David Madden: "Omitted Variables, Dynamic Specification and Tests for
WP94/13: Frank Barry: "Peripherality in Economic Geography and Modern Growth
WP94/14: Frank Barry: "Exchange Rate Policy when the Labour Market Exhibits
Hysteresis" September 1994
WP94/15: Kevin O'Rourke: "Industrial Policy, Employment Policy and the Non-Traded
Sector" October 1994.
WP94/16: Anthony Murphy: "Artificial Regression Based Mis-Specification Tests for
WP94/17: Anthony Murphy: "A Simple Artificial Regression Based LM Test of
WP94/18: Anthony Murphy: "A Simple Artificial Regression Based Test of the Fit


WP94/26: Kevin O'Rourke: "Emigration and Living Standards in Ireland since the Famine" December 1994.


Policy Papers 1994

PP94/1: Joseph Durkan: "The EU Structural Fund Programme and Ireland Compensation for SMP: Experience and Some Lessons." August 1994

WORKING PAPERS 1995


WP95/6: Kevin O'Rourke and Jeffrey G Williamson: "Open Economy Forces and Late 19th Century Scandinavian Catch-Up" April 1995.


WP95/12: Cormac Ó Gráda: "Was The Great Famine Just Like Modern Famine?" September 1995.


WP95/16: Kevin O'Rourke: "Economic Integration and Convergence: An Historical Perspective" November 1995.


WORKING PAPERS 1996

WP96/1: Kevin O'Rourke and Cormac Ó Gráda "Migration as Disaster Relief: Lessons from The Great Irish Famine" January 1996.


WP96/5: Morgan Kelly: "Do Noise Traders Influence Stock Prices?" March 1996.


WP96/7: Steven Durlauf and Morgan Kelly: "Thresholds in Development and Growth" March 1996.


WP96/15: David Madden: "Sources of Income Inequality in Ireland", June 1996.