Financial constraints and the internationalisation of Irish firms

Mary Everett[1]

Central Bank of Ireland

(read before the Society, 9th October 2014)

Abstract: This paper examines whether financial constraints have hindered the expansion of Irish firms internationally since the financial crisis. Recent years have witnessed an increasing number of multinational corporations relocating their headquarters to Ireland, without creating real economic activity, but holding significant foreign investments. As a result, these redomiciled PLCs have inflated Irish aggregate outward direct investment statistics since 2008. Using firm-level data, which provide for the elimination of redomiciled PLCs from the data sample, financial constraints are found to hinder the expansion of Irish firms into foreign markets. This effect is significantly felt by larger firms. Relatively larger Irish firms with greater internal cash flow, and which are highly indebted, are associated with a greater probability of becoming international through establishing foreign affiliates. Moreover, the empirical evidence suggests there is heterogeneity in the influence of financial constraints on firm internationalisation across economic sectors.

1. INTRODUCTION

This paper investigates the effects of financial constraints on the internationalisation of Irish firms, through outward direct investment, since the financial crisis. In recent years, the redomiciling of Public Limited Companies (PLCs) in Ireland has posed new difficulties in interpreting developments in Irish macroeconomic statistics. Building on the estimates of Fitzgerald (2013), the contribution of these redomiciled PLCs to the international investment of all firms headquartered in Ireland is estimated. Next, using micro-level data, which facilitate the exclusion of redomiciled PLCs from the dataset, the influence of firm specific financial constraints on the international expansion of Irish firms is examined.

Since 2008, the increased number of PLCs relocating their headquarters to Ireland, in the absence of meaningful economic activities, has translated into inflated Irish macroeconomic statistics (Everett 2012, Fitzgerald 2013, Lane, 2014). Difficulties in ascertaining the precise magnitude of this redomiciling effect has made empirical analysis of Irish macroeconomic developments challenging. The first objective of this paper is to highlight the contribution of redomiciled PLCs to aggregate outward direct investment statistics. The estimates of these activities suggest that at end-2013 redomiciled PLCs accounted for 41 per cent of the outstanding stock of outward direct investment by Irish firms.

Next, to address the question of whether financial constraints influence a firm's probability of internationalisation, the empirical analysis exploits a panel dataset of 2,516 Irish firms, between 2004 and 2012. The results provide support for the hypothesis that financial constraints determine the probability of a firm's entry into a foreign market by establishing foreign affiliates. These findings highlight the importance of firm specific financial constraints as determinants of firm internationalisation.

---

[1] The views expressed in this paper are the author's own, and do not necessarily reflect the views of the Central Bank of Ireland, or the European System of Central Banks. E-mail: mary.everett@centralbank.ie.

Specifically, the empirical analysis shows that internal cash flow matters for internationalisation, where greater cash flow increases the probability of becoming international. The empirical evidence also suggests that more highly indebted firms, that have pledged collateral for external credit, have a relatively greater likelihood of being outward direct investors. Furthermore, the analysis distinguishes between large firms and small firms, on the grounds that the probability of internationalisation increases with firm size. The estimates indicate that financial constraints are binding for large firms but not small firms, consistent with the idea that smaller firms are relatively less inclined to engage in internationalisation (Helpman et al 2004, Buch et al 2014). In addition, the magnitude of firm specific financial constraints determining the probability of internationalisation is found to be heterogeneous across key Irish economic sectors.

The theoretical motivation underpinning this research relates to the factors that determine the expansion of firms internationally. Firms' access to foreign markets can take place through a number of channels including exports, outward direct investment and licensing agreements with foreign firms. In the model of Melitz (2003) firm entry into a foreign market through exports requires costs, assumed to be financed internally or without an external financing premium, which can only be overcome by sufficiently productive firms. Only the largest and most productive firms, however, access foreign markets by engaging in outward direct investment Helpman et al (2004). Greenaway et al (2007) find that the financial health of firms is a factor in determining their internationalisation through exports. Chaney (2013) builds upon the model of Melitz (2003) by incorporating liquidity constraints, and shows that liquidity constrained firms may be prevented from accessing foreign markets through exports.

The role financial factors play in the decision of firms to engage in international expansion through outward direct investment has been explored in Buch et al (2014). This paper extends on the theoretical literature that focuses on internationalisation through exports by developing a model that incorporates the financial constraints that prevent firms from accessing international markets through outward direct investment. Buch et al (2014) also contribute to the related empirical literature, in their finding that the financial health of a firm can affect its exploitation of international investment opportunities. Firms, such as large multinational corporations, which are less reliant on external funding can finance international investment projects through internal funds. These authors also report that higher leverage is negatively associated with a firm's decision to invest abroad.

Similarly, a lack of internal funding can hinder a firm's international investment opportunities (Manova 2008). For firms dependent on external funding, the role their assets can play as pledgeable collateral is important. External capital is more easily raised by firms in industries that employ tangible assets (property, plant, equipment and machinery) that can serve as collateral (Claessens and Laeven 2003). Internationalisation should, therefore, be more prevalent for firms that are relatively large in size, have greater cash flow, and hold a greater volume of assets that can be collateralised.

Previous research on outward direct investment by Irish firms has largely been motivated by examining the impact of international investment on their domestic operations, and on the level of development of the Irish economy. O'Toole (2007) asserts that outward direct investment by Irish firms in the early 2000s was motivated by their desire for access to wider geographic markets, rather than a requirement for a lower input cost base. The increased access by Irish firms to foreign markets through outward direct investment by expanding their physical operations abroad across a similar time horizon is also highlighted by Forfás
(2007).

In terms of the Irish literature that has focussed on the stage of investment development path of Ireland, Barry et al (2002) show that the increase in outward direct investment by Irish firms is consistent with the investment development path hypothesis. This hypothesis suggests there is a relation between a country's economic development and its outward direct investment. Görg (2000) also examines Irish outward direct investment in the investment development path framework. Focussing on the direct investment of Irish firms in the US, Görg (2000) finds that this development is consistent with Stage 3 of this framework. At this Stage the economic development of a country is associated with increasing international competition of domestic firms and increasing outward direct investment.

Increases in outward direct investment frequently give rise to concerns that investment is being diverted away from the domestic economy, in that foreign investment acts as a substitute for domestic investment. Outward direct investment has, however, been found to be beneficial to a domestic economy via positive effects for both the firm and its shareholders. Desai, Foley and Hines (2005) provide evidence in support of these benefits, where for US firms increases in outward direct investment are associated with greater levels of investment in the

US domestic economy. Similarly for Ireland, Forfás (2007) found that outward direct investment by Irish firms had a positive effect on both the employment and productivity within these firms. Furthermore, Irish firms engaged in outward direct investment hired more employees and had increased productivity relative to purely domestic Irish firms.

By studying the relation between outward direct investment and firm specific financial constraints this paper contributes to these strands of literature. First, the paper highlights the problems caused by re-domiciled PLCs in aggregate outward direct investment statistics, and employing estimates of Fitzgerald (2013) estimates the extent of this effect in Irish firms' outward direct investment. Second, consistent with the findings of Buch et al (2014), the results in this paper indicate that financial constraints do matter for the internationalisation of Irish firms through establishment of foreign affiliates abroad, namely the extensive margin of foreign direct investment.

The remainder of the paper is structured as follows. Section 2 outlines the issues regarding aggregate outward direct investment statistics and estimates of the contribution of redomiciled PLCs are presented. Section 3 describes the firm-level data and the empirical approach. Section 4 presents the econometric specification and the empirical results. Finally, Section 5 concludes.

2. THE EVOLUTION OF IRISH FIRMS' OUTWARD DIRECT INVESTMENT

In support of the approach to employ firm-level data in the empirical analysis, it is useful to highlight some of the key stylised facts concerning the outward direct investment of Irish firms. Figure 1 plots the evolution of outward direct investment over the period 1970 to 2013. Irish outward direct investment grew at a stable pace up until 2008, and has escalated since then. A contributing factor to this recent rise in outward direct investment is the redomiciling of PLCs in Ireland.

Figure 1: Evolution of Irish outward direct investment, 1970 – 2013
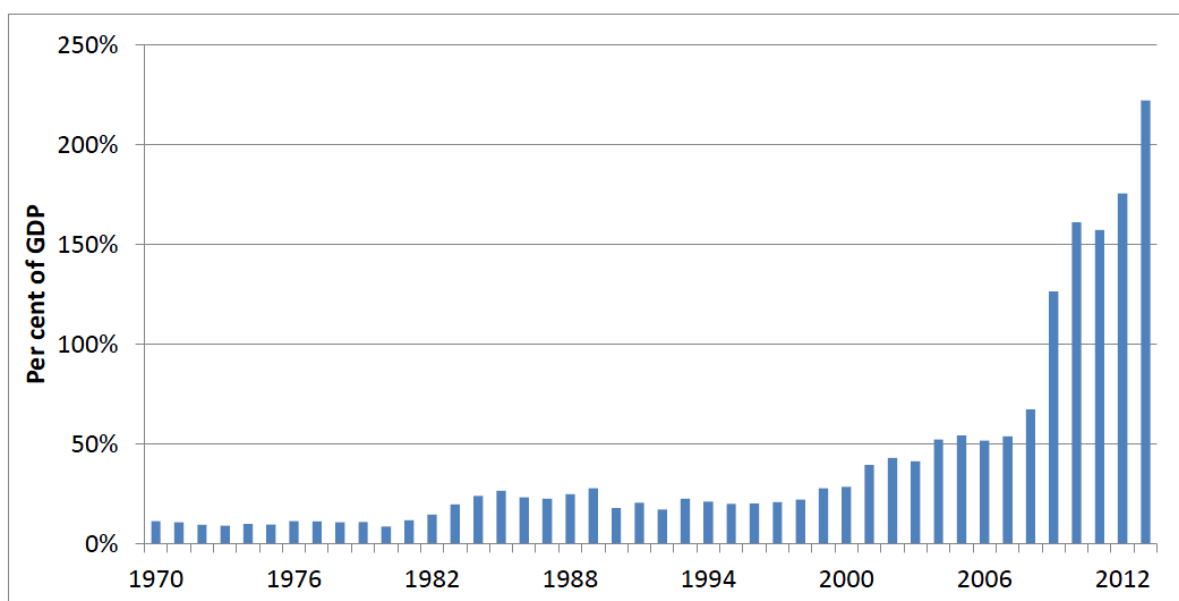
Data sources: Pre-1997 data are sourced from the updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007) and post-2008 data are from the Central Statistics Office.

In 2007, the UK authorities announced their intention to introduce more stringent controlled foreign corporation (CFC) legislation, targeted at curbing multinational companies shifting profits abroad to reduce their tax liabilities. Subsequently, a number of high profile UK firms announced their intention to legally relocate their headquarters to Ireland in the absence of substantive economic activity (Voget 2011). This tax planning strategy by multinational companies has intensified since 2010, and is reflected in the inflation of Irish national accounts and external statistics, including the balance of payments and international investment position (Fitzgerald 2013, Lane 2014).

The redomiciling of headquarters to Ireland was not exclusive to UK companies. In 2009, US proposals intending to curb US companies utilising tax havens and removing their tax incentives for shifting jobs overseas

also led to a number of large US multinationals redomiciling their headquarters to Ireland (Gravelle and Marples 2014).[2] These redomiciled PLCs are virtually 100 per cent owned by foreign investors, and in turn hold significant volumes of foreign assets (Everett 2012, Fitzgerald 2013, Lane 2014). This results in their receipt of large profits from their foreign investments and affiliates, estimated by Fitzgerald (2013) to be €7.4 billion or 4.5 per cent of GDP at end-2012.[3]

To estimate the extent of outward direct investment statistics attributable to redomiciled PLCs, the following specification is considered:

$$\frac{\pi_t^{PLC}}{\pi_t^{Total}} = R_t^{PLC} \qquad (1)$$

where the ratio of redomiciled PLCs' foreign profits, π^{PLC}, to the foreign profits for all firms headquartered in Ireland (both indigenous and redomiciled), π^{Total}, at time t, is given by R^{PLC}. This ratio is then used to estimate the contribution of redomiciled PLCs to the stock
of outward direct investment:

$$R_t^{PLC} * ODI_{t-1}^{Total} \approx ODI_{t-1}^{PLC} \qquad (2)$$

where ODI^{Total} and ODI^{PLC} are the outward direct investment of all headquartered firms and re-domiciled PLCs, respectively. Employing the estimates of undistributed profits from Fitzgerald (2013) and aggregate CSO direct investment data, the estimated adjusted stock of outward direct investment is presented in Figure 2.

Figure 2: Outward direct investment (stock) adjusted for redomiciled PLCs
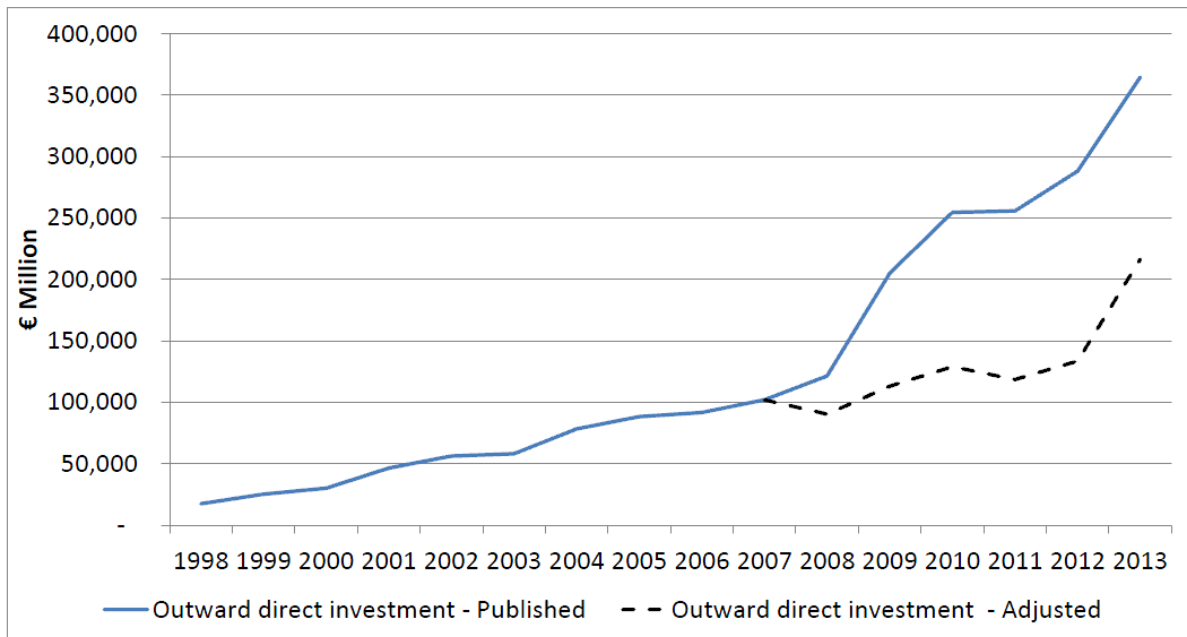
Notes: (i) Data sourced from the Central Statistics Office, Fitzgerald (2013) and author's own calculations, and (ii) Adjusted outward direct investment = Total outward direct investment minus redomiciled PLCs' outward direct investment.

Excluding redomiciled PLCs, the stock of outward direct investment of Irish-owned firms has also been on an upward trend since 2008, and is estimated to have been outstanding at €216 billion (or 124 per cent of GDP) by end-2013. These estimates, detailed in Table 1, suggest that at end-2013 the contribution of redomiciled PLCs to the total outward stock of direct investment was 41 per cent. These findings support the decision to employ firm-level data in the empirical estimation to overcome the ination on aggregate official outward direct investment statistics driven by redomiciled PLCs.

---

[2] A number of corporate strategies are employed by US firms seeking to redomicile their headquarters in other countries, the details of which are described in Gravelle and Marples (2014).
[3] A detailed description of how a multinational redomiciling its headquarters to Ireland is recorded in Irish macroeconomic statistics can be found in Everett (2012).

Table 1: Contribution of redomiciled PLCs to total outward direct investment, € Million

	2009	2010	2011	2012	2013
Published outward direct investment (€bn)	205	255	256	288	365
Adjusted outward direct investment (€bn)	113	129	118	133	216
Contribution of redomiciled PLCs (per cent)	45	49	54	54	41

This table presents the estimates of the contribution of redomiciled PLCs to outward direct investment statistics, derived from author's calculations of equations (1) and (2) based on CSO balance of payments, international investment position data and Fitzgerald (2013).

3. DATA

To comprehensively analyse whether firm specific financial constraints create barriers to foreign market entry, micro-level data on the activities and ownership structure of individual firms are required. In the next section, the approach to constructing a firm-level database that reflects the official statistical framework of outward direct investment is described.

3.1 Data sources

The main source of data is the Bureau van Dijk AMADEUS database, which contains firm-level data on profits and loss accounts, balance sheets, and information on corporate structure. Attributes collected for firms resident in Ireland include ownership structure, cash and cash equivalents, total assets, fixed assets, loans, long-term debt and exporting revenue.

Direct investment statistics are based on the direction of investment, between a direct investor (parent company) and its direct investment enterprise (foreign affiliate), and the size of the related equity investment. Outward direct investment statistics reflect the lasting relationship between a parent company and its foreign affiliates, therefore, in order to successfully employ micro level data, the direction and size of firm ownership must be identified.

A two-step procedure is adopted to distinguish Irish firms from foreign-owned Irish-based firms. First, an Irish firm is identified as a company whose global ultimate owner has a direct or indirect share of at least 25 per cent of the company's capital, and is categorised by AMADEUS as being Irish, according to the ISO country code of the firm's global ultimate owner.

A drawback of this identifier is that the global ultimate owners of some redomiciled PLCs are categorised as Irish (Table 2). To the best of my knowledge, no publically available dataset provides sufficient information to rigorously address this data issue. To further refine the sample of Irish firms, a number of criteria to identify redomiciled PLCs are, therefore, considered. Salient features of redomiciled PLCs are few or no employees and post-2008 incorporation in Ireland (Fitzgerald 2013). Company data reported in AMADEUS are, however, collated on a consolidated basis for a portion of companies, and include the worldwide number of employees within a corporate group, among other potential identification criteria. Removing firms on this basis runs the risk of excluding genuine Irish firms.

Table 2: Top ten firms domiciled in Ireland at end-2012

Name of firm	Year of incorporation	Publically announced intention to redomicile
Accenture PLC	10/06/2009	Yes
CRH PLC	20/06/1949	Not applicable
DCC PLC	09/04/1976	Not applicable
Eaton Corporation PLC	10/05/2012	Yes
Ingersoll_Rand PLC	01/04/2009	Yes
Seagate Technology PLC	22/01/2010	Yes
Covidien PLC	16/01/2009	Yes
Smurfit Kappa Group PLC	24/01/2007	Not applicable
Smurfit Kappa Funding Limited	12/06/2002	Not applicable
Kerry Group PLC	23/12/1985	Not applicable

This table presents the top ten Irish parent firms whose global ultimate owner is identified as Irish according to the Bureau van Dijk AMADEUS database.

In the absence of rule-based exclusion criteria, it is necessary to adopt an alternative approach to excluding redomiciled PLCs from the dataset of Irish firms. Redomiciled PLCs frequently announce their intentions to locate to Ireland publically via the media. Drawing on these announcements, an initial list of redomiciled PLCs is compiled. This list is cross checked and complemented with the companies identified as redomiciling in Ireland in Gravelle and Marples (2014). This approach provides for the manual elimination of the largest redomiciled PLCs from the data sample of Irish firms.

To distinguish between different types of firms the Irish data sample is divided into two groups: (i) Irish firms engaged in outward direct investment, and (ii) purely domestic Irish firms without foreign affiliates.

For the scope of this paper, an Irish firm is defined as an outward direct investor if it holds more than 50 per cent equity capital in a foreign affiliate. The structure of ownership information in AMADEUS, in particular the information relating to subsidiaries, is the key rationale for adopting this definition. This is consistent with the Organisation for Economic Cooperation and Development (OECD) Benchmark Definition of Foreign Direct Investment, 4th edition, that direct investment enterprises are corporations in which over 50% of the voting power is held. This is the definition of direct investment underpinning the compilation of statistics on the Activities of Multinational Entities (or Foreign Affiliates Trade Statistics). In contrast the Irish and international statistical frameworks underpinning the balance of payments/international investment position statistics define outward direct investment as an equity investment greater than 10 per cent by a parent firm in one or more enterprises located abroad.[4] While the definitions outlined in these two statistical frameworks differ, they are complementary. In practice, a number of countries employ the 50 per cent threshold of foreign ownership including Norway and Sweden (Heyman et al 2007, Balsvik and Haller 2010). Irish firms that do not have any foreign affiliates are classified as purely domestic Irish firms.

To eliminate outliers, firms with negative values for variables such as total and fixed assets are excluded from the sample, and loans and long-term debt are truncated at the 99th percentile.

The final data sample is a panel of 2,516 Irish firms over the period 2004 to 2012.[5] Table 3 provides the summary statistics for both Irish firms with foreign affiliates, and purely domestic Irish firms.

3.2 Empirical approach: dependent and explanatory variables
To empirically identify financial constraints and firm characteristics, the empirical approach of Buch et al (2014) is followed where feasible.

The dependent variable in all specifications is the internationalisation of an Irish firm though outward direct investment, $Inter_i$, taking a value of 1 if firm i has one or more foreign affiliates at end-2012, and 0 otherwise. As an additional proxy for the internationalisation of Irish firms, a count variable for the number of foreign affiliates is also calculated. This measures the degree of internationalisation of large corporate groups engaged in complex FDI strategies.

Next, financial constraints are considered from the perspective of the firm. The sensitivity of a firm's investment to its cash flow is typically interpreted as an indication of the extent of its financial constraints (Greenaway et al 2007). The ability of a firm to invest depends on its internal financing. A firm with a higher level of cash is likely to have relatively greater investment even if it has difficulty in accessing external finance. The internal funding available to a firm that can be drawn upon to fund its international expansion is proxied by the log of cash flow. The expected impact of this variable is positive, as it should have a positive effect on the parent firm's ability to establish foreign affiliates.

The second firm specific financial constraint that is considered is collateral. For firms reliant on external financing to fund their internationalisation through outward direct investment, the level of collateral they can pledge is important. Firms that are highly indebted have a reduced availability or eligibility of assets that can be posted as collateral. The ratio of debt (loans plus long-term debt) to total assets is adopted as the measure of collateral. A negative sign on collateral is indicative of a binding collateral constraint, whereas a positive sign suggests that the firm has already posted collateral to draw on credit to finance its internationalisation via foreign affiliates.

---

[4] Central Statistics Office's Foreign Direct Investment Methodological Notes and the International Monetary Fund's Balance of Payments Manual 5th and 6th Editions.
[5] 2013 data is only available for a selection of firms.

Table 3: Summary statistics

Variable	Definitions	Mean	Std.Dev.	Min	Max
		All Irish firms (no of obs = 22,155)			
International firm	0/1 dummy for firms that are outward direct investors	0.127	0.334	0.000	1.000
Collateral	Total debt (loans+long-term debt) / Total assets	0.162	0.314	0.000	1.777
Cash flow	Log of cash flow	-0.917	2.225	-6.908	8.177
Size	Log of total assets	0.174	2.526	-6.908	10.340
Fixed costs	Fixed assets / Total assets	0.206	0.319	0.000	1.000
Exporter	0/1 dummy for firms that engage in exporting activities	0.020	0.142	0.000	1.000
		Irish firms with foreign affiliates (no of obs = 2,824)			
Collateral	Total debt (loans+long-term debt) / Total assets	0.206	0.319	0.000	1.724
Cash flow	Log of cash flow	0.078	2.420	-6.908	7.478
Size	Log of total assets	1.617	2.900	-6.908	9.974
Fixed costs	Fixed assets / Total assets	0.242	0.312	0.000	1.000
Exporter	0/1 dummy for firms that engage in exporting activities	0.050	0.237	0.000	1.000
		Irish firms without foreign affiliates (no of obs = 19,331)			
Collateral	Total debt (loans+long-term debt) / Total assets	0.156	0.313	0.000	1.777
Cash flow	Log of cash flow	-1.062	2.158	-6.908	8.177
Size	Log of total assets	-0.036	2.395	-6.908	10.340
Fixed costs	Fixed assets / Total assets	0.200	0.320	0.000	1.000
Exporter	0/1 dummy for firms that engage in exporting activities	0.015	0.120	0.000	1.000

Note: Negative values are from firms with cash flow (log) and total assets (log) less than € 1 million. All data are sourced from the Bureau van Dijk Amadeus database.

The internationalisation of a firm may also depend on its size and productivity. While a firm can access foreign markets through both exports and outward direct investment, the latter is confined to the most productive firms (Helpman et al 2004). The total assets of firm *i* are taken as a measure of its size, and also captures its productivity. The expected sign on this coefficient is positive.

Higher fixed costs are associated with establishing an affiliate abroad. The fixed costs of investment are empirically measured by fixed assets, normalised by total assets of the firm. A negative sign on the related coefficient is expected given internationalisation requires involves high fixed costs.

Exporting can serve to improve a firm's productivity through learning, and serves as a stepping stone towards entry into a foreign market. An exporting dummy is created, whereby a firm receiving export revenue during the period under review, is assigned a value of 1, and 0 otherwise.

To examine whether there is heterogeneity in the effect of financial frictions on internationalisation the sample of Irish firms is also categorised by size, and into sectors according to NACE Rev 2.[6] The size filter applied is based on a firm's total assets, operating revenue, and number of employees. Large firms are considered as those which have (i) operating revenue in excess of €10 million or (ii) total assets in excess of €20 million or (iii) more than 150 employees. Small firms are considered to be those that are not included in the large category.

In terms of sector, firms are decomposed into manufacturing (NACE codes 1011 to 3320) and services (NACE codes 4511 to 9900) consistent with the NACE code classifications employed in the Foreign Direct Investment Statistics released by the Central Statistics Office (CSO). To conduct a more detailed sectoral analysis of Irish firms, broadly similar to the economic activities of outward direct investment statistics published by the CSO, the manufacturing and services sectors are further decomposed into more detailed economic activity. The data is categorised into firms engaged in the processing of natural resources and construction (NACE codes 0111 to 0900, 4110 to 4399), the manufacture of food and beverages (NACE codes 1011 to 1200), financial and insurance activities (NACE codes 6411 to 6630), and computer software services (NACE codes 6201 to 6399, 5821 5829).

4. ECONOMETRIC SPECIFICATION AND RESULTS

To analyse how financial constraints affect the decision of a firm to enter a foreign market through outward direct investment, similar to Buch et al (2014) the probit specification is given by:

$$\Pr(Inter_i) = \beta_1 \beta_2\, Collateral_{i,t-1} + \beta_3\, Cash_{i,t-1} + \theta Z_{i,t-1} + \gamma S_i + \tau T_t + \epsilon_{i,t} \quad (3)$$

where $Inter_i$ is the dependent variable representing whether firm *i* is an outward direct investor or not, financial constraints are proxied by $Collateral_{i,t}$ and $Cash_{i,t}$. $Z_{i,t}$ is a vector of firm-level time-varying control variables including: firm size, $Size_{i,t}$, as a measure of firm size and productivity; $Fixed_{i,t}$ as a proxy for the fixed costs of investment, and $Exporter_{i,t}$ captures whether firm *i* is an exporter or not. The regressors are included with a lag of one period to account for the potential simultaneity of the explanatory variables. Si and Ti are firm sector and time dummies, respectively. These dummies account for firm sector unobservable factors such as firm strategy, and macroeconomic factors common across all sectors and time specific events which may affect outward direct investment. $\epsilon_{i,t}$ is the error term.

4.1 Regression results
Table 4 presents the results of the baseline specification. The results confirm that financial constraints do indeed affect the probability of an Irish firm becoming international through outward direct investment. In terms of collateral, a one unit increase in collateral that can be pledged for external financing raises the probability of becoming international by 1.8 per cent. This result is consistent with the idea that firms with a high debt ratio have an outstanding stock of external financing drawn from financial markets or banks in order to finance internationalisation. The positive and significant coefficient on *Cash* suggests that a greater internal cash flow is associated with a greater probability of expanding abroad through foreign affiliates.

---

[6] NACE Rev 2 refers to the second version of the European classification of industrial activity.

Table 4: Probability of having foreign affiliates

	Marginal effect	Standard error
Collateral	0.018*	(0.010)
Cash flow	0.011***	(0.002)
Size	0.018***	(0.002)
Fixed costs	0.011	(0.010)
Exporter	0.108***	(0.014)
Observations	17, 269	
Pseudo R^2	0.106	
LR Chi^2	1475	
Prob>Chi^2	0.000	

This table presents the results of the probit regression, where the dependent variable takes a value of 1 if an Irish firm owns a foreign affiliate and 0 otherwise. Firm sector and year fixed effects are included. Standard errors appear in the parentheses. ***, **, * correspond to significance at the one, five and ten per cent levels, respectively.

In terms of firm characteristics, firm size is important for entry into foreign markets through outward direct investment. The positive and significant coefficient on *Size* suggests larger and more productive firms have a higher probability of establishing foreign affiliates. Being an exporter also increases the probability of internationalisation.

Next, as a robustness check, an alternative approach to measuring the internationalisation of Irish firms is considered, where the dependent variable is the number of foreign affiliates. Count variables are necessarily discrete, are associated with a large frequency of zeros, and necessarily have non-negative values. Two common approaches to estimating count data are used, the Poisson and the negative binominal regression models. A well-recognised property of the Poisson model is that its mean is equal to its variance, known as the equidispersion property but Poisson models are vulnerable to overdispersion. To model the overdispersion, the negative binominal distribution is employed. The goodness of fit test of the Poisson model reports a chi-square value of 110, 450 with a p-value of 0, confirms the Poisson model should be rejected in favour of the negative binominal model.

The results of the count data models are reported in Table 5. The results from the count data models confirm the importance of the relationship between financial constraints and internationalisation, but in some respects differ from the Probit model results. Among the financial constraints, the significant coefficient on *Collateral* now enters the count regressions with a negative sign. This indicates firms with a greater level of indebtedness have fewer assets available to pledge as collateral for additional debt. The coefficient on Cash continues to remain positive and significant. Other firm characteristics, including Size and Exporter also continue to retain their positive explanatory power. The degree of internationalisation is also negatively affected by greater levels of fixed costs.

To examine the role firm size plays in determining the likelihood of internationalisation, the sample of Irish firms is split into large firms and small firms for the regressions reported in Table 6.[7] The results suggest that financial constraints bind tighter for large firms relative to small firms. Larger, more indebted firms with higher internal cash flow have a relatively greater probability of becoming international. A one unit increase in collateral raises the probability of a large Irish firm becoming international by nearly 8 per cent. Furthermore, being an exporter is positively associated with internationalisation. In contrast, none of the financial constraints are found to be significant for smaller firms.

---

[7] Irish parent firms were also categorised into publically quoted and unlisted but the number of publically quoted Irish parent firms in the sample only amounted to 40 firms compared with 2476 unlisted firms.

Table 5: Determinants of number of foreign affiliates

	Poisson		Negative binomial	
	Coefficient	Standard error	Coefficient	Standard error
Collateral	-1.054***	(0.024)	-0.800***	(0.108)
Cash flow	0.193***	(0.004)	0.072***	(0.018)
Size	0.457***	(0.004)	0.341***	(0.017)
Fixed costs	-0.326***	(0.022)	-0.670***	(0.117)
Exporter	1.646***	(0.013)	1.571***	(0.168)
Observations	19512		19512	
Pseudo R^2	0.598		0.068	
LR Chi^2	179728		2578	
Prob>Chi^2	0.000		0.000	

This table presents the estimated coefficients of the Poisson and negative binominal regressions, where the number of foreign affiliates for each Irish firm is the dependent variable. Year fixed effects are included. Standard errors appear in the parentheses. ***, **, * correspond to significance at the one, five and ten per cent levels, respectively.

Table 6: Probability of having foreign affiliates, Categorised by size

	Large firms		Small firms	
	Marginal effect	Standard error	Marginal effect	Standard error
Collateral	0.077***	(0.022)	0.001	(0.010)
Cash flow	0.033***	(0.004)	-0.001	(0.002)
Size	0.007*	(0.004)	-0.002	(0.002)
Fixed costs	-0.014	(0.025)	0.021**	(0.010)
Exporter	0.156***	(0.024)	0.015	(0.027)
Observations	5687		10083	
Pseudo R^2	0.098		0.059	
LR Chi^2	681		325	
Prob>Chi^2	0.000		0.000	

This table presents the results of the probit regression, where the dependent variable takes a value of 1 if an Irish firm owns a foreign affiliate and 0 otherwise. Firm sector and year fixed effects are included. Standard errors appear in the parentheses. ***, **, * correspond to significance at the one, five and ten per cent levels, respectively.

Next, it is explored whether the heterogeneity across sectors is observed. In Table 7, the sample is split into the key economic categories described in Section 3.2: manufacturing (total), firms manufacturing in the food and beverage sector, firms engaged in the processing of natural resources (agriculture, forestry, fishing, mining quarrying) and construction, services (total), and services engaged in financial and software services. Of the 2,516 firms in the sample, 154 are engaged in manufacturing activities, 2,001 are in the service sector, and the remainder are in agriculture, forestry, fishing, mining, quarrying and construction and the supply of utilities.

Table 7: Probability of having foreign affiliates, Sector

	(1) Manufacturing	(2) Manufacturing of food and beverages	(3) Agriculture, forestry, fishing, mining, quarrying & construction	(4) Services	(5) Financial services	(6) Software services
Collateral	0.103**	-0.049	0.027	0.009	0.064**	0.012
	(0.047)	(0.128)	(0.036)	(0.010)	(0.029)	(0.064)
Cash flow	0.022**	0.039*	0.017**	0.008***	0.033***	0.015
	(0.007)	(0.020)	(0.005)	(0.002)	(0.006)	(0.010)
Size	0.053***	0.064**	0.027***	0.018***	-0.016***	0.012
	(0.007)	(0.022)	(0.005)	(0.002)	(0.005)	(0.009)
Fixed costs	-0.161**	0.047	-0.041	-0.009	0.125***	0.102
	(0.057)	(0.165)	(0.040)	(0.010)	(0.029)	(0.078)
Exporter	0.102**	Omitted category	-0.111	0.112***	0.123**	0.183**
	(0.047)		(0.129)	(0.014)	(0.042)	(0.076)
Observations	1210	178	1236	15489	2070	607
Pseudo R²	0.205	0.274	0.140	0.052	0.031	0.053
LR Chi²	269	53	138	609	56	27
Prob>Chi²	0.000	0.000	0.000	0.000	0.000	0.009

This table presents the results of the probit regression, where the dependent variable takes a value of 1 if an Irish firm owns a foreign affiliate and 0 otherwise. Year fixed effects are included. Standard errors appear in the parentheses. ***, **, * correspond to significance at the one, five and ten per cent levels, respectively.

Firms engaged in manufacturing activities and financial services with a high debt ratio have a greater probability of being international, suggesting they have drawn on external finance to fund international expansion. The positive and significant coefficients on *Cash* in the regressions reported in columns (2) to (5) indicates that a greater cash flow increases the likelihood of expanding internationally for firms across most sectors, with the exception of those engaged in software services. The magnitude of the coefficient on *Cash* is largest for firms that manufacture food and beverages. For firms in this sector, a one unit increase in their internal cash flow increases their probability becoming international by 3.9 per cent.

For firms in the software services industry financial constraints are not found to be a significant determinant on their probability of internationalisation. One explanation for this is the technical and complex nature of this industry, creates relatively greater information asymmetries, which may reduce their access to external debt financing, instead relying on non-traditional funding sources, for example angel investment and/or venture capital. Being an exporter is found to positively increase the likelihood of these firms internationalising.

Turning to the other firm characteristics, consistent with previous findings, larger and more productive firms have a greater tendency to expand abroad, with the exception of those in the financial services industry, where size has a negative effect on the probability of internationalisation. Additional considerations not explored here, for example the tax and legal framework, may influence the probability of these firms expanding internationally. This is likely to be particularly pertinent for holding and treasury companies. Higher fixed costs are negatively associated with internationalisation of manufacturing firms, consistent with the comparatively higher fixed costs for firms operating in this industry.

In summary, the results confirm that the probability of international expansion through outward direct investment for Irish firms is dependent on financial constraints. The likelihood of internationalisation is sensitive to a firm's cash flow, where a higher cash flow is associated with a greater probability of Irish firms becoming international. Comparatively higher leveraged firms are also those most probable to engage in international activities, indicating external debt sourced from either banks or financial markets is important for financing foreign activities.

Firm size also matters for entry into foreign markets. Larger firms have a greater probability of internationalisation, suggesting the most productive firms are those most likely to expand abroad. In contrast, financial constraints are found to be less important for small firms but these firms are associated with a lesser tendency to invest abroad. Financial constraints are found to bind tighter for manufacturing firms, where both their cash flow and external debt factor in their decision to invest internationally. This reflects internationalisation patterns whereby manufacturing firms are more likely to expand abroad through outward direct investment than firms in the service industry.

These empirical findings are consistent with those of Buch et al (2014) that financial constraints act as a barrier to foreign market entry, an effect that is particularly true for larger firms. In addition, the results provide empirical support for the idea that the size of a firm may be a proxy for its success, whereby larger firms are also the most successful firms (Bernard and Jensen 2004, Helpman et al 2004). Similarly, Chaney (2013) considers that financial constraints are not relevant for less productive or small firms as they are less likely to enter foreign markets.

5. CONCLUSIONS

Greater international expansion by Irish firms into foreign markets since the financial crisis has increased the impetus to understand whether financial frictions influence their decision to internationalise. The paper investigates the influence of financial constraints on the internationalisation of Irish firms through outward direct investment between 2004 and 2012, by employing a micro-level dataset of 2,516 Irish firms.

A number of statistical considerations are addressed in the paper. In recent years, the redomiciling of PLCs to Ireland has inflated Irish macroeconomic statistics, posing a challenge for policymakers and researchers to accurately interpret these data. To probe beneath the aggregate statistics, the contribution of redomiciled PLCs is estimated. At-end 2013, these firms are estimated to account 41 per cent of the outstanding stock of outward direct investment by Irish firms. The use of a firm-level dataset provides a number of advantages for the empirical analysis: it facilitates the exclusion of redomiciled PLCs from the data, and provides for a comprehensive analysis of firm specific financial constraints.

The results establish support for the role of financial constraints as barriers to foreign market entry. The empirical analysis finds that a greater probability of becoming an international firm is associated with a higher

cash flow, and for those firms that rely more on external finance, the holding of assets that can be pledged as collateral. While financial constraints are found to bind more for large firms, the probability of being an outward direct investor also increases with the size of a firm. Heterogeneity across the financial constraints that determine internationalisation is found for the economic sectors of firms. For small firms which are by their nature more reliant on external credit, and firms in the software services industry and have greater information asymmetries, financial constraints are not found to be determinants of their internationalisation.

Overall these findings suggest that the biggest and brightest Irish firms have the greatest probability of expanding internationally. This gives rise to optimistic future prospects for the employees, investors, stakeholders of these firms, as well as the wider Irish economy. This suggests the importance of future work in understanding the financial factors driving internationalisation, and of using those findings to understand the funding structure of Irish firms.

References

Balsvik, R. and S.Haller (2010). "Picking "Lemons" or Picking "Cherries"?" Domestic and Foreign Acquisitions in Norwegian Manufacturing", *Scandinavian Journal of Economics*, Vol.112, No.2, pp 361-387.

Barry, F., Görg, H. and A. Mcdowell (2003). "Outward FDI and the Investment Development Path of a Late-industrializing Economy: Evidence from Ireland", Regional Studies, Vol. 37, Iss. 4.

Bernard, A. and J.Jensen (2004). "Why Some Firms Export", *The Review of Economics and Statistics*, Vol. 86, No.2, pp 561-569.

Buch, C.M., Kesternich, I., Lipponer, A., and M. Schnitzer (2014). "Financial constraints and foreign direct investment: firm-level evidence", *Review of World Economics*, Vol. 150, No. 2, pp 393-420.

Central Statistics Office (2012). Foreign Direct Investment Methodological Notes, August 2012.

Chaney, T. (2013). "Liquidity Constrained Exporters", NBER, Working Papers No.19170.

Claessens, S., and L. Laeven (2003)."Financial development, property rights, and growth", *Journal of Finance*, Vol. 58, No. 6, pp 24012437.

Desai, M.A., C.Foley. and J.R. Hines (2005). "Foreign Direct Investment and the Domestic Capital Stock", *American Economic Review*, Vol. 95, No.2, pp 33-38.

Everett, M. (2012). "The Statistical Implications of Multinational Companies Corporate Structures", *Quarterly Bulletin, Central Bank of Ireland*, Box 3, No. 3 2012.

Fitzgerald, J. (2013). "The Effect of Re-domiciled Plcs on Irish Output Measures and the Balance of Payments", ESRI QEC Research Note No. 2013/1/2.

Forfás (2007). "Outward Direct Investment and the Irish Economy", Forfás, May 2007.

Görg, H. (2000). "Irish Outward Investment in the US: Evidence and Further Issues", *Journal of the Statistical and Social Inquiry Society of Ireland*, Vol.30, pp 33-52.

Gravelle, J. and D. Marples (2014). "Corporate Expatriation, Inversions, and Mergers: Tax Issues", Congressional Research Service Report prepared for the Members and Committees of Congress, May 27 2014.

Greenaway, D., Guariglia, A. and R. Kneller (2007). "Financial factors and exporting decisions", *Journal of International Economics*, Vol. 73, No.2, pp 377-395.

Helpman, E., Melitz, M., and S. Yeaple (2004). "Export Versus FDI with Heterogeneous Firms", *American Economic Review*, Vol. 94, No.1, pp 300-316.

Heyman, F., Sjoholm, F., and P.G. Tingvall (2007). "Is there really a foreign ownership wage premium? Evidence from matched employer-employee data", *Journal of International Economics*, Vol. 73, No. 2, pp 355-376.

International Monetary Fund (IMF), *Balance of Payments Manual 5th and 6th Editions*.

Lane, P. and G.M. Milesi-Ferretti (2007). "The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970-2004", *Journal of International Economics*, Vol. 73, November, pp 223-250.

Lane, P. (2014). "International Financial Flows and the Irish Crisis", IIIS Discussion Paper No. 444.

Manova, K. (2008). "Credit constraints, equity market liberalizations and international trade", *Journal of International Economics*, vol. 76(1), pages 33-47, September.

Melitz, M. (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, Vol. 71, No.6, pp 1695-1725.

Organisation for Economic Cooperation and Development. *Benchmark Definition of Foreign Direct Investment*, 4th edition.

O'Toole, R. (2007). "Outward Direct Investment and Productivity, Perspectives on Irish Productivity Chapter 24", Forfás.

Voget, J. (2011). "Relocation of headquarters and international taxation", *Journal of Public Economics*, vol. 95(9), pages 1067-1081.

FIRST VOTE OF THANKS PROPOSED BY FRANK BARRY, TRINITY COLLEGE DUBLIN

The paper deals with three separate but related issues: (i) the redomiciling of foreign firms in Ireland, (ii) outward direct investment by indigenous Irish firms, and (iii) the impact of financial constraints on these outward direct investment activities.

I have little to say on the first issue other than to point out that while the Central Bank, the ESRI and the Department of Finance all focus on the negative consequences for Ireland of redomiciling, IDA-Ireland might have a slightly different perspective. The agency holds that once a firm's interest has been engaged in the country along any dimension it is easier to get them to locate further activities here. I note furthermore that the paper defines as one of the salient features of redomiciled PLCs that they have few or no employees. A quick search of some of the ten firms includes in Table 2 however reveals that Accenture and Covidien each employ around 1,500 people in Ireland.

On a technical point, equation 2 seems to assume that the main source of ODI financing for redomiciled entities is reinvested earnings. Might it be possible to determine whether these entities might also finance ODI via equity investments and/or intra-company loans?

Turning to the issue of ODI by domestic firms, I note that the final data sample consists of 2,500 firms (from which the author extracts the redomiciled entities by hand). It would be of great value to researchers if the names and foreign activities of all of these firms could be included as an appendix, to be placed perhaps on the journal's website, as there is great value to be had in being able to 'eyeball' the data to understand more fully what is going on. The Barry-Gorg-McDowell paper in Regional Studies used M&A data which allowed them to observe the activities of the largest Irish firms. The present paper offers a potentially much richer data source. This could be exploited further to see for example whether ODI is particularly prevalent in advertising-intensive and R&D-intensive sub-sectors.

It is also unclear as to whether all the ODI in the present paper is in production affiliates. We know from the United States that the largest 100 US corporations have almost 10,000 financial or quasi-financial subsidiaries, and that this tendency varies by sector.

The Barry-Gorg-McDowell paper and O'Toole's chapter on ODI in the 2007 Forfás book *Perspectives on Irish Productivity* suggest that ODI by indigenous firms is largely about market access since many of the largest Irish ODI firms seem to be operating in non-traded sectors from which it is not feasible to export. I am somewhat surprised then by the finding here that "being an exporter increases the probability of internationalisation".

It would also be of interest to know whether there is any measure in the Amadeus database that would equate with the measure of ODI stock in Figure 2 and that could be used as a check on the calculations that exclude redomiciled PLCs.

Turning finally to the issue of financial constraints, I note that Claudia Buch et al. in the *Review of World Economics 2014* report that higher leverage is negatively associated with a firm's decision to invest abroad. Here the finding is that firms with high debt ratios are more likely to have a foreign affiliate, but that high debt ratios are associated with fewer foreign affiliates. This could perhaps be explored further. It would obviously be better if other possible determinants of indebtedness could be introduced as controls.

One aspect of the wording of the paper I find confusing, which is that "the ratio of debt to total assets is adopted as the measure of collateral". This would seem to be an inverse measure, which makes the discussion around the coefficient's sign somewhat confusing.

The paper is thought-provoking and makes a valuable contribution to the literature. I hope that, having put so much work into compiling the database, the author will be willing to share the firm-level details more widely, which might stimulate others to come up with some testable propositions of our own. I commend the paper to the Society.

SECOND VOTE OF THANKS PROPOSED BY SEAMUS COFFEY, UNIVERSITY COLLEGE CORK

I thank the society for the opportunity to propose a vote of thanks for this paper. The paper makes several useful points about the impact of internationalisation on the Irish economy. The first is the impact internationalised companies have on Irish macroeconomic statistics. It is becoming increasingly difficult to identify trends in Irish economic statistics given the impact boardroom decisions in large internationalised companies can have.

As they are required to do, the Central Statistics Office adheres to internationally-agreed standards but it is becoming increasing difficult to analyse the trends of the "Irish economy" as opposed to the "economy in Ireland".

The "domestic" in gross domestic product refers to value-adding activity that occurs within jurisdictional boundaries but difficulties can arise because of the need to extract the volatile impact of somewhat artificial flows across boundaries such as corporate re-domiciling or inversions. These problems are accentuated in Ireland given the size of the economy relative to the impact this corporate actions can have. It is now the case that the most reliable source of data on the Irish economy is not the Quarterly National Accounts which are volatile and subject to revision but the Quarterly National Household Survey. The QNHS has its own difficulties such as those that emerged when the results of Census 2011 had to be incorporated and as we are halfway through the current intercensal period one wonders if other large changes have been missed.

The paper attempts to isolate the outward direct investment of "Irish firms" from the total of firms in Ireland. The assumption that the proportion of outward investment coming from redomiciled firms and coming from foreign firms is the same proportion of foreign profits coming from redomiciled firms is reasonable but limited. Applying this does provide a pattern since 2008 for outward investment by Irish firms that follows the historical trend but the increase in 2013 seems incongruous.

Even with these limitations presenting such results are useful as it highlights the dangers of using aggregate Irish statistics. In particular in recent times there have been references to the indebted nature of the Irish non-financial corporate (NFC) sector. Sectoral data from national accounts shows that the NFC sector has gross debts of around 200 per cent of GDP. Adding in the household and government sectors a debt level of around 450 per cent of GDP can be shown. Even at modest interest rates it would be difficult for any country to sustain a debt of this level. However, a very large part of Irish NFC debt arises from the Irish branches of foreign-owned MNCs. For the end of 2013 data from the CSO show that only 39 per cent of the total amount of NFC debt in Ireland is owed by Irish-controlled enterprises. The remainder is owned by foreign-controlled enterprises and therefore does not need to be serviced by Ireland's national income.

The amount of the debt that has to be serviced from Irish economic activity is lower than 450 per cent of GDP. At the end the sectoral amounts were:

- household debt: 96.0 per cent of GDP
- Irish-controlled NFC debt: 67.5 per cent of GDP
- general government debt: 123.3 per cent of GDP
- total economy debt (excluding financial sector): 286.8 per cent of GDP

The main contribution of the paper relates to the micro analysis undertaken using firms covered by the AMADEUS database. The firms may not be representative of all firms operating in Ireland but detecting a sampling bias is difficult. The results correspond to a priori expectations in that Irish firms which are larger and more successful are more like to internationalise. As with all econometric analysis it is useful to consider what factors could be present in the unobserved disturbance term. In the case of the firms here there may be human capital issues such as the determination of management to expand abroad. By its nature this is impossible to measure but assuming management is unchanged such a factor could be considered a fixed effect. One way of accounting for this would be to run a model in first differences to try and identify if a change in financing conditions results in a change in internationalisation rather than being a long-term objective of management. However, the limited nature of the dependent variable in either binary or count form restricts what might be identified from this approach. To conclude it is my pleasure to propose a vote of thanks to Mary Everett for her paper.

DISCUSSION
Martin O'Brien: I thank Mary for the paper and noted that the incentive, motivation and ability for internationalisation by indigenous firms may be further examined using complementary data to those used in the current study. First, whether the firms expanded through "green field" sites, or mergers and acquisitions could be analysed by linking the detail from Amadeus with the Zephyr database also provided by Bureau van Dijk. Second, some of the results in the econometric analysis may be due to the impact of past internationalisation on the financial performance of the parent indigenous Irish firm. It would be a useful extension to isolate this impact by using the unconsolidated accounts of the foreign subsidiary, where available. This would also allow for further analysis on the relative rates of return Irish firms can accrue in both their domestic and foreign activities.

Kevin Brady: I would like to thank the speaker for presenting a very interesting paper. I found the first part of the paper dealing with the separation of outward investment of indigenous companies from that of re-domiciled companies particularly noteworthy. The paper shows that outward investment attributed to indigenous Irish firms rose significantly in 2013. As noted by earlier speakers, this is most likely due to a rise in outward investment by re-domiciled companies that is not recognised by the 'ratio method' used. If it were possible to examine the destination country of outward investment by firms, it could prove a very useful tool in further understanding.

Frances Ruane: I really enjoyed this paper and it is very timely for us to look at the internationalisation of Irish firms in the context where there have been constraints on local financing which impact on them more that the foreign multinationals based in Ireland. The value of using the Amadeus data set is immediately obvious in the ability created for the analysis to eliminate re-domiciled PLCs given their distorting impact. The level of aggregation is very high in the analysis and I wonder if it might be possible to disaggregate a little further – and particularly to see if one could distinguish between tradable and non-tradable entities. This is particularly important in the Irish context given the scale issues in the Irish market. If this is not possible then further sectoral disaggregation could be useful. It would also be interesting to look a little further at the related entities – where there are separately production and financial affiliates. The picture created can be quite different when they are separated rather than integrated.