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Analysing the Drivers of Services Firm Performance: Evidence for Ireland

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Abstract: We examine drivers of firm performance using a holistic multivariate model which relates services firm growth to firm-characteristic, firm strategy and macroeconomic variables. Using data for 905 services firms in Ireland over the period 2001-2007, we employ System Generalised Method of Moments estimations and multiple firm performance measures to address the possible endogeneity and multidimensionality of firm-level performance. This paper provides empirical evidence on the factors determining services firm performance and the channels through which this occurs. Results confirm the importance of macroeconomic conditions for firm performance. We also find that small services firms in Ireland grew quicker during this period.

I INTRODUCTION

The critical role played by firms in creating jobs, promoting innovation and entrepreneurial skills and stimulating overall economic growth has motivated a large body of research on the factors determining firm performance

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(Lenihan *et al.*, 2010). Firm performance is driven not only by factors internal to the firm (i.e. firm characteristics and firm strategy), but also by external influences such as the macroeconomic conditions within which the firm operates. However, to date, most of the focus in the empirical firm growth literature has been on the internal drivers of firm performance (such as firm size and ownership), while variables related to the macroeconomic environment are frequently neglected in many firm growth studies, particularly in the Irish context.

In light of the above, we conceptualise this debate by presenting a holistic multivariate approach, which considers both the internal and external determinants of firm growth. This research is novel in its treatment of macroeconomic variables, and differs from previous studies where the emphasis is on firm characteristics and firm strategy drivers and which merely employ macroeconomic variables as control variables. Macroeconomic factors are important in determining firm performance, and are among the key relationships this paper is analysing. Hence, we adopt a holistic modelling approach which integrates three key sets of determinants of firm growth – macroeconomic conditions, firm characteristics and firm strategy. In so doing, this research fills a gap in the firm growth literature by testing an enhanced and extended explanatory variable set in an empirical study which not only deepens our knowledge of the drivers of firm growth from a policy perspective, but also employs a different methodological approach to investigating what Stam (2010) describes as the stochastic nature of firm growth.

Given the very significant and increasing contribution of the services sector in the Irish economy – accounting for 68 per cent and 77 per cent of all persons engaged in 2007 and 2012 respectively (Bielenberg and Ryan, 2013; CSO, 2013) – there is a need for research to provide insights on services firm behaviour. The empirical firm growth literature has largely concentrated on manufacturing firms (Daunfeldt and Elert, 2013; Rigtering *et al.*, 2014), while the relatively few studies investigating the services sector in Ireland have tended to focus on internationally traded services (e.g. Girma *et al*., 2008; Lawless, 2014). The neglect of the non-traded services industries in Ireland is an enduring issue, and was highlighted by the Department of Jobs, Enterprise and Innovation (2003) and the Small Business Forum (2006), with enterprise policy focused on supporting the manufacturing and internationally traded services industries due to their perceived wealth-generating abilities. The absence of data on the non-traded services industries, however, makes it difficult to estimate their economic contributions. Thus, the use of the unique Annual Services Inquiry (ASI) dataset employed in the current paper makes it possible to investigate the drivers of performance in both non-traded and internationally traded services firms in Ireland.

After 2000, Ireland experienced significant shifts in the sectoral performance of the economy when the export-led manufacturing growth, which was the dominant engine of Ireland's economic transformation during the 1990s, was in decline. The export-led boom gave way to credit-led, domestic demand-driven growth, financed by net external borrowing. We examine the performance of services firms during this second growth phase of the so-called Celtic Tiger economic transformation, which occurred from 2001 through to 2007. This period is strongly identified with the heavy reliance on the construction sector and the burgeoning credit-led property price "bubble" which later had their cumulative effects in Ireland's banking, sovereign and household debt crises. However, the important contribution of the services sector in the economy during this period has not always been fully acknowledged by policy-makers and researchers alike. Given that our dataset is a comprehensive mix of non-traded and internationally traded services firms, it therefore represents the diversity of services firms, and the drivers of firm growth which we find reflects this broad scope. Additionally, as non-traded services firms are heavily dependent on domestic demand, this research offers a deeper understanding of the determinants of firm growth during a period of domestic demand-driven macroeconomic growth. To the best of our knowledge, this paper is the first attempt to investigate the integrated effects of firm-characteristic, firm strategy and macroeconomic variables on the growth of internationally traded and non-traded services firms.

We address possible issues of individual heterogeneity and endogeneity with the use of the fixed effects (FE) and system generalised method of moments (SYS-GMM) estimation methods respectively to analyse firm growth. The current research differs from other studies in that the multidimensional nature of firm performance is considered within a macroeconomic context, through the use of several performance measures (employment growth, turnover growth and productivity growth) in a holistic framework. Turnover and employment growth measure the firm's actual performance and potential productive capacity respectively (Bottazzi *et al.*, 2008), while productivity growth assesses its efficiency of resource use in producing a given level of output. By adopting such an integrated modelling approach, this research increases our knowledge as to whether firm-specific characteristics, firm strategy and macroeconomic conditions have varying impacts on different facets of firm performance. This approach also incorporates the specific objectives of the key stakeholders (e.g. the firm, policy-makers, employees and consumers).

Our main findings are summarised as follows. First, the macroeconomic environment does play a significant role in the performance of services firms. The specific effect is, however, dependent on the measure of firm growth used. Second, in relation to firm characteristics, the firm's starting quality in terms

of its initial size and initial level of productivity matters for subsequent performance. Specifically, we find a negative relationship between firm growth and firm size; the inverse firm size/growth relationship, however, declines with increased size. This finding is consistent with the literature and remains robust even when regional and knowledge intensity disparities are considered. Third, engaging in trade activities, specifically, import and two-way trade (i.e. both exporting and importing) has a positive effect on turnover growth, while training investment increases growth in both turnover and employment. Overall, we find that the specific effect of determinants is sensitive to how firm performance is measured. Our findings suggest a role for policy which supports the development of small services firms, particularly in the areas of trade and training, while also acknowledging the multidimensional nature of firm performance.

The remainder of the paper is organised as follows: Section II provides further background and reviews the literature. Section III details the data and methodological approach used. Section IV presents our empirical findings, and Section V concludes.

II BACKGROUND

Heterogeneity in the performance of firms even within the same narrowly defined industries is well noted in the literature (Caves, 1998). These performance differences have been attributed to variations in the resources and capabilities embedded in the firm, the strategic choices made in exploiting these resources and capabilities, as well as firm responses to changes in the business environment (Nelson and Winter, 1982; Lockett *et al.*, 2009). We argue that this observed firm performance heterogeneity, along with the multiplicity of determining factors analysed in empirical investigations of firm performance, necessitates the adoption of a holistic multivariate modelling approach. Most of the empirical work on firm performance generally, and not just in services, has focused on internal drivers. This paper presents an integrated model which relates services firm growth (in employment, turnover and productivity) to both its internal (firm characteristics and firm strategy) and external (macroeconomic environment) determinants. This approach is apposite because macroeconomic conditions not only have a direct effect on firm performance, but also have a possible indirect effect through the strategies adopted by the firm. Moreover, the specific impact of macroeconomic conditions on firm performance may also be conditional on the characteristics of the firm.

The literature on the influence of macroeconomic conditions on firm performance is sparse, with many studies employing year dummies to control

for the macroeconomic effect on firm growth (e.g. Coad and Rao, 2008). Other studies, such as Higson *et al.* (2004) and Holly *et al*. (2013) have examined the effect of GDP growth on cross-sectional sales growth rates. However, the effect of firm-characteristic and firm strategy variables is not considered in these analyses. A limited number of other studies (Beck *et al.*, 2005; Mateev and Anastasov, 2011) have also explored the effect of macroeconomic factors such as GDP growth and inflation on sales growth. The latter studies however, are cross-country studies, which are generally hampered by "... definitional and measurement issues … induced by cross-country differences in coverage, unit of observation, classification of activity and data quality" (Bartelsman *et al.,* 2009: pp. 16-17). Importantly, all the aforementioned studies fail to make a distinction between manufacturing and services firms in their investigations. The empirical literature, however, suggests that there is significant heterogeneity in firm performance between manufacturing and services firms (Teruel-Carrizosa, 2010). A separate firm growth analysis for services firms is, therefore, essential in providing insights on the drivers of their performance.

This research addresses a gap in the firm growth literature by providing an empirical analysis of services firm growth in a holistic multivariate specification in a within-country context, thus improving on previous firm performance studies. Additionally, Ireland serves as a very interesting locale in which the integrated effects of the firm's inherent characteristics, firm strategy and macroeconomic conditions on firm growth in the services industries can be investigated. During our sample period (2001-2007), Irish economic growth was driven by domestic demand, fuelled by access to cheap credit. This period was characterised by strong annual average real GDP growth of 5.6 per cent, low unemployment, high inflation and negative real interest rates. The very favourable domestic demand dynamic provided a fertile environment for services firm growth. Overall, however, there has been scant research on the determinants of services firm performance in Ireland, and this period, in particular, has received little attention.

During the first, export-led, growth phase of the Celtic Tiger boom (from the early 1990s to 2000), the services sector's contribution to total employment grew from 58.6 per cent in 1992 to 62.3 per cent in 1998, while manufacturing's share increased marginally to 28.7 per cent in 1998 from 27.8 per cent in 1992. Yet, in relation to output, services' contribution declined significantly from 59.7 per cent of Net Domestic Product (NDP) in 1992 to 54 per cent in 1998, whereas manufacturing generated 37.2 per cent and 42.5 per cent of NDP in 1992 and 1998 respectively (Bielenberg and Ryan, 2013). The second, credit-led, domestic demand-driven, growth phase was characterised by declining manufacturing performance, with strong growth in the services and construction sectors. Much of the demand for services is indigenous, and, therefore, the domestic economy

is a key driver of services growth. In addition, the services sector is relatively less exposed to adverse changes in external competitiveness. The 2001-2007 period witnessed a trend loss in wage competitiveness and steadily rising nominal unit labour costs, with obvious implications for export-oriented manufacturing industries. Services' share of total employment increased from 64 per cent in 2001 to 68 per cent in 2007, while its contribution to NDP grew sharply from 53.9 per cent in 2001 to 62.9 per cent in 2007 (Bielenberg and Ryan, 2013). Also, the contribution of services to total exports of goods and services in Ireland increased from 22 per cent to 35 per cent between 2000 and 2005 (Forfás, 2006).

III METHOD AND DATA

3.1 *Analytical Framework*

Our choice of explanatory variables, drawn from the firm performance literature, is underpinned by economic theory and aims to proxy the firm-characteristic, firm strategy and macroeconomic factors that drive firm growth.

3.1.1 Firm Characteristics

Based on theory, firms' response to macroeconomic changes may vary according to their inherent characteristics. In selecting the firm characteristics to be included in our analysis, we draw on existing research which suggests variables such as firm size, initial level of productivity, industry minimum efficient size (MES) and industry growth (Delmar and Wennberg, 2010; Huynh *et al.,* 2010; Mazzucato and Parris, 2015; Sutton, 1997). These variables control for the firms' starting quality and the characteristics of the industry within which they operate. We also include the nationality of firm ownership, a binary variable which controls for the effect of foreign ownership on firm growth. This is particularly relevant given the significant contribution of foreign-owned firms in the Irish economy and the foreign direct investment-oriented policies pursued by successive governments (Collins and Grimes, 2011; Bailey and Lenihan, 2015). In line with findings reported in the empirical literature, we expect to find a positive effect for all firm characteristics variables, with the exception of initial firm size which would be expected to have a negative impact on firm growth.

3.1.2 Firm Strategy

The link between firm performance and the macroeconomic environment may be driven by the strategies adopted by firms in response to changes in their operating environment. Again, we draw on the extant literature to select the

strategy variables to be included in our analysis. The strategy variables we consider most relevant given the data available to us are training and trade.[1] With increasing globalisation, trade has become an important strategy in enhancing performance in the services sector. Thus, we include a categorical variable, *trade*, with no trade activity as the omitted category. This controls for performance heterogeneity due to a firm engaging in only import or export activities. A third category is also included to control for the simultaneous positive effect of engaging in both export and import activity (two-way trade) in line with recent research (Castellani *et al.,* 2010; Haller, 2012). Training is a key element of a firm's investment in human capital, which helps equip its employees with skills and knowledge which may potentially increase its productivity and competitiveness (De Grip and Sauermann, 2013). While there is some ambiguity in relation to the *a priori* direction of the effect of training on firm growth, we expect a positive effect consistent with most of the literature (Jones *et al.*, 2013).

3.1.3 Macroeconomic Environment

Firms' performance may affect the macroeconomy and vice versa. In relation to our macroeconomic variable set, we include the usual suspects of real Gross Domestic Product (GDP) growth, as well as the inflation and unemployment rates to reflect the impact of changes in economic activity, prices and the labour market on firm performance. Furthermore, given the open nature of the Irish economy, along with the loss of international competitiveness and phenomenal credit growth experienced in Ireland during our sample period, we also define the macroeconomic environment in terms of the real effective exchange rate (REER), and domestic credit to the private sector as a percentage of GDP. Inclusion of the REER index provides insights on the link between national competitiveness[2] and firm growth, while domestic credit growth takes into account the effect of the availability of credit on firm performance. We expect GDP and credit growth to be positively associated with firm growth. The link between the unemployment rate and the REER index is, however, ambiguous.

To summarise, based on previous evidence from both theoretical and empirical literatures, we hypothesise that small foreign firms in high growth industries, with high initial levels of productivity, which invest in trade and

[1] Other strategy variables relevant to an analysis of firm performance in the Irish context include investments in R&D and the use of public support or subsidies. Data for these variables are, however, only available in the ASI dataset from 2005. Given that the SYS-GMM estimation method requires at least four consecutive years of data (Nunes *et al.*, 2013), we are unable to include these strategy variables.

[2] We also employ the unit labour cost (average cost of labour per unit of output produced) as a measure of competitiveness, but we do not report these results as they were not significant.

training activities are likely to grow faster. Firm growth is also expected to be higher during periods of high GDP and credit growth, and low inflation. On the other hand, the link between the unemployment rate, real effective exchange rate, and firm performance is not clear *a priori*.

3.2 *Model Specification*

To test the hypotheses set out above, we estimate the model summarised in Equation (1):

$$\Delta \ln(S)_i = \beta_0 + \beta_1 \ln(S)_{i,t-1} + \beta_2 \ln(S_{i,t-1})^2 + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\Delta \ln(S)_i$ is the growth of firm i at time t (measured alternatively in terms of employment, turnover and productivity), $X_{i,t}$ is a vector of explanatory variables consisting of firm characteristics, firm strategy and macroeconomic variables. We include a squared size term to take account of the possible non-linear relationship between initial firm size and growth (Evans, 1987; Bigsten and Gebreeyesus, 2007). Additionally, an important consideration is how best to deal with possible econometric issues that may arise in estimating Equation (1). These include issues related to the potential endogeneity of some regressors such as macroeconomic factors and firm characteristics, since causality may run in both directions. It is also important to acknowledge the possible presence of unobserved time-invariant firm factors (fixed effects) which may be correlated with the explanatory variables in the firm performance model. We employ the fixed effects (FE) method as a means of controlling for unobserved heterogeneity (firm differences) arising from the non-availability of data on factors such as managerial and labour force quality which may lead to biased estimates.

If we are concerned about omitted factors that may be correlated with key predictors at the firm level, then we should estimate a fixed effects model. When using FE, we assume that some factor(s) within the firm which we cannot observe or measure (e.g. managerial quality, cultural factors or difference in business practices across firms) may bias the predictor or outcome variables and we need to control for this. The key insight is that if the unobserved variable does not change over time (time invariant), then any changes in the dependent variable must be due to influences other than these fixed effects. FE regression exploits within-firm variation over time. Across-firm variation is not used to estimate the regression coefficients, because this variation might reflect omitted variable bias. The key source of omitted variable bias is unobservable across-firm differences. If we believe that these unobservable factors are time-invariant, then FE regression will eliminate omitted variable bias. "Fixed effects" regression holds constant (fixes) the average effects of each firm. By including fixed effects, we are controlling for the average differences across firms in any observable or unobservable predictors. The FE coefficients soak up

all the across-firm action. Thus, it accounts for individual heterogeneity. What is left over is the within-firm action. The coefficient on each key predictor gives the average effect of that predictor (i.e. the common slope averaged across the firms).

One potentially significant limitation of FE models is that we cannot assess the effect of (observed) explanatory variables that have little within-firm variation. FE will not work well with data for which within-cluster variation is minimal or for slow changing variables over time. Therefore, where there is an interest in studying the effect of time-invariant variables such as industry or nationality of ownership on firm performance, the FE estimation is not useful.

Following other studies (Nunes *et al.*, 2013; Caglayan and Demir, 2014), we also use the SYS-GMM estimation method, to deal with potential endogeneity. This approach not only supports the inclusion of time-invariant determinants, but also remains robust in the presence of autocorrelation and heteroskedasticity, producing unbiased, efficient and consistent estimates (Roodman, 2009). Moreover, SYS-GMM allows the selection of instruments from within the econometric model, using lags of explanatory and dependent variables. We estimated various specifications of all firm growth models (turnover, employment and productivity) with different lags of firm-level variables as instruments. Also, in relation to the macroeconomic variables, the link between GDP growth and firm growth is likely to be endogenous, as high GDP growth could lead to increased growth in employment and turnover and vice-versa. Testing for causality between GDP and each of the dependent variables, we find that GDP should be treated as potentially endogenous in our analysis.[3] We find a significant causal relationship, in both directions, between GDP and the turnover and productivity growth dependent variables. Additionally, to minimise instrument proliferation, which may potentially reduce the consistency of results, we experiment with collapsing the instruments matrix (Merhrhoff, 2009). The Hansen test is used to assess the validity of the instruments, and we also test for second-order serial correlation.

3.3 *Data*

This paper uses data from the ASI dataset collected by the Central Statistics Office (CSO) covering the period 2001-2007. The ASI is an annual enterprise[4] survey covering all firms in NACE Rev. 1.1 industries G, H, I, K and O[5] which began in 1999. The dataset is unique in that it provides comprehensive coverage of all services firms with twenty or more employees.

[3] We test for endogeneity using the Granger causality test.

[4] An enterprise is defined as the smallest legally independent unit (CSO, 2008, p. 7).

[5] These are Wholesale and Retail Distribution, Hotels and Restaurants, Transport Storage and Communications, Real Estate and Other Community Services respectively.

Additionally, the survey comprises a stratified random sample of services firms with less than twenty employees. It, thus, provides data on micro-sized firms, with fewer than ten employees – this group of firms is often omitted in many firm growth studies (Reid, 2006). The dataset is an unbalanced panel since not all firms are sampled in all the years considered. Unique firm identifiers allow firms to be tracked across years.

For our study period, 2001-2007, the full dataset consists of 51,229 observations on 16,083 firms, with 978 firms present in all seven years. Firms with non-consecutive observations in the period of interest (i.e. _N-1) were removed from the panel as this discontinuity could potentially distort the analysis. This left 6,670 firms with 23,685 observations in the panel and 978 firms present in all the years. Furthermore, firms missing one year of employment and/or turnover data, had the average value of the preceding and subsequent years imputed for the missing year. However, where this could not be done due to data being missing for two or more consecutive years, such firms were excluded from the dataset. After this data cleaning, the panel then comprised 22,569 observations on 6,271 firms in the period, 2001-2007, with 972 firms and 6,804 firm/year observations present in all the years.

Firms observed switching between industries[6] in the sample period were dropped, leaving 905 firms present throughout the period. Based on the substantial difference in the total number of firms in the dataset and the actual number of firms present in all the years, ultimately, our empirical analysis is based on a balanced panel of 905 services firms and 6,335 firm/year observations. While, there are issues (e.g. selection bias) associated with the use of balanced panels, our approach is in line with recent firm performance studies such as Holzl (2014) and Karhunen and Huovari (2015) which have also employed balanced panel datasets.[7] Furthermore, balanced data reduces the noise introduced by unit heterogeneity. Also, if there is non-random attrition in an unbalanced panel (which is likely in this case), applying fixed effects can cause biased (or at least inconsistent) estimators. In all of our analyses, we use 2-digit NACE industry codes. Turnover was deflated using two-digit sectoral level output prices collected from the EU KLEMS database (EU KLEMS, 2011). Finally, we combine the ASI dataset with annual data for key macroeconomic variables obtained from the World Bank's (2012) World Development Indicator database.

Table 1, which outlines the distribution of firms in our sample by size class and industry, reveals a highly skewed distribution consistent with evidence in

[6] For instance, firms switching from NACE industry 51 (wholesale trade and commission trade) to NACE industry 52 (retail trade).

[7] For a detailed discussion on the merits and demerits of balanced *vs.* unbalanced panels, the interested reader should refer to Wooldridge (2010).

the literature (Gil, 2010). We find that 93 per cent of the firms in the sample are small and medium-sized enterprises (SMEs) broken down as follows: small firms (55 per cent) and medium firms (35 per cent), while 3 per cent of the firms are micro-sized firms.[8] Services firms have generally been found to be relatively smaller than manufacturing firms (Teruel-Carrizosa, 2010). Indeed, CSO data confirms that services firms in Ireland had a lower average number of employees per firm (9.4) relative to the manufacturing ratio of 42.1 in 2007.[9]

Table 1: *Classification of Firms by Industry and Size Classes*

Industry	*Micro*	*Small*	*Medium*	*Large*	*Total*
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel (50)	1	65	17	1	84
Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)	2	104	54	7	167
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	13	67	50	18	148
Hotels and restaurants (55)	2	80	102	3	187
Transport, storage and communications 60,62,63,64)*	1	26	16	8	51
Real estate activities (70)	1	7	3	0	11
Renting of machinery and equipment without operator and of personal and household goods (71)	0	8	4	1	13
Computer and related activities (72)	1	9	7	1	18
Research and development (73)	0	1	1	0	2
Other business activities (74)	7	82	54	17	160
Recreational, cultural and sporting activities (92)	1	35	12	1	49
Other service activities (93)	2	13	0	0	15
Total	31	497	320	57	905

Source: Authors' calculations from ASI dataset, 2001-2007.
Note: *Due to CSO confidentiality rules, NACE industries 60, 62, 63 and 64 are aggregated. Figures in parentheses are 2-digit NACE Rev.1.1 codes.

[8] Four size categories are identified based on the European Commission (2003) definitions: micro-sized firms (1-9 employees), small firms (10-49 employees), medium-sized firms (50-249 employees) and large firms (>250 employees).
[9] Figures are based on calculations using Annual Enterprise Statistics on Distribution and Services (1999-2007) and Census of Industrial Production (1991-2007) data from the CSO database direct.

The "hotels and restaurants", "wholesale trade", and "other business activities" industries account for 21 per cent, 18 per cent and 18 per cent of total firms respectively, whereas "retail trade" has the largest population of micro-sized firms (42 per cent) and large firms (32 per cent). Firms in the "wholesale trade" industry are mainly small, with 62 per cent of total firms in this industry found in the small size category. In relation to the knowledge-intensive industries, micro-sized firms are not represented in the "renting of machinery" and "research and development" industries, while the "transport, storage and telecommunications" and "computer and related activities" industries have one micro-sized firm respectively. The limited presence of micro-sized firms – which are usually prone to financial constraints – in these sectors may be related to high investment costs associated with, for example, product development and protection of intellectual property such as patents and trademarks, which may deter the entry of small firms into such industries.

3.4 *Summary Statistics*

We present the means and standard deviations of the variables to be analysed in Table 2 along with variable definitions and expected signs. The table shows a significant variation in growth over the period 2001-2007 as indicated by the standard deviations. In relation to the dependent variables, mean growth rates in the sample are quite low ranging from –0.4 per cent to 2 per cent, with negative growth in productivity. With respect to firm-characteristic and strategy variables, 11 per cent of firms in the sample have foreign ownership, 21 per cent of the firms reported training costs, while about 44 per cent of the firms in the sample engaged in trade activity.

Table A1 (See Appendix) presents the mean growth rates by industry sector. Again, this reveals considerable heterogeneity in growth rates across industries and growth measures. In relation to employment, growth rates range from –1.8 per cent in the "research and development" sector to 3.8 per cent for "retail trade" firms. Furthermore, with respect to the turnover measure, growth rates vary between –0.1 and 4.9 per cent in the "hotels and restaurants" and the "other business activities" industries respectively. Productivity growth was generally negative across industries, ranging from –0.4 per cent for "recreational, cultural and sporting activities" firms, to 4.6 per cent in the "other service activities" sector.

Next, we examine patterns of firm mobility within our sample. Based on the initial employment size class at the beginning of the period (2001), Table A2 (see Appendix) shows the number of firms that moved into other size categories at the end of the period. In general, a large proportion of firms in the sample (micro firms, 71 per cent; small firms, 80 per cent; medium firms, 83 per cent; and large firms, 93 per cent) remained in the same size category at

Table 2: *Description of Variables, Means and Standard Deviations*

Variable	*Definition*	*Mean*	*Standard Deviation*
Dependent Variable: Firm Performance			
Employment growth	Logarithm difference of employment in consecutive years	0.02	0.25
Turnover growth	Logarithm difference of turnover/sales in consecutive years	0.02	0.25
Productivity growth	Logarithm difference of labour productivity (turnover per employee) in consecutive years	–.004	0.31
Firm-Characteristic Variables			
Log employment$_{t-1}$	Logarithm of employment in previous period	3.94	1.08
(Log employment $_{t-1}$)^2	Square of logarithm of employment in previous period	16.72	10.22
Log turnover$_{t-1}$	Logarithm of total turnover in previous period	3.66	1.49
(Log turnover$_{t-1}$)^2	Square of logarithm of total turnover in previous period	15.63	13.05
Log labour productivity$_{t-1}$	Logarithm of labour productivity in previous period	–0.28	1.11
Location	1=Southern and Eastern; 0= Border Midlands and Western		
Nationality of ownership	1= Foreign; 0= Domestic	0.11	
Industry	2-digit Nace Rev. 1.1. classification (50-93)		
Industry minimum efficient scale	Minimum efficient scale measured as ratio of sales to number of firms in industry	206.57	244.85
Industry growth	Logarithm difference of total turnover in industry	0.02	0.09
Strategy Variables			
Trade	1= No trade; 2= Firm exports only; 3= Firm imports only; 4= Firm both exports and imports		
Training	1= Firm has training costs; 0 = Firm has no training costs	0.21	
Macroeconomic Variables			
GDP	Annual growth rate in real GDP (%)	5.57	0.74
Unemployment rate	Annual average unemployment rate (%)	4.39	0.23
Inflation	Annual growth rate in consumer prices (%)	3.78	1.13
Real effective exchange rate	Real effective exchange rate index, 2005=100	97.09	8.15
Credit growth	Domestic credit to private sector (%)	143.79	36.75

Source: Authors' calculations from ASI dataset, 2001-2007 and World Bank (2012) World Development Indicator database.

the end of the period. This implies that only very few firms in the distribution actually grew in terms of employment during this period. The greatest amount of upward mobility was observed for small and medium-sized firms, with 26 per cent (18 per cent) of micro-sized (small) firms and 5 per cent of medium-sized firms moving up one employment size class by 2007. The largest amount of downward movement to the next lower size class at the end of the period was seen in the medium and large size categories, with 12 per cent of medium-sized firms and 5 per cent of large firms moving one size class down over the course of the 2001-2007 period. Overall, results from the transition matrix show a high probability of growth for micro-sized and small firms, consistent with findings in the literature (Oberhofer, 2012; Daunfeldt and Elert, 2013).

To examine the patterns of growth in the three key services firm performance dependent variables, we compute mean growth rates by size classes. The mean growth rates for employment, turnover and productivity are presented by size in Table A3 (See Appendix). Employment and turnover growth declined with size for micro-, small- and medium-sized firms. Overall, micro-sized firms showed the highest mean employment growth, but large firms had the highest mean turnover growth rate. These findings are broadly in line with evidence in the literature where growth is more pronounced in smaller firms, with the growth effect diminishing with increased size (Sutton, 1997; Fotopoulos and Giotopoulos, 2010). Furthermore, across all classes, productivity growth rates increased with employment size, indicating that large firms have higher productivity growth. This is consistent with the passive learning model suggested by Jovanovic (1982), wherein efficient firms grow, whilst less efficient firms decline or fail.

IV EMPIRICAL FINDINGS

First, we discuss results for our estimated turnover and employment growth models, followed by those for productivity growth.

4.1 *Determinants of Turnover and Employment Growth*

Table 3 presents our FE and SYS-GMM estimates for the turnover and employment growth models. While GMM is our preferred or base modelling approach, results are generally robust across both estimation methods.

4.1.1 Firm Characteristics

We find that most of our results are in line with *a priori* expectations. Consistent with the literature (e.g. Fotopoulos and Giotopoulos, 2010; Daunfeldt and Elert, 2013, for manufacturing and all industries in Greece and Sweden

Table 3: *Determinants of Turnover and Employment Growth*

	Turnover Growth		*Employment Growth*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*
Log turnover $_{t-1}$	–0.903***	–0.243***		
	(0.010)	(0.044)		
(Log turnover $_{t-1}$)^2	0.099***	0.028***		
	(0.001)	(0.005)		
Log employment$_{t-1}$			–0.960***	–0.493***
			(0.006)	(0.047)
(Log employment$_{t-1}$)^2			0.112***	0.052***
			(0.001)	(0.006)
Log labour productivity$_{t-1}$	–0.049***	–0.038***	0.002	0.021***
	(0.009)	(0.013)	(0.005)	(0.006)
Industry growth	0.064**	0.226***	0.002	–0.010
	(0.026)	(0.045)	(0.016)	(0.030)
Industry minimum efficient scale	–0.000***	–0.000	–0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Nationality of ownership		0.001		0.004
		(0.017)		(0.018)
Export	0.002	–0.028	0.006	0.007
	(0.014)	(0.020)	(0.008)	(0.022)
Import	0.001	0.018**	0.001	0.012
	(0.008)	(0.009)	(0.005)	(0.010)
Export- Import	–0.007	0.027**	0.002	0.018
	(0.010)	(0.012)	(0.006)	(0.011)
Training	0.012*	0.035***	0.001	0.050***
	(0.006)	(0.009)	(0.004)	(0.009)
GDP	–0.008*	–0.018**	–0.002	–0.003
	(0.004)	(0.009)	(0.003)	(0.005)
Unemployment	0.060	0.218**	–0.030	–0.051
	(0.067)	(0.086)	(0.040)	(0.078)
Inflation	–0.001	–0.013	0.003	0.023**
	(0.009)	(0.013)	(0.005)	(0.011)
Real effective exchange rate	–0.000	–0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Credit	0.000**	0.001***	–0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	1.524***	–0.683*	2.071***	1.108***
	(0.285)	(0.365)	(0.172)	(0.344)
Observations	5,430	5,430	5,430	5,430
R-squared	0.764		0.918	
F-test	1041 (0.000)	6.503 (0.000)	3348 (0.000)	9.608 (0.000)

Table 3: *Determinants of Turnover and Employment Growth (Contd.)*

	Turnover Growth		*Employment Growth*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*
Number of Firms	905	905	905	905
Hansen test		0.698 (0.952)		2.772 (0.428)
m1		–2.711		–7.625
m2		–0.880		0.415
Instruments		31		31

*** significant at 1%, ** significant at 5%, * significant at 10%.
Note: Robust standard errors are in parentheses. Hansen is a test of over-identifying restrictions asymptotically distributed as χ^2 under the null of instrument validity with p-values reported in parentheses. m1 and m2 are the tests for first and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0, 1) under the null of no serial correlation. Values in parentheses represent the p-values for the F test and Hansen test. Estimates include industry dummies, but are not shown. Nationality of ownership and industry dummy variables were dropped from the fixed effect models as these do not vary over time.

respectively), we observe an inverse firm size-growth relationship; evidence that small services firms show higher employment and turnover growth. This growth effect, however, declines with increased size, as indicated by the positive coefficient on the squared size term.

The effect of the initial level of productivity varied with the firm performance measure employed. We find a convergence effect of the initial level of productivity on turnover growth, implying that firms with lower initial levels of productivity show higher turnover growth than more productive firms. This suggests that new entrants into a given industry at low productivity levels are forced to increase output quickly to reach the industry minimum efficient size (MES) so as to avoid failure. On the other hand, the positive coefficient for the labour productivity coefficient observed for employment growth indicates that firms with higher initial levels of productivity grow faster than less productive firms. This is in line with Jovanovic's (1982) model of passive learning, which argues that firms only gain knowledge of their true efficiency after entry into a given industry and adjust their sizes accordingly. Consistent with results for US and German manufacturing firms, industry growth has a positive effect on turnover growth only – an indication of a low competition effect and the availability of more opportunities in a given industry (Audretsch, 1995; Otto and Fornahl, 2009; Delmar and Wennberg, 2010).

4.1.2 Firm Strategy

The SYS-GMM results suggest that trade is important for turnover growth in services firms. Firms with import activity only increased turnover by 1.8 per

cent, whilst a trade premium of 2.7 per cent on average was found for firms engaged in two-way trade (i.e. both exporting and importing). The latter result is similar to findings by Vogel and Wagner (2010) and Haller (2012) who found a trade premium for two-way traders for manufacturing firms in Germany and Ireland respectively. The above findings are likely related to the increasing internationalisation of services in Ireland during the period of analysis. Here, we note the role played by multinational companies in providing support services (such as finance, trade facilities, professional and technical services) to their international affiliates, as well as payments made for patents, licences and franchises (Grimes, 2006). Indeed, Ireland is a net importer of services – the Irish services trade deficit peaked at €13,889 million in 2000, and thereafter declined steadily to €1,121 million in 2007. The most significant contribution to this deficit was from royalties and licenses – €10,371 million and €17,756 million in 2001 and 2007 respectively (CSO, 2015) – reflecting the significant activities of foreign-owned firms in Ireland and payments made for the use of foreign-owned technologies, patents and franchises. The contribution of an indigenous software sector with a strong export focus was also important during this period.

Training had a strong positive effect on turnover and employment growth in the SYS-GMM models, while a weak effect (at the 10 per cent significance level) was found for turnover growth in the FE model. These results, which are consistent with findings for manufacturing turnover growth in Brazil and UK (Bryan, 2006; Goedhuys, 2007), suggest that training is also a relevant strategy for services firms during the sample period. Training increases productivity by making workers more flexible and adaptable to changing conditions, as well as increasing their skills and knowledge of innovative processes. In contrast, Bryson and Nurmi (2011) found no training effect on employment growth in a sample of UK manufacturing and services firms.

4.1.3 Macroeconomic Environment[10]

We find that the macroeconomic environment matters for turnover growth in services firms. However, contrary to expectations, we find a negative GDP-turnover growth relation. This counter-cyclical effect suggests that services firms are likely to increase revenues during periods of low economic growth. We also observe a positive effect for unemployment on turnover growth in the SYS-GMM model only. It was during the second, credit-led, growth phase that

[10] We estimated several other macroeconomic variables in addition to those reported in Table 3 – *inter alia* these included the real interest rate, and unit labour costs, to assess the impact of rising wages and the resulting loss of competitiveness. However, estimation results for these variables are not reported here as they were not found to be statistically significant and did not contribute to the explanatory power of the models.

Ireland experienced a sharp loss of competitiveness as wages and prices increased. The dampening effect of a higher pool of unemployed workers on wage growth was missing as the country moved to full employment. This was a period characterised by low or negative real interest rates and steadily rising nominal unit labour costs. A trend loss in wage competitiveness had been underway since 2000. However, the effects were not felt in aggregate unemployment while the domestic "boom" continued. Additionally, inflation was found to have a positive effect on employment growth in the SYS-GMM model. Real interest rates in the years 1998-2007 averaged minus 1 per cent. Lower real interest rates will likely stimulate consumption and investment spending through borrowing, with the higher aggregate demand leading to services firms employing more workers. Consistent with *a priori* expectations, we find that growth in domestic credit has a small growth-enhancing effect on turnover and employment (albeit a weak effect was observed for employment growth in the SYS-GMM model).

4.2 *Determinants of Productivity Growth*

We now turn to address the question of the extent to which our set of explanatory variables (firm-characteristic, firm strategy and macroeconomic) explains the efficiency with which services firms produce output given their resource base. We test the sensitivity of productivity growth to different size measures through the use of log employment and log turnover in alternate specifications. This approach is motivated by the fact that productivity (turnover per employee) consists of two components: turnover (output) and employment (input). The use of these two size variables is apposite as they focus on different aspects of the firm. Our estimation results are presented in Table 4.

We find that the specific effect of some of the drivers of productivity growth is dependent on the size measure employed. For instance, a negative significant effect of firm size was found in the turnover size model, suggesting convergence effects, whilst a positive effect was found in the employment size model (evidence of increasing returns). Again, the size-growth relationship was found to be non-linear as indicated by the significant coefficients on the squared size terms. A convergence effect was also observed for the initial level of productivity in the two size models – indicating that firms with lower levels of productivity showed faster growth. Similar to our previous results for employment and turnover growth, we find that industry growth has a growth-enhancing effect on productivity growth in both size models. However, we do not find any evidence of a trade effect after controlling for endogeneity in the SYS-GMM models.

Table 4: *Determinants of Productivity Growth*

	Turnover		*Employment*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*
Log turnover $_{t-1}$	–0.229***	–0.147***		
	(0.019)	(0.043)		
(Log turnover $_{t-1}$)^2	0.061***	0.019***		
	(0.002)	(0.005)		
Log employment$_{t-1}$			0.327***	0.356***
			(0.017)	(0.040)
(Log employment$_{t-1}$)^2			–0.074***	–0.037***
			(0.002)	(0.005)
Log labour productivity$_{t-1}$	–0.718***	–0.111***	–0.645***	–0.085***
	(0.016)	(0.014)	(0.014)	(0.017)
Industry growth	0.086*	0.253***	0.117***	0.289***
	(0.049)	(0.057)	(0.045)	(0.057)
Industry minimum efficient scale	–0.000	–0.000	0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Nationality of ownership		–0.000		0.016
		(0.017)		(0.019)
Export	–0.004	–0.029	–0.051**	–0.029
	(0.025)	(0.022)	(0.023)	(0.023)
Import	–0.024*	–0.003	–0.010	–0.002
	(0.014)	(0.009)	(0.013)	(0.010)
Export-import	–0.052***	0.013	0.014	0.012
	(0.019)	(0.012)	(0.018)	(0.013)
Training	–0.011	–0.004	0.002	–0.025**
	(0.011)	(0.012)	(0.011)	(0.011)
GDP	–0.004	–0.023*	–0.006	–0.020*
	(0.008)	(0.012)	(0.007)	(0.012)
Unemployment	0.266**	0.428***	0.301***	0.325**
	(0.124)	(0.145)	(0.115)	(0.126)
Inflation	–0.038**	–0.050**	–0.039**	–0.046**
	(0.017)	(0.022)	(0.015)	(0.019)
Real effective exchange rate	–0.000	–0.000*	–0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Credit	–0.000	0.000	0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	–1.229**	–1.662***	–1.420***	–2.028***
	(0.528)	(0.614)	(0.491)	(0.541)
Observations	5,430	5,430	5,430	5,430
R-squared	0.495		0.564	
F-test	295.3(0.000)	5.883(0.000)	389.1(0.000)	7.639(0.000)

Table 4: *Determinants of Productivity Growth (Contd.)*

	Turnover		*Employment*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*
Breusch-Pagan test				
Number of Firms	905	905	905	905
Hansen test		1.708(0.635)		1.804(0.614)
m1		–5.564		–3.415
m2		0.453		–0.222 I
nstruments		31		31

*** significant at 1%, ** significant at 5%, * significant at 10%.
Note: Robust standard errors are in parentheses. Hansen is a test of over-identifying restrictions asymptotically distributed as χ^2 under the null of instrument validity with p-values reported in parentheses. m1 and m2 are the tests for first and second-order serial correlation in the first-differenced residuals, asymptotically distributed as N(0, 1) under the null of no serial correlation. Values in parentheses represent the p-values for the F test and Hansen test. Estimates include industry dummies, but are not shown. Nationality of ownership and industry dummy variables were dropped from the fixed effects models as these do not vary over time.

In relation to the macroeconomic control set, we observed negative GDP and inflation effects on productivity growth in both size models. The GDP result is similar to the GDP-turnover growth relation, while the inflation finding is robust across both FE and SYS-GMM model estimations. High inflation and increasing wage costs cause an erosion of competitiveness, with a consequent reduction in productivity growth. Also, in line with expectations, we find a negative REER effect in the estimated SYS-GMM turnover size model. This result indicates that declining competitiveness is associated with lower productivity growth, and backs up the inflation finding. Conversely, we observe a positive unemployment growth effect. This finding was robust to the size measure and estimation method used, and corroborates the positive unemployment growth effect previously found for turnover growth. Finally, the FE estimations reveal a positive credit growth effect in the employment size model.

Overall, the FE and SYS-GMM results suggest that firm characteristics such as size, initial level of productivity and industry growth rate are important for productivity growth in services firms. Additionally, both estimation methods confirm the importance of unemployment and inflation for productivity growth, with productivity likely to increase during periods of high unemployment and low inflation.

An investigation of the effects of determinants across the three performance indicators reveals some similarities. A negative size-growth effect was found

for all growth measures, with the largest effect found for employment growth. However, we find that the definition of size used in the analysis of productivity growth also matters, as a positive size-productivity growth effect is observed with the use of employment as a size measure. Industry growth had a larger positive effect on productivity growth relative to turnover growth, while trade, specifically importing and two-way trade, had a growth-enhancing effect on turnover growth only. Results indicate a positive training effect for employment and turnover growth – the training effect was more pronounced for employment growth. This is in contrast to the negative effect seen for productivity growth. In relation to the macroeconomic effects, GDP had a counter-cyclical effect on turnover and productivity growth, in contrast to a positive unemployment effect found for both growth variables. We find a smaller positive unemployment effect for turnover growth. Credit growth was observed to promote both employment and turnover growth.

4.3 *Tests of Robustness*

To assess the robustness of our results, we repeat our estimation approach in relation to employment and turnover growth for sub-samples of firms classified by firm size – SMEs *versus* large firms. A comparison of the results for SMEs, large firms and all firms (Table 5) indicates that while the effects of most firm characteristics, such as firm size and initial level of productivity, remain robust across all specifications, the impact of strategy and macroeconomic factors on firm growth does vary across size class. Furthermore, a weak nationality effect on employment growth was observed for SMEs. This suggests that indigenous firms are more likely on average to employ more workers. Table 5 also highlights substantial differences in the magnitude of parameter coefficients between SMEs and large firms.

Table 5: *Determinants of Growth in SMEs and Large Firms*

	Turnover Growth		*Employment Growth*	
	SMEs	*Large*	*SMEs*	*Large*
Size	–0.152**	–0.622***	–0.732***	–0.965***
Size squared	0.044***	0.044***	0.098***	0.067***
Labour Productivity	–0.330***	0.042*	0.054**	–0.011
Industry Growth	0.148***	0.263*	0.010	0.091**
Nationality	–0.012	0.024	–0.053*	–0.002
Training	–0.004	0.019	0.015***	0.007
GDP	–0.004	–0.003	–0.002	0.008*
Inflation	–0.019	0.001	0.009*	–0.011
Real Effective Exchange Rate	–0.000	0.000	0.000	0.000***

*** significant at 1%, ** significant at 5%, * significant at 10%.

4.3.1 Knowledge Intensity

To determine whether our results are driven by variations in knowledge intensity, we repeat the analyses of employment and turnover growth across sub-samples of firms classified by knowledge intensity (knowledge-intensive *versus* less knowledge-intensive). We define knowledge intensity in terms of technology intensity using the Eurostat definition based on NACE Rev. 1.1 2-digit code (Eurostat, 2015). The following NACE codes are defined by Eurostat as knowledge-intensive services: 61, 62, 64, 70-74 and 92.[11] Due to CSO confidentiality policy, 51 services firms in NACE code industries 61-64 were dropped from the analysis. Thus, analysis of knowledge intensity in services firms is based on a sample of 854 firms. Results are reported in Table 6.

Results are broadly similar to our previous findings. An inverse size effect was found for both knowledge-intensive services (KIS) and less knowledge-intensive services (LKIS) firms, with the largest effect seen in KIS firms. The initial level of labour productivity showed a positive effect on employment growth in both samples of firms – this effect was also more pronounced for KIS firms. Similarly, industry growth is important for turnover growth in both groups of firms, with a larger effect found for KIS firms. Investment in training was found to matter more for employment and turnover growth in LKIS firms, whereas this had a positive effect on turnover growth only in KIS firms. This finding suggests that the positive training-employment growth effect found in the larger sample was driven by the LKIS firms. A weak negative export effect was observed for turnover growth in LKIS firms only, which indicated that LKIS firms engaged in export activity show lower turnover growth. The results indicate that macroeconomic conditions are not important for turnover and employment growth when variations in knowledge intensity are taken into account.

4.3.2 Regional Variations

Next, we discuss our findings from the analysis of employment and turnover growth based on Nomenclature of Territorial Units for Statistics (NUTS 2) regional classifications.[12] This takes into account the influence of regional disparities on firm growth. For Ireland, there are two NUTS 2 regions – Border, Midland and Western (BMW) and Southern and Eastern (SE). We therefore, split the sample across both regions. Table 7 presents our results.

Again, the negative size-growth effect is confirmed across both regions, with a larger employment and turnover growth effect observed for firms in the BMW

[11] The knowledge-intensive industries are Transport, storage and communications (NACE 61-64), Real estate, renting and business activities (NACE 70-74); Recreational, cultural and sporting (NACE 92).

[12] Regional data for the services industry is only available at the NUTS 2 level.

Table 6: *Determinants of Employment and Turnover Growth by Knowledge Intensity*

	Turnover growth				*Employment growth*			
	Knowledge-intensive		*Less Knowledge-intensive*		*Knowledge-intensive*		*Less Knowledge-intensive*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*
Log turnover $_{t-1}$	–0.875***	–0.299***	–0.960***	–0.273***				
	(0.014)	(0.048)	(0.014)	(0.074)				
(Log turnover $_{t-1}$)^2	0.122***	0.040***	0.107***	0.031***				
	(0.002)	(0.006)	(0.001)	(0.009)				
Log employment$_{t-1}$					–0.950***	–0.700***	–0.956***	–0.407***
					(0.011)	(0.060)	(0.008)	(0.059)
(Log employment$_{t-1}$)^2					0.114***	0.075***	0.113***	0.044***
					(0.001)	(0.008)	(0.001)	(0.008)
Log labour productivity$_{t-1}$	–0.045***	–0.025	–0.035***	–0.013	0.036***	0.021*	–0.014**	0.015***
	(0.010)	(0.016)	(0.012)	(0.013)	(0.010)	(0.012)	(0.006)	(0.004)
Industry growth	–0.024	0.196*	0.125***	0.208***	0.013	–0.055	0.006	0.027
	(0.046)	(0.107)	(0.039)	(0.055)	(0.037)	(0.085)	(0.023)	(0.052)
Industry minimum efficient scale	0.000	0.001**	–0.001***	0.000**	0.001	–0.000	–0.000***	–0.000***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Nationality of ownership		0.017		–0.012		0.040		–0.024
		(0.031)		(0.020)		(0.037)		(0.021)
Location	–0.011	–0.052	–0.011	0.009	–0.018	–0.054	–0.006	0.004
	(0.038)	(0.035)	(0.042)	(0.010)	(0.030)	(0.035)	(0.025)	(0.010)
Export	0.024	–0.056*	0.012	–0.000	–0.005	–0.015	0.010	0.010
	(0.018)	(0.030)	(0.018)	(0.044)	(0.015)	(0.048)	(0.010)	(0.011)
Import	0.016	0.025	0.001	0.016	0.000	0.007	0.002	0.017
	(0.012)	(0.018)	(0.009)	(0.011)	(0.010)	(0.021)	(0.005)	(0.011)
Export-import	–0.010	–0.001	–0.004	0.040**	–0.009	0.020	0.001	0.014
	(0.016)	(0.026)	(0.013)	(0.017)	(0.013)	(0.030)	(0.008)	(0.012)
Training	–0.005	0.034**	0.016**	0.048***	–0.007	0.031	0.005	0.048***
	(0.009)	(0.017)	(0.008)	(0.013)	(0.008)	(0.020)	(0.004)	(0.011)

Table 6: *Determinants of Employment and Turnover Growth by Knowledge Intensity (Contd.)*

	Turnover growth				*Employment growth*			
	Knowledge-intensive		*Less Knowledge-intensive*		*Knowledge-intensive*		*Less Knowledge-intensive*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*
GDP	0.003	0.006	0.003	–0.000	0.003	–0.002	–0.003	–0.005
	(0.010)	(0.018)	(0.007)	(0.008)	(0.008)	(0.014)	(0.004)	(0.009)
Unemployment	–0.134	0.167	–0.078	–0.111	–0.071	–0.043	–0.002	–0.041
	(0.155)	(0.287)	(0.127)	(0.210)	(0.125)	(0.180)	(0.075)	(0.162)
Inflation	0.012	–0.006	0.019	0.026	–0.001	0.016	0.004	0.022
	(0.022)	(0.041)	(0.018)	(0.032)	(0.018)	(0.024)	(0.011)	(0.023)
Real effective exchange rate	0.002	0.002	0.003	0.006	0.001	0.002	–0.001	–0.002
	(0.003)	(0.006)	(0.002)	(0.004)	(0.002)	(0.004)	(0.001)	(0.003)
Credit	–0.000	–0.000	–0.000	–0.001	–0.001	0.000	0.000	0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Constant	1.712***	–0.478	2.031***	0.362	2.147***	1.546**	1.993***	1.127**
	(0.477)	(0.839)	(0.398)	(0.671)	(0.383)	(0.698)	(0.234)	(0.496)
Observations	1,374	1,374	3,750	3,750	1,374	1,374	3,750	
R-squared	0.842		0.754		0.953		0.891	
F-test	401.2	4.964	635.4	9.429	1529	18.37	1688	8.423
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of Firms	229	229	625	625	229	229	625	625
Hansen test		2.913		1.709		2.920		1.681
		(0.405)		(0.635)		(0.404)		(0.641)
m1		–6.131		–1.896		–3.796		–6.717
m2		0.208		–1.226		1.569		–0.261
Instruments		20		20		20		20

*** significant at 1%, ** significant at 5%, * significant at 10%.

Note: Robust standard errors are in parentheses. Hansen is a test of over-identifying restrictions asymptotically distributed as χ^2 under the null of instrument validity with p-values reported in parentheses. m1 and m2 are the tests for first and second order serial correlation in the first-differenced residuals, asymptotically distributed as N(0, 1) under the null of no serial correlation. Values in parentheses represent the p values for the F test and Hansen test. Nationality of ownership was dropped from the fixed effects models as this does not vary over time.

Table 7: *Determinants of Employment and Turnover Growth by Location*

	Turnover Growth				*Employment Growth*			
	BMW		*SE*		*BMW*		*SE*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*
Log turnover $_{t-1}$	–0.881***	–0.416***	–0.919***	–0.197***				
	(0.049)	(0.098)	(0.056)	(0.055)				
(Log turnover $_{t-1}$)^2	0.129***	0.067***	0.097***	0.026***				
	(0.011)	(0.013)	(0.008)	(0.006)				
Log employment$_{t-1}$					–0.903***	–0.757***	–0.970***	–0.498***
					(0.048)	(0.080)	(0.014)	(0.062)
(Log employment$_{t-1}$)^2					0.140***	0.102***	0.109***	0.052***
					(0.006)	(0.011)	(0.005)	(0.007)
Log labour productivity$_{t-1}$	0.023	–0.076*	–0.057***	–0.140***	–0.016	–0.028	0.003	0.079
	(0.044)	(0.042)	(0.021)	(0.053)	(0.020)	(0.107)	(0.012)	(0.061)
Industry growth	–0.035	0.082	0.086**	0.249***	–0.006	–0.041	–0.000	0.084
	(0.047)	(0.092)	(0.037)	(0.071)	(0.020)	(0.073)	(0.015)	(0.076)
Industry minimum efficient scale	–0.000	–0.000	–0.000*	–0.000*	0.000	0.000	–0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Export	0.018	–0.086	0.008	–0.020	0.001	0.013	0.005	–0.026
	(0.022)	(0.054)	(0.010)	(0.035)	(0.009)	(0.034)	(0.010)	(0.034)
Import	–0.012	–0.017	0.005	–0.014	0.003	–0.012	0.002	–0.020
	(0.011)	(0.020)	(0.007)	(0.033)	(0.008)	(0.024)	(0.005)	(0.036)
Export-import	–0.011	–0.046	–0.006	–0.028	–0.018	0.040	0.007	–0.053
	(0.014)	(0.072)	(0.010)	(0.049)	(0.016)	(0.069)	(0.006)	(0.055)
Training	0.016	–0.006	0.009	0.014	–0.012	0.016	0.002	0.028
	(0.016)	(0.020)	(0.006)	(0.019)	(0.009)	(0.021)	(0.003)	(0.017)
GDP	–0.010*	0.002	–0.007	–0.008	0.001	0.000	–0.002	–0.001
	(0.006)	(0.008)	(0.004)	(0.006)	(0.003)	(0.006)	(0.002)	(0.005)
Unemployment	0.046	0.198	0.057	0.156	–0.052	0.004	–0.038	–0.080
	(0.069)	(0.149)	(0.042)	(0.100)	(0.044)	(0.103)	(0.030)	(0.079)

Table 7: *Determinants of Employment and Turnover Growth by Location (Contd.)*

	Turnover Growth				*Employment Growth*			
	BMW		*SE*		*BMW*		*SE*	
	FE	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*	*FE*	*SYS-GMM*
Inflation	0.008	–0.030	–0.003	–0.017	–0.000	0.003	0.005	0.021**
	(0.017)	(0.018)	(0.006)	(0.012)	(0.006)	(0.013)	(0.004)	(0.009)
Real effective exchange rate	–0.000	–0.000	–0.000	–0.000	0.000	–0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Credit	0.000	–0.000	0.000	0.000	–0.000*	–0.000	–0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	1.131***	–0.825	1.647***	–1.316*	1.603***	1.258**	2.175***	0.654
	(0.321)	(0.602)	(0.219)	(0.679)	(0.290)	(0.545)	(0.179)	(0.608)
Observations	1,021	1,021	4,409	4,409	1,021	1,021	4,409	4,409
R-squared	0.741		0.777		0.941		0.922	
F-test	75.90	6.054	84.97	6.785	855.9	11.46	839.3	9.179
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Number of Firms	183	183	742		183	183	742	742
Hansen test		16.15		22.56		14.46		9.384
		(0.443)		(0.126)		(0.342)		(0.743)
m1		–2.200		–2.257		–1.981		–6.317
m2		–1.094		–0.067		0.246		0.235
Instruments		42		43		39		40

*** significant at 1%, ** significant at 5%, * significant at 10%.

Note: Robust standard errors are in parentheses. Hansen is a test of over-identifying restrictions asymptotically distributed as χ^2 under the null of instrument validity with p-values reported in parentheses. m1 and m2 are the tests for first and second order serial correlation in the first-differenced residuals, asymptotically distributed as N(0, 1) under the null of no serial correlation. Values in parentheses represent the p values for the F test and Hansen test.

region. This suggests that small firms located in the BMW region are, on average, more likely to create jobs and produce more output relative to firms in the SE region. The initial level of labour productivity matters only for turnover growth when regional differences are taken into account – similar to our previous findings, we find a convergence effect in both regions. This convergence effect, however, is more pronounced in the SE region suggesting that firms with initial low levels of labour productivity located in the SE experience higher turnover growth rates. Lastly, results from the regional analyses suggest that the positive effect of industry growth and inflation on employment growth and turnover growth respectively were driven by firms in the SE region. In line with results observed for technology intensity, we do not find macroeconomic effects when regional differences are considered.

V CONCLUSION

This paper analyses the determinants of firm growth in services firms in Ireland, using 2001-2007 firm-level panel data combined with macroeconomic variables. We add to the firm growth literature by developing a holistic multivariate modelling approach which relates firm growth to firm characteristics, firm strategy and the macroeconomic environment, and also considers multiple firm performance measures (growth in employment, turnover and productivity). Our sample period coincides with a cycle of variable macroeconomic conditions in the Irish economy – characterised by rapid credit growth, rising wage and price levels and the attendant loss of price competitiveness. The 2001-2007 period – when export-led manufacturing growth was in decline – represents a "tailing-off" of foreign direct investment activity; what is left is Ireland's indigenous economy. The credit-led, domestic demand-driven dynamic provides an interesting environment for the study of services firm performance. Our paper, therefore, provides much needed empirical evidence, and contributes to the sparse literature on the relationship between firm growth and prevailing macroeconomic conditions. This is even more pertinent for services firms which are frequently overlooked in empirical firm growth research, despite their significant economic contribution.

Our results suggest that the firm's starting quality, in terms of its initial size and initial level of productivity are essential for subsequent growth. This highlights the need for policies aimed at enhancing productivity in services firms. In terms of strategy, we find evidence that firms engaged in import activity and two-way trade have better turnover performance than firms which do not trade. Similarly, training has a positive effect on employment and turnover growth. Taken together, these findings suggest the need for policies

which incentivise firms to invest in trade and training activities. In line with the rest of the literature, our results show that small firms create more jobs and produce more output, suggesting a potential role for policies to support small firm development. The results remain robust even when regional and knowledge intensity variations are taken into account. Additionally, our approach promotes the efficacy of using multiple firm performance measures rather than single indicators in assessing performance outcomes in firms. Finally, future research should benefit from the availability of additional firm performance measures such as profitability and total factor productivity.

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APPENDIX

Table A1: *Mean Growth by Industry Sector*

Industry	*Obs*	*Employment*		*Turnover*		*Productivity*	
		Mean	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel (50)	504	0.016	0.154	–0.002	0.485	–0.018	0.484
Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)	1002	0.015	0.153	0.016	0.172	–0.037	0.19
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	888	0.038	0.249	0.022	0.163	–0.017	0.227
Hotels and restaurants (55)	1,122	0.004	0.256	–0.001	0.189	–0.011	0.259
Transport, storage and communications (60,62,63,64*)	306	0.017	0.195	0.022	0.313	0.005	0.319
Real estate activities (70)	66	0.014	0.232	–0.017	0.312	–0.02	0.379
Renting of machinery and equipment without operator and of personal and household goods (71)	78	0.036	0.162	0.004	0.145	–0.032	0.157
Computer and related activities (72)	108	0.011	0.446	0.002	0.278	–0.009	0.467
Research and development (73)	12	–0.018	0.069	0.005	0.129	0.022	0.106
Other business activities (74)	960	0.031	0.321	0.049	0.221	0.018	0.339
Recreational, cultural and sporting activities (92)	294	0.011	0.328	0.007	0.259	–0.004	0.347
Other service activities (93)	90	–0.014	0.341	0.032	0.354	0.046	0.485

Source: Authors' calculations from ASI dataset, 2001-2007.
Note: *Due to CSO confidentiality rules, NACE industries 60, 62, 63 and 64 are aggregated. Figures in parentheses are 2-digit NACE Rev. 1.1 codes.

Table A2: *Transition Matrix of Service Firms by Size Category*

Size at Beginning of Sample Period	*Size at End of Sample Period* 1-9	10-49	50-249	250+	Total
Transition of size by employment, 2001-2007:					
1-9	22	8	1	0	31
	(.71)	(.26)	(.03)	(.00)	
10-49	9	397	91	0	497
	(.02)	(.80)	(.18)	(.00)	
50-249	0	38	264	18	320
	(.00)	(.12)	(.83)	(.05)	
250+	0	1	3	53	57
	(.00)	(.02)	(.05)	(.93)	
Total	31	444	359	71	905

Note: The numbers in parentheses give the ratios of firms in the size class of the row that reached the size class of the column at the end of the given period. The numbers not in parentheses give the number of firms in each size class.

Table A3: *Mean Growth and Variability of Growth by Size Class*

	Size Class [a] *1-9*	*10-49*	*50-249*	*250+*
Employment Growth	7.4 (0.43)	2.2 (0.22)	0.90 (0.26)	1.4 (0.29)
	31	497	320	57
Turnover Growth	2.3 (0.22)	1.4 (0.27)	1.06 (0.23)	5.09 (0.23)
	31	497	320	57
Productivity Growth	–5.13 (0.48)	–0.82 (0.31)	0.09 (0.29)	3.72 (0.22)
	31	497	320	57

Source: Authors' calculations from ASI dataset, 2001-2007.
Note: [a] Size classification is based on initial size at the beginning of sample period, 2001.
[b] The figures given in parentheses correspond to the standard deviations of growth rates in each size category. The first row of numbers, not in parentheses, are the mean growth rates expressed as percentages, while the second row of figures represent the number of firms in each size class.