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O L L S C O I L L U I M N I G H

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***“The impact of Foreign Direct Investment on the
Profitability of the Software Sector in Ireland”***

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THE IMPACT OF FOREIGN DIRECT INVESTMENT ON THE PROFITABILITY OF THE SOFTWARE SECTOR IN IRELAND

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ABSTRACT

This paper examines the extent to which foreign direct investment in the software sector in Ireland has an impact on the reported profits in domestic firms. A model of corporate profitability is developed to assess the implications for the domestic sector of inward investment flows. The paper concludes that there is a significant positive relationship between the two and contributes to the present debate relating to the potential dynamic gains of inward investment and the role of MNC's as engines of growth.

I. INTRODUCTION:

Ireland has several policy and economic based “competitive advantages” which have enabled it to attract key international players to the country. These include supportive State strategy resulting in lower tax rates, tax free patent royalties and employment grants for inward investment, a skilled English speaking workforce with what is perceived to be a strong work ethic, and a stable economic environment (Hannigan, 1998;Gorg and Ruane, 2000b; Gorg and Strobyl (1999,2000)

These have enabled Ireland to establish a strong multinational-based software localisation sector and additionally software development spin-offs such as training, consultancy and maintenance (Enterprise Ireland, 2000). Foreign direct investment in Ireland is believed to have been highly beneficial to the economy, particularly in terms of upgrading skills and management techniques, as well as “best practice” thinking on business and engineering practices and strategies (Harrison et al, 2000). Additionally, international company presence has helped to fuel demand and consequentially the availability of IT/computing and software courses¹.

The software industry in Ireland has grown significantly over the past ten years. At the end of 1998, it was estimated that some 20K were employed in the sector and that total exports were valued at approximately £4.2bn. However, of this total, only some 10% was generated by the indigenous sector in 1998, which amounted to just over £530 million. At the end of 1999, there were some 570 indigenous software companies and some 108 foreign owned companies in Ireland, representing a total of almost 680 companies. These figures show a growth rate of 70% and 25% respectively (National Software Directorate 1999).

The small number of overseas companies in the industry, earned 83% of the total revenue generated in the Irish software industry. The vast majority of these earnings, however, are repatriated. In contrast, the indigenous software companies, representing some 84% of the number of companies in the industry earned a mere 14% of the revenue generated.

¹ See, for example, Barry et al (1999) and Gorg and Ruane (2000a) for recent discussions on the importance of FDI from the US and other countries for the Irish economy

The growth in revenue earned by indigenous companies grew by 37% from 1997 to 1998 while growth in overseas revenue grew by 14% (National Software Directorate, 1999).

This paper examines the degree to which foreign direct investment in the software sector has an impact on the reported profitability of domestic firms operating in that sector in Ireland. As such, the paper contributes to the present crucial debate regarding the potential dynamic gains and the role of MNCs as “engines of growth”. A key constituent of dynamic gains is the role that foreign capital plays in improving the technological base of chosen locations (Young et al, 1994). Ideally, a strong economy permeated by vibrant research and technological base could attract high-quality inward investment (i.e. that combining production, development and research functions). This functional agglomeration might encourage further development in local firms, such that the technological capacity of the locality is extended, with benefits accruing in terms of international competitiveness (Cantwell, 1991)

II. A MODEL OF PROFITABILITY

The essential hypothesis is that multinational presence in the Irish software sector impacts on the profitability of indigenous firms operating in that sector. Thus, it is not the differences in levels of profitability across firms in the software sector that is

important but the extent to which one can explain the differences in the changes in profits of domestic firms following inward investment by multinationals

$$\Delta\Pi_i = f_i(\mathbf{FDI}_i, \mathbf{Z}_i) \quad (1)$$

In equation 1, $\Delta\Pi_i$ is the change in domestic firm profitability and \mathbf{Z} is a vector of other firm and industry specific factors expected to impact on firm profitability. The change in sectoral foreign involvement (\mathbf{FDI}_i) is measured by the change in foreign owned employment in the software industry

THE COMPONENTS OF \mathbf{Z}

It is therefore necessary to generate a model of corporate profitability, with reference to a number a combination of product and labor market variables. This involves use of data at both the firm and the industry level.

A number of factors may affect the reported profitability in the domestic software sector following investment by multinationals. There is some evidence to suggest that the existence of foreign MNC's in a given sector are expected to have a beneficial effect on domestic firms through increased competition (Dunning, 1993). If the impact on domestic profitability of inward investment occurs merely through a reduction in domestic sales, then this will be picked up by the turnover variable rather than by the

inward investment variable. If this is the case, the effect of entry by foreign firms may then be caught by the turnover variable in the model. Changes in turnover are expected to be positively related to changes in reported profitability of domestic firms. However, the indigenous software sector is composed mainly of a large number of small firms operating in specialised niches and therefore not operating in direct competition with larger MNC.

There is some evidence to suggest that the presence of foreign multinationals in a given industry has been positively associated with the labour productivity of that industry (Blomstrom, 1989, Dunning, 1993). Labour productivity in the model is measured by turnover per employee. Changes in this variable are again expected to be positively related to domestic firm profitability.

The effect of investment on domestic profitability is expected to be linked with increasing profitability of domestic firms. However, this paper recognises that increasing investment levels may have a detrimental effect on domestic profits in the short run. This variable is measured by examining the change in fixed assets. Foreign firms have higher capital intensities of production when compared with indigenous firms (Ruane & Gorg, 1996). However, the software industry is not particularly capital intensive business. Indigenous software companies do not make major capital investments since they generally require only office premises and standard computing equipment (O Gorman,

1997). Thus, it is expected that this variable will be less important in explaining firm profitability in the indigenous software sector in Ireland.

The market share of the firm is one indicative measure of relative size and monopoly power. Firms that have relatively high price-cost margins potentially experience the greatest profit erosion from new entry (Geroski, 1995). Geroski (1995), shows that high price cost margins in domestic sectors will induce foreign and domestic entry. Entry by efficient firms should reduce the market share of domestic firms and thus reduce profitability (Driffield (1998)) Thus market share for the selected sectors at the start of the period could be related to reductions in reported domestic profitability.

Research and development expenditures of domestic firms are of significant importance to the development of the software sector and is postulated to be positively related to domestic firm profitability.

A good quality labour force is very important condition for the success of the indigenous software industry. One indication that the industry requires a highly skilled workforce is the fact that it undertakes an exceptionally high level of staff training and development. (National Software Directorate, 1999). This variable is expected to be positively related to reported profits of domestic firms.

The availability of a good telecommunications network is essential and vital for growth and development of this sector (OECD, 1992). This is measured in the model by examining telecommunication expense as a percentage of operating expenses. and is expected to be negatively related to profitability.

The proportion of inputs supplied to MNC's by indigenous firms operating in the software sector is also included in the model. The purpose of this variable is to measure the domestic content of foreign firm production. A high domestic content would enhance "supplier creation" and multiply "backward linkages" to ultimately create a competitive indigenous industrial base (Walid, 1999).

Finally, the growth rate of markets is also included in the model. This can be measured through examining the share of output that is exported by domestic firms. This is postulated to be positively related to domestic firm profitability. An export bias by indigenous firms means that they may be in a sense 'protected' from direct competition with local FDI firms on the home market. The possibility of "crowding out" of domestic firms by foreign firms in factor markets, an export bias would effectively remove any possibility of crowding out in local product markets (Ruane & Gorg, 1996). ECLAC (1985) found the odds of exporting for a foreign firm to be double or triple that of a local firm once the effects of size, capital intensity, wage levels, product differentiation and other variables were accounted for. These results are to be expected because the costs of exporting are much lower for foreign firms, which have access to market information and sales organizations abroad [Wilmore, 1986]

III. THE DATA

The first step in the analysis was to find a sample of domestically owned firms operating in the software sector. Enterprise Ireland² and the National Software Directorate³ provided this data. The next step involved collecting detailed data at the firm level. This was achieved using an interview-based questionnaire. In undertaking this study, only those indigenous companies with employment figures in excess of thirty were targeted (140 in all). Forty-three questionnaires were returned fully complete. This data was supplemented by detailed company account information obtained from the FAME⁴ database.

The foreign penetration variable in the model is measured by the proportional change in foreign owned employment in the software sector. This data was obtained from IDA Ireland⁵..

² Enterprise Ireland is responsible for providing a broad range of supports to Irish Indigenous Industry

³ Responsible for promoting and developing the software industry in Ireland

⁴ The Fame database contains detailed annual accounts and financial ratios on 500,000 public and private British and Irish companies plus summaries for an additional 1.3 million companies

⁵ IDA Ireland has national responsibility for securing new investment from overseas in manufacturing and international services sectors and for encouraging existing foreign enterprises in Ireland to expand their businesses.

IV. THE MODEL

The paper proceeds with the analysis of the impact of foreign direct investment on the profitability of domestic firms in the software sector through the use of a weighted least squares regression which is estimated for a sample of 43 firms.

The dependent and independent variables are converted into logs and the model below (2) is estimated using weighted least squares with variables weighted by firm size by employment in 1999. This method is used to alleviate the problem of heteroscedasticity caused by differences in the size of the sampled firms. The expectation is that the impact on profits will lag behind inward investment. As such the change in profitability is measured between 1995 and 1999 while inward investment is measured as the change in foreign employment between 1994 and 1997.

$$\Delta PD_i = a + b_1 \Delta FORE_i + b_2 \Delta TURN_i + b_3 \Delta PI_i + b_4 \Delta K_i + b_5 MS_i + b_6 \Delta HK_i + b_7 \Delta TEL_i + b_8 \Delta KI_i + b_9 \Delta GM_i + b_{10} \Delta R\&D + U \quad (2)$$

where

ΔPD_i is the change in the log of profits between 1995 and 1999

$\Delta FORE_i$ is the change in the log of foreign employment at the industry level between 1994 and 1997

$\Delta TURN_i$ is the change in the log of turnover between 1995 and 1999

ΔPI_i is the change in the log of productivity between 1995 and 1999. This is measured by turnover per employee

ΔK_i is the change in the log of fixed assets between 1995 and 1999

MS_i is the market share of the firm in 1995

ΔHK_i is the change in the log of investment in human capital between 1995 and 1999.

ΔTEL_i is the change in the log of telecommunications expense (as part of operating expenses) between 1995 and 1999

ΔKI_i this is the change in the log of the proportion of capital inputs supplied to MNC's by indigenous firms between 1995 and 1999

ΔGM_i is the change in the log of the share of output exported by domestic firms between 1995 and 1999

$\Delta R\&D_i$ is the change in the log of research and development expenditures by domestic firms between 1995 and 1999

The procedure generates homoscedastic disturbances, based on a Whites test. The results of the estimation are presented in Table 1.

Table 1. Estimation Results

Variables	Estimated Coefficients	t-statistics
Dependent		
ΔPD_i		
Independent		
Constant	8.17	1.77*
$\Delta FORE_i$	0.71	5.12**
$\Delta TURN_i$	0.67	1.71*
ΔPI_i	0.72	3.41**
ΔK_i	0.35	1.68*
MS	-1.51	-3.95**
ΔHK_i	0.64	2.43**
ΔTEL_i	-.59	-2.11**
ΔKI_i	0.46	1.39*
ΔGM_i	0.29	1.49*
$\Delta R\&D$	0.74	2.97**

Notes: *, ** significance at 1% and 10% levels

Diagnostics:

N=43 R^2 (adj) 0.50 (0.45) $F(10,32) = 5.16^{**}$

Whites hetroskedasticity test : $\left\{ \chi^2(k(k+1)/2) - 1 \right\} = 4.32$

RESULTS

The results in Table 1 demonstrate that foreign investment in the software sector has a significantly positive effect on domestic profitability in the domestic software industry in Ireland. A 10% increase in foreign employment in the software sector is connected with a 7 per cent rise in the reported profits of domestic software firms. The table also demonstrates that the remaining variables affect reported profitability in the expected manner. Significant determinants in changes in reported profitability are labour productivity, investment in human capital, research and development and telecommunications expense. This is not surprising given the nature of the software sector. The market power variable would indicate that firms operating in the more oligopolistic sectors suffered the largest reductions in reported profits over the period 1995-99.

V. CONCLUSIONS

The paper presents evidence that increases in sectoral concentrations of foreign employment in MNC software firms is positively related to reported profits in domestic firms. The study provides evidence of improvements in the profitability of the Irish software sector over time with the presence of foreign owned firms and thus reveals important links between FDI and local sectoral productivity.

However, the interpretation of the main empirical result of this paper is not straightforward. Limitations on the time series available have constrained the analysis to one period, which has been subject to extraordinary growth. Irish growth in GDP has averaged more than 8% a year from 1995 through 1998, compared with about 2% in France, Germany and the UK. It is also expected that refinement in measurement of foreign involvement in the software sector is required, based on smaller samples of competing domestic and foreign firms playing an important role in supporting modelling exercises.

Nevertheless, the spillover impacts of concentrations of foreign software companies may be deemed to be positive for the Irish software sector and thus inward investment is one solution to domestic market failure. Historically, some of Ireland's success has been due to its competitive labour costs, skilled labour force, strong work ethic and the fact that it successfully won a disproportionate amount of US localisation/IT investment in Europe at a time when information technology was evolving.

Going forward, it is believed that the emergence of Asian economies with lower labour costs and strong technical skills (India in particular) will prove to be a threat to Ireland as a provider of what may be considered to be “lower value added” activities in the software value chain (such as localisation and lower level software development)

The future of the Irish software industry is therefore more strongly linked to fully exploiting both indigenous companies capacity for higher value activities and multinational relationships for R&D activities.

REFERENCES

Barry, Frank ;Bradley, John and O'Malley, Eoin (1999): "Indigenous and Foreign Industry: Characteristics and Performance" in F. Barry (ed) *Understanding Ireland's Economic Growth*, London :Macmillan, pp45-74.

Blomstrom, M. (1989) "Foreign Investment and Spillovers: A study of Technology transfer in Mexico", Routledge, London

Cantwell, J. (1991) "The International Agglomeration of R and D", in M, Casson (ed) *Global Research Strategy and International Competitiveness*, Blackwell, Oxford.

Dunning, J (1993) "Multinational Enterprises and the Global Economy", Addison Wesley, Wokingham.

Driffield, N (1998) "The Indirect Employment Effects of FDI in the UK, in S.Hill and B. Morgan (eds) *Inward Investment, Business Finance and Regional Development*, Macmillan, London

Enterprise Ireland (2000): "Strategy for Irelands High Tech Future" Government Publications: Stationary Office: Dublin.

Geroski, P (1995) "What do we know about entry?" *International Journal of Industrial Organisation*, 13, 421-420

Gorg, Holger and Ruane, Frances (2000a): "European Integration and Peripherally: Lessons from the Irish Experience", *The World Economy*, Vol23, pp.405-421.

Gorg, Holger and Ruane, Frances (2000b): " An analysis of Backward Linkages I in the Irish Electronics Sector", *Economic and Social Review*, Vol 31, pp215-235.

Gorg, Holger and Strobyl. Eric (2000): " Multinational Companies, Technology Spillovers and Firm Survival: Evidence from Irish Manufacturing". GLM Research paper 00/12, University of Nottingham.

Hannigan, Kevin (1998) "The Business Climate for Multinational Corporations in Ireland", *Irish Banking Review*, Autumn 1998, pp2-13

Harrison, A.;Dalkiran and E. Elsey (2000) “International Business: Global Competition from a European Perspective”, Oxford University Press.

O’ Gorman, C, (1997) “The Irish Indigenous Software Industry: An Application of Proters Cluster,” NESC, Dublin.

National Software Directorate. Survey, 1999: <http://www.nsd.ie/survey99/>

OECD, (1992) “Global Industries and Natioanl Policies” OECD Observer, Dec-Jan N179, pp1-14. (OECD, Paris)

Wallid, H (1999), “Trade, Foreign Direct Investment, and R&D Spillovers”, *Journal of International Business Studies*, Vol 30, Issue 3.

Wilmore, L (1986) “The Comparative Performance of Foreign and Domestic Firms in Brazil”. *World Development*, 14(4), 489-502.

Young, S., Hood, N and Peters, E. (1994) “Multinational Enterprises and Regional Economic Development”, *Regional Studies*, 28(7), 657-77.