

4 Impact of corporate tax on FDI

4.1 Background and objectives

Within Europe there is considerable competition to attract investors with many countries offering lower than average corporate tax rates. The Republic of Ireland (ROI) has one of the lowest corporate tax rates in the EU, which at 12.5% is less than half the level of corporation tax in the UK (27% as of 1st April 2011).

This section considers what impact reducing the corporation tax in NI to the same level as ROI would have on FDI into NI.

4.2 Methodology

4.2.1 Existing evidence

There has been extensive research examining the impact of corporate tax on FDI. The OECD reports that most studies have found that a 1pp¹ decrease in corporate tax leads to a 0-5% increase in FDI.² There is, however, a wide variation in the findings of studies on corporate tax, which is in part due to studies being based on aggregate FDI flows data, whereas the impact of tax on FDI is at the firm-level.³

Studies using firm level datasets have primarily examined the impact of tax on US FDI overseas due to the availability of data on the operations of US subsidiaries overseas. One of the most important studies of US FDI into Europe by Devereux and Griffith (1998)⁴ found that a 1pp reduction in UK effective average corporate tax rate would increase US FDI into the UK by 1%. A more recent study by the Deutsche Bundesbank (2005)⁵ of German firm-level investment overseas finds a 1:2 ratio between tax rates and the impact on FDI, with FDI into the EU countries more sensitive to changes in the tax rate. The Deutsche Bundesbank study also found market size (using GDP as a proxy) and labour costs were the other factors having a significant impact on the location of FDI.

The most recent study of the impact of corporate tax on FDI into the EU (Hansson and Olofsdotter, 2010)⁶ found that FDI in Western Europe is most strongly influenced by GDP and agglomeration (using the proxy track record of FDI) and that corporate tax has a more important impact on the amount of FDI rather than the decision to invest.

¹ Percentage Point

² OECD (February 2008) *Tax Effects on Foreign Direct Investment*. Policy Brief, OECD Observer.

³ See Deutsche Bundesbank (2005) *Tax incentives and the location of FDI: evidence from a panel of German multinationals*. Discussion Paper Series 1: Economic Studies No17/2005.

⁴ Devereux, M.P. and Griffith, R. (1998) *Taxes and the location of production: Evidence from a panel of US multinationals*. *Journal of Public Economics* 68, 335-367. Also see Devereux, M.P. and Griffith, R. (2002) *The impact of corporate tax on the location of capital: A review*. *Swedish Economic Policy Review* 9, 79-102.

⁵ Deutsche Bundesbank (2005) *Tax incentives and the location of FDI: evidence from a panel of German multinationals*. Discussion Paper Series 1: Economic Studies No17/2005.

⁶ Hansson, A. and Olofsdotter, K. (March 2010) *Tax differences and foreign direct investment in the EU27*. Department of Economics, Lund University, Sweden

4.2.2 Locations and dataset

The impact of corporate tax on FDI was analysed for greenfield (non-retail) FDI jobs attracted to NI, Belfast and competitor cities and regions over the period 2008-10. Twenty-eight locations were analysed, which include both large and small cities as well as key competitor regions within the UK:

1. Brussels, Belgium
2. Sofia, Bulgaria
3. Toronto, Canada
4. Prague, Czech Republic
5. Tallinn, Estonia
6. Paris, France
7. Budapest, Hungary
8. Dublin, Ireland
9. Cork, Ireland
10. Galway, Ireland
11. Vilnius, Lithuania
12. Amsterdam, Netherlands
13. Krakow, Poland
14. Warsaw, Poland
15. Bucharest, Romania
16. Singapore, Singapore
17. Bratislava, Slovakia
18. Johannesburg, South Africa
19. Barcelona, Spain
20. Stockholm, Sweden
21. Geneva, Switzerland
- 22. NI, UK**
23. Scotland, UK
24. North East, UK
25. London, UK
26. Cambridge, UK
27. Reading, UK
- 28. Belfast, UK**

The fDi Markets dataset on greenfield FDI was used for the baseline data on FDI in each of the 28 locations.⁷ A total of 9,472 non-retail FDI projects were recorded by fDi Markets in the 28 locations included in the study from 2003-2010. In 2010, 1,354 FDI projects were recorded in the 28 locations.

4.2.3 Location determinants

Previous firm-level studies of the impact of corporate tax on FDI found that the number of significant location determinants were very few. For example, one of the most recent and comprehensive studies on the role of corporate tax on firm-level FDI in Europe found GDP, labour cost, and corporate tax as influencing FDI (Bundesbank, 2005).⁸

However, in order to provide as comprehensive an analysis as possible data on the following indicators for each of the 28 locations was included in the initial analysis to ensure that all major location determinants were included in the assessment:

⁷ Over 100 governments around the world subscribe to fDi Markets to monitor FDI trends. fDi Markets has been the exclusive source of greenfield FDI data for the UNCTAD World Investment Report since 2003 and is also the major source of Greenfield FDI data for the World Bank and Economist Intelligence Unit.

⁸ Deutsche Bundesbank (2005) *Tax incentives and the location of FDI: evidence from a panel of German multinationals*. Discussion Paper Series 1: Economic Studies No17/2005.

1. Corporate Tax (Average corporate tax rate)
2. Market Size (GDP)
3. Productivity/Wealth (GDP/capita)
4. Openness to FDI (Foreign ownership restrictions)
5. Experienced Labour Pool (Size of labour force, with breakdown for key industries)
6. Inexperienced Labour Pool (Number of university students)
7. Skills (Tertiary education levels)
8. Tightness in the Labour Market (Unemployment rate)
9. Labour Regulations (Hiring and Firing Flexibility)
10. Agglomeration (stock of foreign investors, with breakdown for key industries)
11. Innovation (Number of patents, with breakdown by key industries)
12. R&D (R&D as % of GDP)
13. Infrastructure (Number of international airport connections)
14. Quality of Life (Quality of living index)
15. Labour Costs (Labour costs, with costs for key job functions)
16. Property Costs (Property costs – office or industrial rents)
17. Incentives (Maximum investment incentives as % of capital investment)

The above indicators, for which comparable data is available, cover most of the key location criteria investors assess when deciding in which location to invest. The above indicators were identified based on previous studies on the role of corporate tax in FDI location and on the fDi Benchmark location benchmarking database of fDi Intelligence, Financial Times Ltd, which provides detailed location weighting models for over 50 sectors and 250 location factors.

4.3 Results

4.3.1 Assessment of location determinants

Over 30 different multiple regression models were tested. The model used in this study contained 25 of the 28 original locations. Johannesburg, Singapore and Toronto were removed due to data availability issues for some of the independent variables. A logged model was used to pull outlying data closer to the bulk of the data.

The model uses FDI jobs, over the period 2008-10, as the dependent variable. Models using FDI projects (2008-10) were also considered. However the independent variables were not as accurate in explaining FDI project numbers as they were in explaining FDI jobs. This was expected as the number of jobs shows variances in FDI performance of locations much more clearly than the number of projects because key location determinants, such as the corporate tax rate, are likely to have a bigger impact on strategic (larger) projects than the overall number of projects. Furthermore, the dataset on the number of FDI jobs is more reliable than dataset on the number of FDI projects due to major job-creating projects being more easily identifiable than (small) projects.

Most variables were *not* statistically significant. The variables that consistently achieved a high level of statistical significance (indicated by low p values in different model combinations) were:

- Corporate tax (average corporate rate)
- Market size (GDP)
- Labour costs (average labour costs)

- Agglomeration (stock of foreign companies investing)

These are also the same factors found to be significant determinants of FDI in previous studies, indicating that the location of FDI is largely determined by taxes, market size, costs, and agglomeration.

Other factors, in particular incentives, labour force and skills, were found to have an impact on FDI but to be less statistically significant.

Incentives were found to be significant in some models but at a lower level of significance (typically at the 10% level) than the chosen variables (significant at the 1% level). Given the list of locations used in the study it is difficult to properly gauge the effect of incentives as very large, wealthy regions like London and Paris attract high levels of FDI in the absence of incentives. When analysing two similar locations competing for a project, incentives are likely to be more decisive in determining which location wins the investment.

The size of the experienced and inexperienced labour force was found to be a significant determinant of the number of FDI projects attracted, but not for the number of FDI jobs created. When further tested it was found that multicollinearity existed, with other location determinants capturing the influence of labour related factors. For example, the number of students and the size of the available labour force are strongly correlated to market size as typically the larger the market size the larger is the population and the labour force. In terms of skills (measured by tertiary education levels and also captured in the university student data), these were not found to be significant due to multicollinearity and because most of the locations included in the study would be considered high skill locations. Furthermore, skills are often project specific (e.g. availability of specific skills in a computer language) so would not be accounted for in a general model of FDI.

4.32 Regression results

Figure 3 below shows the most accurate multivariate regression model for predicting the number of FDI jobs created in the 25 cities (dependent variable) based on corporate tax, market size, labour cost, and agglomeration (independent variables). The regression equation is:

$$\text{Log FDI jobs} = 7.39 - 1.2(\text{Log CT}) + 0.65(\text{Log MS}) - 1.45(\text{Log LC}) + 0.65(\text{Log AG})^9$$

The coefficients in the model show that corporate tax and labour costs have a negative impact on FDI while market size and agglomeration have a positive impact. Analysing the effect of a 1% change in each variable,¹⁰ the model shows that:

⁹ FDI jobs recorded between 2008 and 2010; CT is corporate tax rate; MS is Market Size (GDP); LC is Labour Cost; AG is agglomeration. LOG is the logarithmic transformation.

¹⁰In this case, a 1% increase/decrease is a 1% *change* from the given value of the variable. For example, if the corporate tax rate was initially 26% and was to decline by 1%, it is 1% of 26%, which is 25.74%.

- A 1% decrease in corporation tax leads to a 1.20% increase in Jobs
- A 1% increase in market size leads to a 0.65% increase in Jobs
- A 1% increase in labour costs leads to a 1.45% decrease in jobs
- A 1 % increase in agglomeration leads to a 0.65% increase in Jobs

Figure 3: Multivariate regression results for location determinants of FDI jobs in 25 cities

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.890412574
R Square	0.792834551
Adjusted R Square	0.751401462
Standard Error	0.242642569
Observations	25

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	4	4.506394727	1.126598682	19.13529877	1.3E-06
Residual	20	1.177508327	0.058875416		
Total	24	5.683903053			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	7.388543865	1.15324866	6.406722263	2.99733E-06	4.982909322
Log Corporate tax rate	-1.20125725	0.367448035	-3.269189485	0.003838214	-1.967740422
Log Market size	0.653324907	0.192797498	3.388658642	0.002916631	0.251156375
Log Labour cost	-1.45080733	0.300917321	-4.821282203	0.000103772	-2.078509857
Log Agglomeration	0.652273577	0.196958296	3.31173447	0.003481323	0.241425773

Source: fDi Intelligence, Financial Times Ltd

The regression model uses as its measure direct jobs created by both new FDI projects and the expansion of existing FDI projects. This follows the approach of most previous studies, which do not separate new and expansion FDI.

Testing showed that regressing new projects and expansion projects separately was much less accurate than when they are combined. This is likely because the sample size for each location is smaller and less reliable when separating new and expansion jobs and it also reflects the close linkage between new and expansion jobs, as the importance of agglomeration shows.

The underlying data used in the multivariate regression is shown in Table 35 below. The source and year of the data for each dependent and independent used is shown below Table 35.

Table 35: Underlying data* in FDI location model

City	FDI jobs 2008-10	Corporate tax rate	Market size	Labour cost	Agglomeration
Brussels	4,895	33	51,085	56,207	264
Sofia	4,604	10	732	8,983	240
Prague	12,318	19	29,586	21,238	258
Tallinn	2,201	21	7,639	16,018	128
Paris	10,731	33	151,033	42,255	803
Budapest	28,251	16	31,924	19,796	414
Dublin	9,528	13	57,273	40,614	427
Cork	3,330	13	24,333	37,149	106
Galway	2,317	13	9,938	36,335	43
Vilnius	5,601	15	10,063	12,937	119
Amsterdam	5,636	26	53,943	42,108	286
Krakow	8,241	19	8,895	11,665	83
Warsaw	28,070	19	38,260	14,210	291
Bucharest	103,722	16	25,324	11,242	341
Bratislava	9,051	19	13,449	17,335	124
Barcelona	11,413	30	119,798	33,192	346
Stockholm	3,161	26	77,200	43,362	289
Geneva	3,824	9	21,167	66,321	120
Northern Ireland	8,904	28	33,023	24,023	232
Scotland	18,773	28	118,606	25,831	420
North East	7,559	28	46,956	24,383	218
London	33,747	28	230,866	36,565	1,701
Cambridge	937	28	16,087	28,938	69
Reading	661	28	31,432	28,799	73
Belfast	3,636	28	9,917	24,943	125

Source: FDI jobs (FDI new and expansion jobs 2008-10 from fDi Markets, fDi Intelligence, Financial Times Ltd); Corporate tax (average corporate tax rate 2010 from Deloitte International Tax); Market size (GDP in 2008 from Eurostat and fDi Benchmark, fDi Intelligence, Financial Times Ltd); and Labour costs (average labour costs – wages plus social security - in 2010 from fDi Benchmark, fDi Intelligence, Financial Times Ltd); Agglomeration (stock of foreign companies investing in the location 1997-2007, fDi Intelligence, Financial Times Ltd). Note 2002 was omitted due to lack of data.

* This data was subsequently logged before being used in the model.

4.33 Technical assessment of the accuracy of the results

The overall regression has a very high adjusted R squared of 75.14%, indicating that the model is accurate in predicting FDI jobs created in the 25 cities. An adjusted R squared of 75.14% means that 75.14% of the variation in FDI jobs in the 25 cities, over the 2008-10 period, is accounted for by the four explanatory variables (corporate tax, market size, labour costs, and agglomeration).

The P-values in the regression are statistically significant at the 1% level for corporate tax, market size, labour costs and agglomeration. The P-value is a measure of how likely it is that we can reject the null hypothesis. In this case, the null hypothesis is that the independent variables have no effect on the dependent variable (FDI jobs). The P-value ranges on a scale of 0 to 1. In order to see the statistical significance of a variable you subtract its p value from 1. An independent variable is typically said to be statistically significant when the P-value is less than 0.1 (10%), 0.05 (5%), or 0.01 (1%). All independent variables in the model are in the range of highest possible significance (1%), allowing us to conclude with 99% certainty that the variables *do* have an effect on FDI job creation.

Multicollinearity, when two variables are near perfect linear combinations of each other, can be found in most multiple regression models. It is likely that each independent variable will have some form of collinearity with the others. What is important is the extent of this. Table 36 below provides the *variance inflation factors* (VIF) for each variable. The VIF measures the degree of multicollinearity existing in the FDI location model. As a general rule, discussed by Kutner (2004)¹¹, a VIF greater than 10 demonstrates a strong form of multicollinearity – which would warrant a rethink of the model. It has also been suggested that a VIF greater than 5 should also merit further investigation. In the multivariate regression shown in Figure 4 the VIF of each variable is less than 5, with the average of all the variables being 2.42 - suggesting that the level of multicollinearity is not high enough to cause concern.

Table 36: Variance inflation factor results for location determinants

Independent variables	VIF
Log Corporate tax rate	1.59
Log Market size	4.13
Log Labour cost	1.94
Log Agglomeration	2.01
Average of variables	2.42

Source: fDi Intelligence, Financial Times Ltd

The multivariate regression provides a statistically robust model for measuring the impact of corporate tax on FDI. The coefficients in the model for the role of corporate tax on FDI are used in the below sections to evaluate the impact of reducing corporate tax in NI on FDI.

4.34 Impact of 12.5% corporate tax on FDI in NI

Based on the results of the econometric model, the predicted number of FDI jobs in Northern Ireland during 2008-10 for varying levels of corporation tax is shown in Table 37. Starting from a base point of 26%, each 1pp decline in the base point will increase job creation by

¹¹Neter, Kutner, Wasserman and Nachtsheim (2004) – *Applied Linear Statistical Models*

4.82-9.69%.¹² The impact of corporate tax increases the closer the tax rate gets to 12.5% as the percentage change in the level of tax becomes higher. At the lower end (4.82%), this finding is in the same range as most academic studies examining the impact of corporate tax on FDI¹³. The higher end (9.69%) is outside of the range typically found in previous academic studies, although the higher end is when the tax rate converges on 12.5%, which is not typical of the sample of locations included in previous studies.

Corporate tax is also likely to have a bigger impact in this study due to the inclusion of similar cities competing for FDI (most academic studies are at the country level) and on greenfield FDI (most academic studies focus on FDI flows).

Table 37: Forecasts for FDI jobs in NI with impact of reduced corporate tax*

Corporate Tax Rate in NI (%)	Predicted New FDI Jobs 2008-10	Predicted Expansion FDI jobs 2008-10	Predicted Total FDI Jobs 2008-10
28	2,669	3,495	6,164
26	2,918	3,821	6,738
23	3,381	4,427	7,808
12.5	7,033	9,209	16,242

Source: fDi Intelligence, Financial Times Ltd

* The New and Expansion split is indicative based on historical trend.

For the period that the data refers (2008-10), the UK rate of Corporation Tax was 28%. However, the current tax rate stands at 26% and this is set to reduce to 23% by 2014. For the timeframe being considered to implement a lower rate of corporate tax in Northern Ireland, it is most relevant to look at the impact of moving from a 23% rate to as 12.5% rate.

Table 38 shows that a reduction Northern Ireland's corporate tax rate from 23% to 12.5% is expected to create an additional 8,434 FDI jobs over a three year period or 2,811 new jobs per annum based on performance during 2008-10. Based on the historical trend, the majority of these jobs would be expansions of existing firms, although it is likely that if the corporate tax rate was reduced to 12.5% there would be more new firms setting up a base initially which would then be expanding further in subsequent years.

Table 38: Net impact of moving from 23% rate to 12.5% rate

Timeframe	Additional New FDI Jobs 2008-10	Additional Expansion FDI jobs 2008-10	Additional Total FDI Jobs 2008-10
Three Year Period	+3,652	+4,782	+8,434
Annual	+1,217	+1,594	+2,811

Source: fDi Intelligence, Financial Times Ltd

¹² This range is the percentage increase in FDI jobs as calculated by the model results of moving from a corporate tax rate of 26% to 25% (lower range) and moving from 13.5% to 12.5% (upper range).

¹³ See OECD (February 2008) *Tax Effects on Foreign Direct Investment*. Policy Brief, OECD Observer.

4.35 Impact of 12.5% corporate tax on sectors

The corporate tax model was run on the following four sector groupings:

- Business, professional, and financial services (including BPO)
- Manufacturing
- Research and development
- Software and IT

The impact of corporate tax was modelled using actual data on FDI jobs for the period 2008-2010 and for the period 2006-2010 to enable a larger sample size in the 28 locations included in the model. The model was run for all the location determinants, including sector-specific data points (see Section 4.2.3), which were further refined based on the statistical analysis. The corporate tax model was also run for each sector using the same four independent variables used in the general model (corporate tax, agglomeration, GDP, and labour costs). In total, over 50 combinations of variables and locations were tested. While it was not possible to accurately model the impact of corporate tax by sector, Table 39 provides an assessment of the likely impact on key sectors.

Table 39: Sector analysis: Expected impact of lower corporate tax

Sector	Impact	Evaluation
Business & financial services	<ul style="list-style-type: none"> • Positive impact • Above average impact for FS and RHQs • Below average impact for front/back office cost centres and market seeking FDI 	<ul style="list-style-type: none"> • CT very important for strategic business functions which are regional/global profit centres • Can be seen in relocation of HQs/FS to Switzerland • And growing success of ROI in FS and HQs • CT likely to have a smaller impact on front and back office operations which are cost centres or for market seeing projects
Manufacturing	<ul style="list-style-type: none"> • Positive impact • Average impact 	<ul style="list-style-type: none"> • Manufacturing FDI driven by access to markets and suitable labour force available at reasonable cost • Large scale capital investment facilitates channelling of regional/global profits to the country • CT is therefore an important consideration especially for high capital investment / high profit projects (e.g. life sciences)
R&D and software	<ul style="list-style-type: none"> • Positive impact • Below average impact 	<ul style="list-style-type: none"> • Driven by availability & quality of HR, research, and clustering • Often cost centres, not profit centres, so less tax driven • CT is of less importance but still has a positive impact

Source: fDi Intelligence, Financial Times Ltd

The fDi Markets database, which tracks the motives determining investment location, finds that corporate tax is more frequently cited by companies as a critical factor determining investment location for manufacturing projects than for R&D or software & IT projects.

Manufacturing operations typically involve large-scale capital investment and are profit centres for international companies, while R&D and software & IT are driven by more by the availability and quality of human resources, research, and clustering and are often cost centres rather than profit centres.

The role of corporate tax for business, professional and financial services is likely to depend on the nature of the operation. Strategic operations with regional or global coverage are more sensitive to corporate tax than retail or back office type operations. The importance of corporate tax for services can be seen in the steady relocation of financial services and headquarters operations from London to Switzerland and the growing role of Republic of Ireland for both functions.

Reducing corporate tax to 12.5% in NI would be expected to have a strong impact on business, professional and financial services and on manufacturing and the share of these sectors in overall job creation in NI should increase.

Reduced corporate tax would also increase job creation in R&D and software & IT, although the percentage increase in job creation is expected to be below that of overall resulting job creation in NI.

4.36 Impact of corporate tax on capital investment

While the study focused on the impact of corporate tax on FDI jobs, the impact on capital investment is likely to be very similar.

Figure 4 below shows the relationship between FDI jobs and greenfield FDI capital investment for 2008-10 in 10 locations in the UK* and ROI.¹⁴ There is a very close positive correlation between job creation and capital investment with an R squared of 93.8%.

Jobs creation is closely related to capital investment as the larger the capital investment the larger the job creation. This correlation explains why the impact of corporate tax on job creation found in this study is similar to previous studies examining the impact of corporate tax on capital investment.

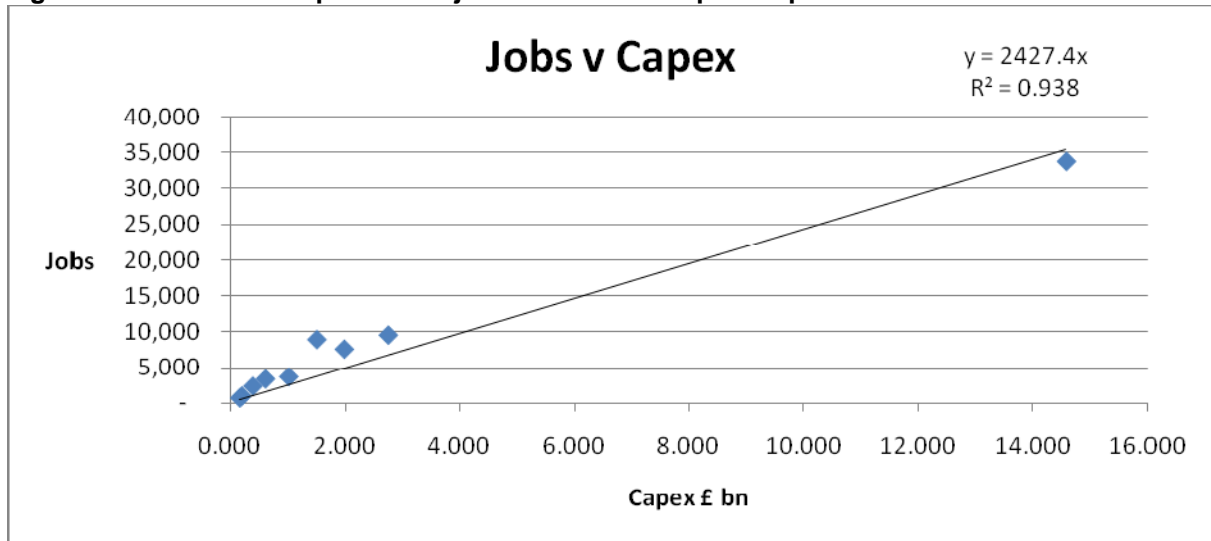
Figure 5 below shows the relationship for the locations in UK and ROI, excluding London.¹⁵ The analysis proves a similar relationship between jobs and capital investment exists. The R squared (86.2%) is slightly lower and the trend line equation also differs. In this case, the result is a higher jobs per capital investment ratio (more jobs would be expected from each monetary investment) compared to the analysis inclusive of London.

¹⁴Belfast, Cambridge, London, Reading, Cork, Dublin, Galway, NI, North East.

* Scotland has been excluded from the graph due to the volume and nature of investment in its Energy sector, which typically witnesses high expenditure and low job creation, resulting in a smaller than expected jobs to capital investment ratio.

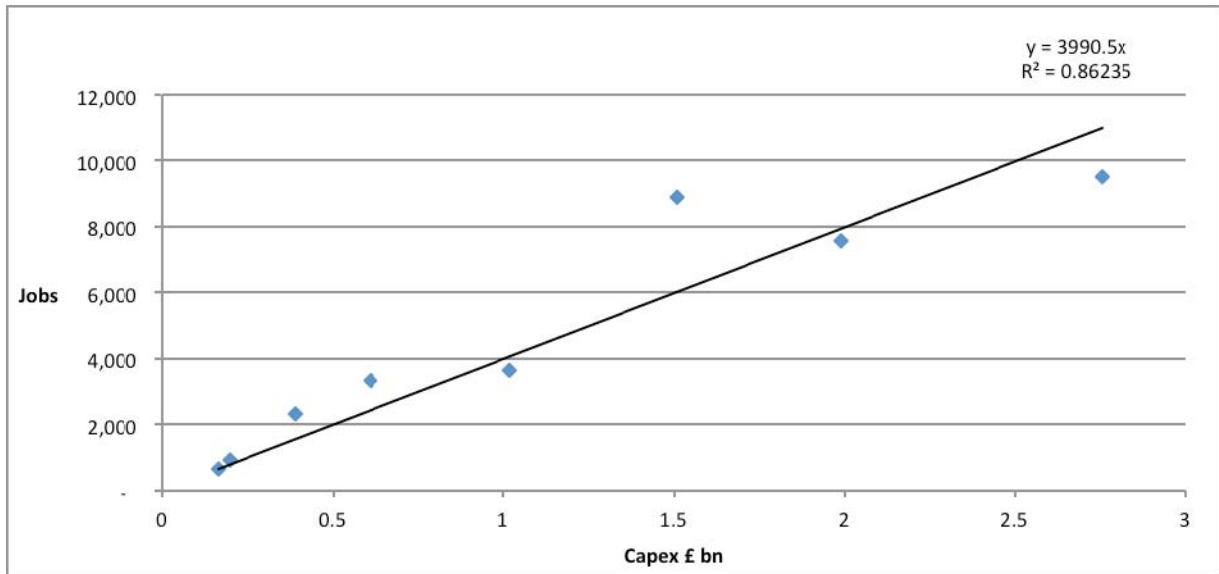
¹⁵Due to London consistently securing a larger than proportionate share of FDI into the UK, the relationship has been tested to ensure the results are similar with London omitted.

Figure 4: The relationship between job creation and capital expenditure from FDI



Source: fDi Intelligence from the Financial Times Ltd

Figure 5: The relationship between job creation and capital expenditure from FDI, *excluding London*

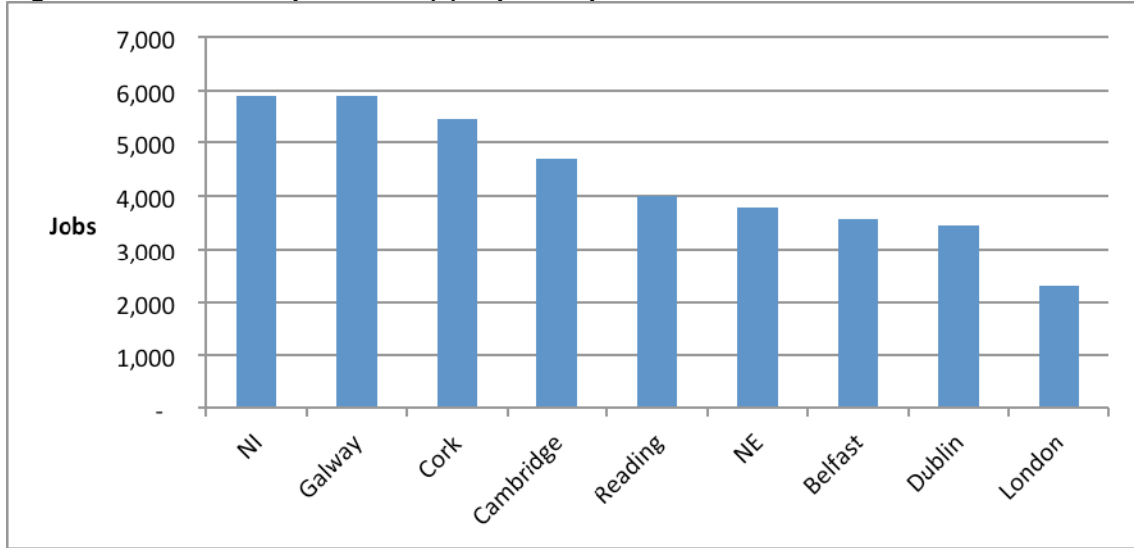


Source: fDi Intelligence from the Financial Times Ltd

Figure 6 below shows the number of FDI jobs created per £ billion capital investment for selected UK and ROI locations for the period 2008-10. Northern Ireland has the highest job creation per £ billion capital investment – and compared to all the regions of the UK. This is likely due to the lower labour costs in Northern Ireland which allow companies to establish larger operations with lower capital investment as well as the type of operations Northern Ireland has been attracting, in particular labour-intensive manufacturing and services.

Job creation per £ billion is lower in Belfast than in Northern Ireland as whole due to most of the operations being in the services sector with a lower level of capital investment per job created than manufacturing or other business activities.

Figure 6: Job creation per billion (£) capital expenditure from FDI in UK and ROI locations



Source: fDi Intelligence from the Financial Times Ltd