An Analysis of the Firm-Level Factors That Influence the Export Performance of Indigenous Irish Companies

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MEconSc April 2021

Acknowledgments

I would like to thank my supervisor Dr Stephen Weir for his guidance and assistance throughout the research process. I would also like to thank Dr Conor O’Toole for his advice. Thanks to my colleagues in the Enterprise Ireland policy department for their feedback and advice. Finally, I would like to thank my family for their support.

MEconSc April 2021

**A Dissertation submitted to the Institute of Public Administration,**

**in part fulfilment of the degree of MA.**

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**I affirm that this dissertation is my own work and that I have acknowledged any material I have used from other sources**

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# **Abstract**

Developing the export capability of indigenous companies has been one of the key objectives of Irish industrial policy for decades. The purpose of this paper is to provide an understanding of the factors which influence export performance at the firm level. An extensive literature review provides an overview of existing research on the determinants of firm-level export performance both in Ireland and internationally. Based on this review, five influential factors are identified which are prevalent in the literature: productivity, innovation, skill levels, export promotion policies and firm age / experience. Relevant variables are then selected as indicators for each of these areas based on company data from the Annual Business Review survey and from internal EI databases. Descriptive statistics are presented to outline the characteristics of companies in the two sectors and trends in some of the key indicators since 2010.

The methodology consists of an empirical analysis of annual company data from a sample of 2,780 client companies of Enterprise Ireland over a ten-year period from 2010 to 2019. The System GMM dynamic panel model is used to account for persistence in the dependent variables and potential endogeneity issues in the sample. The analysis is carried out separately for the manufacturing and services sectors and two distinct aspects of export performance are analysed separately; the scale of exports (total value of goods and services exported) and market diversification (number of markets which a company sells into).

The analysis identifies several strong relationships between the regressors and the two indicators of export performance:

* Expenditure on R&D is found to have a significant, positive effect on the scale of exports in both sectors while new product development has a positive effect on both scale and diversification for manufacturers.
* The analysis identifies no significant relationship between productivity levels and manufacturing exports and a small, negative relationship with services exports. Supports for capital investment are, however, found to have a positive impact on the scale of exports for manufacturers.
* There is limited evidence of a strong link between exports and average wage levels or expenditure on training. There is, however, some indication that services companies that pay higher wages tend to have larger exports, particularly in the ICT services sector.
* A large, positive relationship is identified between export performance, in terms of both the scale and diversification of exports, and services provided by the EI overseas offices. This suggests that these services are beneficial in helping companies enter new markets and grow their overall exports.
* A negative relationship is identified between firm age and export performance which is likely due to the large proportion of early stage, export-orientated companies in the EI client base.

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# **Introduction**

The economic benefits of exports are widely acknowledged, and export growth is particularly crucial for the economic development of small, open economies such as Ireland. At the macro level, export growth injects additional income into the domestic economy and increases aggregate demand which, in turn, leads to employment growth and increased tax revenue. Export growth has been a major driving force in Ireland’s recovery from the financial crisis over the past decade and can play a similar role in the coming years as the global economy begins to recover from the economic damage caused by the Covid-19 pandemic. At the firm level, exporting provides companies with access to larger end markets for their products and services, allows them to exploit economies of scale and fosters technological innovation in response to greater competition from abroad.

Irish industrial policy has, therefore, focused heavily on growing exports mainly through two channels; attracting foreign direct investment (FDI) into Ireland and developing the export capability of indigenous companies. This was not always the case as industrial policy in the first half of the 20th century prioritised self-sufficiency and various protectionist policies were implemented to achieve this objective such as high trade tariffs and limits on foreign direct investment. However, despite widespread economic growth throughout Europe and the US during the post war period in the 1950’s, Ireland suffered from prolonged economic decline with persistently high levels of unemployment and mass emigration. The severity of the situation led to a growing recognition of the failures of these protectionist policies and the publication of the ‘Economic Development’ report in 1958 marked a shift in industrial policy towards opening up the Irish economy to trade. The intervening decades saw a continued move towards open trade with Ireland joining the European Economic Council in 1973 and subsequent membership of the European single market.

While Ireland did achieve some success in growing exports during this time, concerns began to arise from the 1980’s onwards that the economy was becoming overly reliant on FDI while the performance of indigenous industries remained relatively stagnant. These issues were highlighted in several reviews of Irish industrial policy including the Telesis Report (National Economic and Social Council, 1982) and the Culliton Report (1992) both of which advocated for a greater commitment towards developing a strong base of indigenous firms in order to achieve sustained economic development and income growth. The increased scrutiny on the performance of indigenous enterprises ultimately led to the establishment of Enterprise Ireland (EI) which was formed in 1998 following the merger of several existing agencies including Forbairt and An Bord Trachtala. EI is the state agency with responsibility for supporting the development of indigenous companies in the manufacturing and internationally traded services sectors enabling them to compete internationally and achieve export growth. The agency takes a holistic approach to company development by working with companies to identify their needs in several areas of business performance such as sales and marketing, finance, and innovation and providing specific supports based on these requirements. EI provides a range of supports to promote internationalisation including in-market supports from a network of over 30 overseas offices located in various markets throughout the world.

Given the strategic importance to the Irish economy of developing a strong, internationally competitive base of indigenous exporters and the level of resources allocated towards achieving this objective, it is important to understand the factors which influence export performance at the firm level. This paper aims to address this question by analysing the influence of five distinct factors on firm level export performance; productivity, innovation, skill levels, export promotion policies and firm age. The analysis is carried out on firm level data from 2,780 EI client companies over the period from 2010 to 2019. This dataset is made up of various indicators of company performance which are gathered by EI each year in the Annual Business Review (ABR) survey. This includes sales, exports, employment, and payroll data as well as indicators of innovation including expenditure on R&D and sales generated from new products. These indicators are also combined with data from internal EI databases on the wide range of supports which client companies have received from the agency over that period including grant funding for capital investment and services provided by the overseas office network.

One of the main contributions of this paper to the literature on firm level export determinants is that it analyses two distinct aspects of export performance. The most commonly used indicators in existing empirical studies are export propensity, an indicator of whether a company exports or not, and export intensity, the proportion of sales generated from exports (Roper et al., 2006; ESRI, 2006). While these indicators are informative, they provide limited insight into the scale of export growth which companies achieve or the diversification of their export markets. In the ABR survey, annual export figures are provided at the market level and data is available on the number of markets which a company sells into in a given year along with the total value of those exports. It is, therefore, possible to analyse the impact of the regressors on both the scale of exports and the level of market diversification.

Another key feature is the broad range of relevant variables examined in the empirical analysis. Numerous studies have looked separately at the influence of different factors such as innovation, skill levels and productivity on firm level export performance. However, the unique structure of this dataset in terms of its size, length, and level of granularity allows for a wide range of factors to be examined together in the analysis. This granularity also makes it possible to include multiple relevant variables for each of these factors. For example: there are three variables related to innovation including an input indicator (expenditure on R&D), an output indicator (sales generated from new products) and an indicator which shows whether a company engaged in collaborative R&D projects.

The paper is structured as follows:

* **Section 2 - Literature Review**: An extensive review of the existing research on firm-level export performance both in Ireland and internationally. The review outlines five influential factors which are prevalent in the literature: productivity, innovation, skill levels, export promotion policies and firm age.
* **Section 3 - Data:** This section provides details on the sample for the econometric analysis and the data sources used. It also gives an overview of the Enterprise Ireland client base and the types of companies that are eligible to become EI clients.
  + **Section 3.1 - Variable Descriptions:** Descriptions of the variables used in the analysis. This includes an outline of the process and rationale for selecting relevant independent variables for each of the focus areas identified in the literature review as well as the dependent variables to represent export performance.
  + **Section 3.2 - Sectoral Characteristics and Trends:** Descriptive statistics which give insights on the characteristics of companies in the sample. This includes data on average company size, productivity, and innovation activities. The section also outlines trends in these variables from 2010 to 2019, the period covered in the analysis.
* **Section 4 - Methodology:** The methodology section describes several models which are commonly used to analyse panel data, their main features and the advantages and drawbacks of each model. It also outlines the steps taken to identify the appropriate model for this analysis based on the characteristics of the dataset as well as potential issues which can arise when analysing panel data.
* **Section 5 - Results:** The outputs of the analysis are presented in two separate tables for each of the dependent variables: the value of exports (intensive margin) and the number of export markets (extensive margin). The interpretation of these outputs is outlined below each table with commentary on the relationships identified between export performance and the regressors as well as comparisons with the findings of existing literature.
* **Section 6 – Conclusions:** The final section provides a summary of the main findings, the possible implications of these findings as well as potential areas for further research.

# **Literature Review**

Empirical analysis on the characteristics of exporting companies and the determinants of export performance has become increasingly prominent since the 1990s. Previous research tended to focus on macro-economic trade patterns and the characteristics of countries which influence their openness to trade. However, increasing levels of globalisation and greater availability of granular datasets has led to a growing body of literature that uses firm-level data to examine a wide range of variables which influence the export performance of individual companies. Early empirical studies have generally found that exporting firms tend to perform better than non-exporters across a range of performance indicators such as productivity, innovation, and wage levels. Many early studies analysed cross-sectional data to test the relationship between firm characteristics and export propensity or intensity at a particular point in time. Over time, more and more studies began to use longitudinal panel data to analyse the impact of those variables on a firm’s export performance over a particular period of time. The following review of the relevant literature outlines the factors which have been commonly identified as influencing export performance.

# **Productivity**

Much of the literature on firm-level export determinants has focused on the relationship between productivity and exporting. The two most commonly used indicators of productivity are labour productivity, which is often calculated as value added per employee, and total factor productivity, a measure of productivity which accounts for three factors of production: labour, capital, and intermediate inputs. Early firm level studies on the characteristics of American exporters by Bernard and Jensen (1999, 2001) identify a strong link between firm productivity and export participation. Their 1999 study, based on data from over 50,000 US manufacturing plants from 1984 to 1992, finds that exporters are significantly larger and more productive than non-exporters with a labour productivity differential of 12-24% (measured as value added per worker). However, while exporters are found to be more productive and have higher productivity growth prior to exporting, they find limited evidence of further productivity gains as a result of exporting. Following on from the publication of Bernard and Jensen’s influential papers, researchers from across the world began using micro data to analyse the relationship between firm characteristics and exports, with a particular focus on productivity. Wagner (2007) surveys the results of 45 such studies from 33 countries and finds that “with only a few exceptions, exporters are found to have higher productivity, and often higher productivity growth”. In other words, the most productive firms are most likely to export.

**Sunk Costs Theory:** One of the most common theories explaining the link between productivity and exporting is the ability of more productive firms to absorb the initial entry costs incurred when entering a new export market. These costs may include product development and modification, market research, distribution and marketing costs and costs associated with regulatory compliance. Sunk costs have been shown to be a significant influence on the decision to enter a new export market and the decision to continue exporting (Krugman 1988) (Dixit 1989). Roberts and Tybout (1997) were among the first to examine the impact of sunk costs on export propensity using firm level data. Their research, based on annual data from 1981-89 for a panel of Colombian manufacturing firms, found that “sunk costs are a significant source of export-market persistence” and that previous export history in a market has a positive and significant influence on current activity in the market. The presence of sunk costs acts as a barrier that only the most productive firms are able to overcome. The result of this, as noted by Greenaway and Kneller (2004) in their study of UK manufacturing firms, is that “self-selection takes place, with larger and more productive firms entering export markets, and firms have to become more productive to enter.” However, research by Lawless et al. (2017) on the export characteristics of Irish manufacturing firms suggests that market entry costs are not just an initial hurdle to overcome when a firm begins exporting but rather “there are ongoing hurdles or fixed costs associated with each new product introduced and each new export market entered.”

**Learning by Exporting:** As well as the impact of sunk costs which requires that exporters have higher ex-ante productivity, there is some evidence to suggest that the process of exporting can lead to subsequent productivity gains as selling on international markets exposes companies to greater levels of competition and can generate organizational learnings from more sophisticated buyer and market requirements. This necessitates high levels of efficiency in order to achieve economies of scale and can lead to greater productivity improvements as a result (Hansen 2010). However, Wagner (2007) notes that the empirical evidence for this “learning by exporting” theory is mixed with most studies finding no strong evidence of productivity gains. The International Study Group on Exports and Productivity (2008), which used firm level data from 14 countries and applied a consistent methodology, also finds limited evidence of productivity benefits from exporting.

**Empirical Analysis:** The impacts of market entry costs on export performance are modelled in Melitz’ research (2003) which provides a framework showing how “exposure to trade will induce only the more productive firms to enter the export market and will simultaneously force the least productive firms to exit.” The model also predicts that only the most productive firms can achieve significant export diversification and enter the least popular export markets. These findings are consistent with the previously mentioned sunk costs theory. Lawless and Whelan (2008) provide an assessment of this model based on firm level panel data from Irish firms including data on export destinations as well as firm characteristics. Their analysis shows that the prediction of a productivity hierarchy falls short of explaining the firm-market export patterns in their dataset and that “no single firm factor can explain the observed data on export market participation.” This suggests that, while exporters tend to have higher productivity than non-exporters, other firm-specific factors beyond productivity play an important role in determining firm export participation and level of export sales.

**Irish Context:** In addition to Lawless and Whelan (2008), several other studies have examined the firm-level determinants of export performance from an Irish perspective. Research carried out by the ESRI (2006) on a sample of 3,058 exporters in the Republic of Ireland (both domestic and foreign owned) finds that higher levels of labour productivity (measured as sales per employee) increase the likelihood that a firm exports and that exports make up a greater share of turnover. However, it should be noted that sales per employee does not account for intermediate inputs and is, therefore, more of an output indicator compared with other productivity measures.

An analysis of approximately 5,000 manufacturing firms based on data from the Census of Industrial Production from 1992 to 2005 by McCann (2009) produces several interesting findings. The analysis finds no evidence that exporters have higher ex-ante productivity levels (measured as total factor productivity) than firms which remain domestically focused. It is suggested that this could be due to Ireland’s history of interventionist trade promotion policies aimed at helping companies to enter new export markets. This may allow firms to overcome the entry costs of exporting and “help firms who would not have been productive enough in a Melitz-style laissez-faire world to enter international markets.” The analysis does, however, provide evidence in support of the learning by exporting theory as “becoming an exporter significantly increases total factor productivity”, significant for up to four years after entry. This is in contrast with the generally inconclusive findings of international research and the author suggests that this could be due to firm productivity being hampered by the relatively small size of the domestic market prior to exporting. The final finding is that firms which stop exporting experience an almost equal and inverse result compared to new exporters which “suggests a role for policy in encouraging firms to continue to export.”

**Hypothesis:** Overall, it is expected that there is a positive relationship between productivity levels and export performance. However, while this positive relationship has been widely identified in the international literature, the evidence from empirical studies of Irish firms is relatively mixed. Similarly, it is expected that companies which undertake projects aimed at increasing production capacity and improving efficiency will experience subsequent benefits in terms of increased exports.

# **Innovation**

The relationship between innovation and export performance has also received a lot of attention in the literature on firm level export determinants. Innovation is defined by the OECD (2018) as “a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)” with the overall objective of generating a competitive advantage and improving firm performance. The majority of the research to date has looked at the link between exporting and product innovation which involves the introduction of new goods and services or significant changes to the characteristics or intended uses of existing products. A wide range of measures are used in the literature as indicators of firm level innovation. These measures generally fall under two categories: input measures, such as R&D expenditure, R&D intensity and employment in R&D departments, and output measures including sales generated by new products, number of patents held, as well as bespoke indicators of process innovations. Empirical studies on the firm level impact of innovation activities have had some mixed results and Van Beveren & Vandenbussche (2010) note that the findings of these studies may depend on the types of innovation measures used. However, product innovation is consistently shown to have a positive impact on export performance. This manifests itself in the supportive policy measures, such as tax credits and grant funding for R&D projects, which are commonplace in many countries to incentivise and support companies to undertake innovation.

Early research in international trade theory such as the technology gap theory, developed by Posner (1961) and expanded on by the product life cycle theory (Vernon, 1966), allude to the importance of innovation for companies entering new markets. These theories suggest that patterns of international trade are determined by a continuing process of innovation and technology transfer. Through product innovation firms can increase the variety and quality of products and enhance their attractiveness to customers. This allows them to generate a competitive advantage on international markets. Micro-economic studies analysing firm level data have also identified a strong link between innovation activity and exporting. Bernard and Jensen (1999) find that the introduction of new products has a significant positive effect on export probability among American manufacturers.

**Firm Level Empirical Studies:** Love and Roper (2002), building on earlier research from Wakelin (1998), examine the links between innovation and exporting using firm level data from 1,700 UK manufacturing plants and 1,300 German plants. Different variables are used to represent the inputs (a dummy variable for in-house R&D department) and outputs (new products introduced) of innovation as well as the possibility of regional, sectoral or supply chain spill overs or benefits accrued as a result of proximity to innovative firms. They find that “Product innovation, however measured, has a strong effect on the probability and propensity to export in both countries” and that innovative UK firms are more likely to experience spill over benefits of innovation undertaken elsewhere. Gourlay et al. (2005) study the determinants of export behaviour for a panel of over 1,000 UK service firms for the period 1988 to 2001 using R&D intensity (R&D expenditure as a percentage of sales) as an indicator of innovation, and find that R&D intensity has a strong positive effect on both the probability and intensity of exporting, “R&D intensity, we find a positive impact on export probability, thereby supporting technology and proprietary based explanations of exporting.”

Positive links between innovation and exporting have also been observed in various other countries. Becker and Egger (2013) examine the impacts of product and process innovations on the export propensity of over 1,500 German manufacturing firms. Using a propensity score matching approach to account for endogeneity issues, they find that “there is a strong, positive role to play for product innovation for a firm’s propensity to export.” Process innovation alone is not found to have a significant impact on export propensity. In a similar analysis of Spanish manufacturing firms, Caldera (2010) finds that both product and process innovation increase firm’s propensity to export. However, other empirical studies, such as Van Beveren and Vandenbussche (2010) using data for Belgian firms and Damijan et al. (2010) for Slovenia, find no significant effect of either product or process innovation on export propensity at the firm level.

**Effects on the Intensive Margin of Exports:** While there is a vast body of literature examining the impact of innovation on the extensive margin of exports by looking at export participation and entry/exit into markets, there has been less focus on the intensive margin; that is changes in the value of exports to existing markets. This is despite the fact that several studies analysing country level trade data have found that the majority of trade growth in recent decades is due to the intensive margin rather than the extensive margin (Felbermayr and Kohler, 2006; Helpman et al., 2008). Elliott et al. (2020) analyse firm level data from a panel of French manufacturing firms for the period of 1999 to 2007 to investigate the effects of innovation on both the extensive and intensive margins of exports. They find that R&D expenditure has a positive and significant impact on total exports with this increase being primarily driven by the intensive margin. On the other hand, they find limited evidence that innovation leads to an increase in total exports through diversification into new markets (the extensive margin). “By innovating and replacing obsolete products with new ones, innovating exporters are able to maintain their market shares in foreign markets while non-innovators see their exports falling.” Tavassoli (2018) and D’Angelo (2012) also provide evidence of the positive effects of product and process innovations on export intensity for Swedish and Italian firms respectively.

**Collaborative Innovation:** Over the past twenty years, there has been a rapid growth in the number of studies examining the benefits of open or collaborative innovation at the firm level. Various definitions have been put forward but, broadly speaking, collaborative innovation refers to firms engaging with external actors in research projects. Industry networks and research partnerships with third level institutions are the most common forms. Cooperative arrangements can improve the innovation performance of firms by allowing them to share the costs and reduce the risks of undertaking research and providing access to expertise and equipment that may not be available internally. Research on external innovation linkages of Irish manufacturing plants based on data from 1994-2008 by Vahter et al. (2014) finds that, although large firms are more likely to be engaged in collaborative R&D, the benefits in terms of improved innovation performance are proportionately more important for small firms. Ganotakis and Love (2011) examine the effects of collaborative innovation on the export propensity of UK firms in high-tech industries and find that firms with “commercial collaborative agreements are more likely to export.” D’Angelo (2012), using panel data on Italian manufacturing SMEs, finds that external R&D linkages, particularly with universities, have a positive influence on firm’s export intensity and suggests an important role for public policy in supporting collaborative research programmes.

**Effects of Exporting on Innovation:** In addition to the effects of innovation on exporting, there is also some evidence that causality may run from exporting to innovation. Exporting can lead to increased innovation activity at the firm level through a ‘learning by exporting’ effect, as mentioned earlier in the context of productivity improvements. In a study of Spanish manufacturing firms, Golovko and Valentini (2011) find that exporting leads to improved innovation performance. At the same time, firms can grow exports through innovation with new and improved products. Girma et al. (2008) investigate this possible two-way relationship between exports and R&D among UK and Irish firms using dummy variables for R&D expenditure and exports and controlling for other variables such as firm size and average wages. They find that past R&D activity plays a major role in determining the probability of exporting for Irish firms while domestic Irish exporters also benefit from “large and significant direct learning-by-exporting effects” where previous exporting experience leads to increased R&D activity. UK firms, on the other hand, show no significant effects of previous exporting on innovation. There are several possible reasons for the apparent presence of this learning-by-exporting effect in Irish firms. Higher R&D intensity among Irish firms may indicate that they have “higher absorptive capacity to assimilate the knowledge that is being transferred from exporting.” Ireland is also a small, highly specialized economy and, therefore, exposure to larger, more sophisticated markets may be more likely to impact on a company’s future innovation activities and pipeline of products under development.

**Irish Context:** Several studies have examined the effects of R&D and innovation on firm level export performance from an Irish perspective. Firm level analysis on the determinants of export propensity and intensity by the ESRI (2006) shows that R&D active firms (using internal employment in R&D as a measure of R&D activity) are more likely to export and tend to export a larger share of their output. Lawless et al. (2017) produce several interesting findings in their study of the trade patterns of Irish manufacturing firms which uses a dataset of highly granular product-destination data and enterprise characteristics. They find that exporting is highly dynamic with continuing exporters showing high levels of entry and exit in both products and destinations and that, while short term changes in export volumes are driven by existing product-market combinations, “in the long run the drivers of export growth are expansion of market and product portfolios.” This highlights the importance of product innovation and market diversification to enable firms to be flexible in the face of changing market conditions and achieve long-term export growth.

**Hypothesis:** There is a positive relationship between firm level export performance and the three indicators of innovation; R&D intensity, new product development and engagement in collaborative innovation.

# **Skill Levels**

**Exports and Average Wage Levels:** The literature on firm level determinants of export performance has largely focused on the impact of observable, quantifiable firm characteristics, such as firm size, productivity and R&D intensity, rather than those factors that are more difficult to identify and measure. One such factor, which has received limited attention in empirical studies to date, is the link between exports and labour inputs including both the characteristics of senior management and of the wider workforce. Average wages are often used as a proxy for the skill level of a firm’s workforce and several empirical studies have found that exporters tend to pay higher wages than non-exporters (Bernard and Jensen, 1999; Brakman et al., 2020). Schank et al. (2010) use granular employee-employer data to examine the direction of causality in the export-wage relationship among German firms and find that “the exporter wage premium does already exist in the years before firms start to export, and that it does not increase in the following years.” Munch and Skaksen (2006) show that this positive link between exporting and wage levels can even be found after controlling for heterogeneity among employees in Danish firms. They argue that this disparity is due to higher skill intensities among exporters which allows them to differentiate their products and compete on international markets. On the other hand, the ESRI (2006) find no strong evidence that average wages have an effect on either the likelihood of exporting or export intensity among Irish firms.

**Management Characteristics:** As well as the general skill levels in a workforce, management structures and the individual characteristics of senior managers can have a significant influence the export performance of a firm (Leonidou et al. 1998; Lloyd-Reason and Mughan 2002). Bloom et al. (2018) examine the role of management practices in export performance using plant level data on production, management practices and trade from a large sample of US and Chinese manufacturers. Their analysis shows that, in both countries, firms with more effective management practices are more likely to export and “sell more products to more destination countries and earn higher export revenues and profits.” They propose that “superior management enables firms to use more sophisticated, higher-quality inputs and more complex assembly technologies that increase output quality.”

Sala and Yalcin (2012) use a matched employee-employer dataset of over 9,000 Danish manufacturing firms from 1999 to 2006 which combines firm statistics such as sales, exports and value added with employee characteristics such as salary, education level and age. Overall, they find that managerial characteristics have a significant influence on export propensity. In particular, having a manager with previous export experience increases the likelihood of exporting. Mion and Opromolla (2013) provide further evidence of the transfer of export knowledge through the labour market in their analysis on a similar sample of Portuguese firms. Their dataset has a further degree of granularity in that it contains information on the specific markets in which managers have previous experience. They find that (after controlling for other potentially influential factors such as productivity and R&D) having a manager with previous experience in a specific market increases the likelihood of entering/staying in that market and increases the value of existing exports to the market by 20-69%. This implies that there is substantial value in having a manager with relevant contacts in the market as well as experience and knowledge of the market including the regulatory, tax and import requirements.

**Impact of Training:** Despite the evidence that staff skill levels and management characteristics can have a significant influence on firm export performance, there have been relatively few studies on the effects that staff training may have on exporting. Various studies have identified the positive impact of educational outcomes on export performance at the macro level (Chuang, 2000; Contractor and Mudambi, 2008). However, empirical studies on the firm level effects of investment in human capital are rare. Konings & Vanormelingen (2015) and Dearden et al. (2005) find that investment in staff training leads to increases in firm productivity. Dostie (2020) reviews and summarises the findings of empirical research on the returns of firm-sponsored training of employees. He finds that “firm-sponsored training helps employees acquire new skills and adjust to organizational and technological change. It also in turn leads to higher wages, improved firm-level productivity, and better firm-level innovation performance.” Blyde (2016) is one of the only empirical studies to examine the effects that staff training has on export status. The author uses firm level data on Chilean manufacturers and finds that providing training to a higher proportion of employees increases the probability that a firm becomes an exporter. This effect is larger when training is provided continuously and when more resources are committed to it.

**Hypothesis:** Export Performance is positively related to average wage levels, which are used as a proxy for workforce skill levels, and expenditure on staff training.

# **Export Promotion Policies**

Government-funded export promotion policies (EPPs), designed to help domestic firms succeed in export markets, are common throughout the world and almost universal in developed countries. Public support for export promotion is based on the idea that growth in exports will lead to subsequent benefits for society through increased employment, earnings and tax revenues as well as other intangible effects such as transfer of technology and management knowledge from export destinations (Brewer, 2009). It is, therefore, argued that the benefits will outweigh the costs of government expenditure. EPPs are often used to address the market failure of asymmetric information. This occurs where firms do not have the resources to cover the costs associated with gathering foreign market information and are, therefore, at a disadvantage when selling in those markets (Lederman et al. 2010). Export promotion policies can include a wide range of supports but are generally defined as a set of activities to help firms overcome trade barriers when entering a new market or expanding in existing markets (Van Biesebroeck et al. 2016). Provision of market information around consumer preferences, business opportunities, quality and technical requirements etc. is one of the most common and important elements of export promotion policies. Other activities include disseminating information on domestic firms’ products and services, assisting firms to participate in international marketing events such as trade fairs, and identifying relevant contacts for firms entering a new market such as distributors and regulatory officials or partners. These activities are often carried out in-market by a network of overseas offices or through embassies/consulates.

**Empirical Analysis of Export Promotion Policies:** The increase in the number of export promotion agencies and the level of resources allocated to them in recent decades has led to a corresponding growth in empirical studies of the effectiveness of EPPs in driving export growth at the firm level. Van Biesebroeck et al. (2016) provide a comprehensive overview of 21 empirical studies covering 16 countries. These studies are all based on firm-level data and matching techniques such as propensity score matching are commonly used. Overall, they conclude that “almost all studies find a positive and significant effect of export promotion support on firm-level exports.” These effects are particularly large at the extensive margin where firms are entering a new export market or introduce a new product for the first time. There is little evidence to suggest that EPPs encourage non-exporters to begin exporting. However, in many cases the main policy objective of EPPs is to provide support to existing exporters rather than targeting non-exporters in the domestic market. Volpe Martincus & Carballo (2010) find evidence that export promotion policies are more effective when bundled and provided on an ongoing basis throughout the exporting process rather than as isolated supports. Despite the abundance of international research on the topic, empirical analysis on the firm level effects of Irish EPPs has been relatively limited to date.

**Hypothesis:** There is a positive relationship between export performance and export promotion policies which includes in-market, advisory supports and funding supports for firms to conduct market research and develop market entry strategies.

# **Firm Age/Experience**

Love et al. (2016) highlight a lack of consensus regarding the role of firm age on export performance and that the literature is characterised by a contrast between two theories of internationalisation. The first theory is the process or stages approach, originated by Johanson & Vahlne (1977), which focuses on the “gradual acquisition, integration and use of knowledge about foreign markets and operations, and on the incrementally increasing commitments to foreign markets.” In this theory, companies first establish their position in the domestic market and then grow their international presence gradually, learning from their experience along the way. There are, however, some limitations with this theory, for example; it does not account for the potential to acquire export experience and market knowledge through the labour market as mentioned previously. It is also possible that flexibility and openness to new knowledge decreases with age as managerial routines are established and organisational rigidities develop. As a result, older firms may not take full advantage of the learning potential from international experience. On the other hand, the ‘Born Global’ theory of early internationalisation, which came to prominence in the mid 1990’s (Oviatt & McDougall, 1994), outlines how some small, technology-orientated firms are internationally focused from their inception. Autio et al. (2000) argue that born-global firms can internationalize quickly because of a lower degree of organisational inertia. They propose that, “as firms get older, they develop learning impediments that hamper their ability to successfully grow in new environments and that the relative flexibility of newer firms allows them to rapidly learn the competencies necessary to pursue continued growth in foreign markets.”

Given the contrasting theories in the literature, it is not surprising that empirical studies on the impact that a firm’s age has on their export performance have produced mixed findings. Majocchi et al. (2005) find a positive and robust relationship between firm age and export performance among Italian manufacturing SMEs, arguing that their results “tend to confirm the idea that small firms need time to develop necessary experience of the market in order to export successfully.” However, a subsequent study by Brancati et al. (2018) finds that firm age does not have a significant impact on the export propensity of Italian firms. Love et al. (2016) take a different approach by distinguishing between firm age (the number of years since the firm was established) and export experience (the number of years that the company has been active in overseas markets), two variables that are often conflated in the literature. They find that firms with greater levels of export experience tend to have higher export intensity and greater diversification (measured as the number of markets and geographic regions served). On the other hand, firm age is found to have an insignificant effect on export diversity and a negative effect on export intensity after international experience is taken into account. From an Irish perspective, Roper et al. (2006) find a higher export propensity among younger manufacturing firms. Mac an Bhaird and Curran (2016) also find an inverse relationship between age and export intensity among Irish SMEs. This effect is particularly strong in the computer software sector with the authors proposing that “despite a lack of resources typical of young firms, knowledge-based firms in the services sector have fewer barriers to exporting and greater ease of access to foreign markets than manufacturing firms.”

**Hypothesis:** Firm age is negatively related to export performance; this effect is larger among services firms.

# **Data**

Data for the econometric analysis is largely taken from the Annual Business Review (ABR) survey which is carried out on an annual basis by Enterprise Ireland and contributes to the Department of Enterprise’s Annual Business Survey of Economic Impact (ABSEI) report. The survey population is made up of client companies of EI which are predominantly Irish-owned, export orientated companies in the manufacturing and internationally traded services sectors (as specified in the Service Industries Order 2010) with 10 or more employees. The client base also includes a small cohort of domestically focused companies with little or no exports as well as High Potential Start Ups (HPSUs) which have received funding from EI. HPSUs are defined as internationally focused companies with the potential to employ at least 10 persons and to generate revenues of at least €1million within 3 years of receiving investment from EI. The ABR survey collects company information such as sales, exports and employment including detailed, market-level export data. It also provides data on companies’ innovation activities such as R&D expenditure and R&D employment as well as data on different types of expenditure such as payroll and materials costs.

In addition to the ABR survey, Enterprise Ireland maintains a database with records of all funding provided to client companies since the agency’s foundation in 1998. This includes support for various types of activities/investments including market research, projects to enhance productivity and funding for research & development. The database provides details on the purpose of the funding, the type of grant provided and the amount of funding which was approved, paid out and cancelled. This allows the wide range of funding supports offered by EI to be grouped under broad thematic headings.

The sample used in the econometric analysis consists of an unbalanced panel of 2,780 companies with data from 2010 up to 2019. On average, companies in the dataset have responded to the ABR survey in 7 of the last 10 years. There is, therefore, a level of attrition which causes companies to stop reporting or drop out of the survey population from year to year. This is largely due to the fact that the average response rate to the survey has been around 65% each year with a cohort of companies that have responded sporadically over this period. In addition, there are 212 companies that have been liquidated or dissolved since 2010 according to information from the Company Registration Office (CRO). On the other hand, there are 148 companies which have been transferred out of Enterprise Ireland into the client base of the Industrial Development Agency (IDA) in the last 10 years. This occurs where a client company has been acquired by a foreign-owned multinational or their ownership has been moved out of Ireland. These companies tend to be strong performers with high growth in sales and exports in the years prior to being acquired. Finally, there are 404 companies that were established after 2010 according to their CRO registration date.

It is important to note that, given the criteria required to become a client company of Enterprise Ireland, the sample used for this analysis is not representative of the entire indigenous enterprise base. In particular, the majority of micro enterprises with less than 10 employees as well as companies in sectors such as retail and tourism are not eligible to become EI clients. According to CSO statistics on Exporting Enterprises in Ireland, there were 9,167 domestically owned exporters in 2017 with combined exports of €51 billion. The EI client base, on the other hand, is comprised of approximately 3,300 companies with exports of €22.7 billion in 2017 - 45% of the total for domestically owned exporters. The sample is, however, broadly representative of the EI client base.

# **Variable Descriptions**

The purpose of this study is to examine the influence of a range of factors on the export performance of indigenous Irish companies. Much of the existing literature has focused primarily on examining the characteristics of exporters relative to non-exporters as well as export intensity, the proportion of exports relative to total sales (ESRI, 2006; Bernard and Jensen, 1999). This study, on the other hand, examines the export performance of companies in terms of both the total value of exports (the intensive margin) and the number of markets which a company sells to (the extensive margin). Felbermayr and Kohler (2006) outline the distinction between intensive and extensive margins of trade between countries in their study on the growth of manufacturing trade throughout the latter half of the 20th century. “Where a bilateral trading relationship already exists, it may increase through time (intensive margin). But trade may also increase if a trading bilateral relationship is newly established between countries that have not traded with each other in the past (extensive margin).” In the context of individual companies, the intensive margin of exports can be viewed as increases in the value or quantity of goods traded while entry into new markets represents growth at the extensive margin. A similar approach is adopted by Elliott et al. (2020) in their analysis of the effects of innovation on the intensive and extensive margins of exporting among French manufacturers.

Therefore, for the purposes of the econometric analysis, two measures of export performance are examined as the dependent variables in separate multivariate regressions. Firstly, the overall value of exports is used as an indicator of the intensive margin with a large proportion of growth due to increases in the value/volumes of sales to existing markets. The extensive margin is represented by the total number of export markets which a company sells to each year. A €25,000 minimum threshold is applied in determining the number of export markets. The reason for this is to ensure that markets are only counted where there are sustained sales and one-off or sporadic, small scale exports to new markets are excluded. It should be noted that the export data in the ABR survey measures total sales from Irish operations. Any sales from overseas operations or foreign-based subsidiaries are not included in the total export figures. In any case, there are a relatively small number of client companies with significant overseas operations.

The econometric analysis examines the relationship between two dependent variables and a range of independent variables (also known as regressors) which are selected to represent each of the thematic areas identified in the literature review. These independent variables can take two forms:

* Continuous variables are numerical values which vary over time; and
* Binary (or dummy) variables which take the value of 1 or 0 and are used to indicate the presence of a particular characteristic/treatment in a given year.

**Productivity:** Productivity has been studied widely in the literature as a determinant of export performance. Despite this, there is no clear consensus on the most appropriate indicator of firm level productivity. A variety of different measures have been used in previous studies including sales per employee (ESRI, 2006) and total factor productivity (Arnold and Hussinger, 2004). Value added per employee is perhaps the most widely used indicator in the literature (Bernard and Jensen, 1999). The UK’s Office of National Statistics (ONS) also uses it as a measure of firm level productivity and it is, therefore, adopted for this analysis. Value added (VA) per employee is calculated as sales minus services costs and materials costs associated with production divided by total employment. An additional variable is also included which indicates whether a company has received funding from Enterprise Ireland to support projects aimed at increasing capacity and enhancing productivity. This includes funding under the Capital Investment Initiative which provides grant support of up to €250,000 for the acquisition of new capital equipment and technologies. It also includes support for LEAN projects which involve an extensive training programme aimed at improving productivity within the company by establishing and embedding continuous improvement systems and behaviours.

**Innovation:** Innovation is a broad term which can refer to a wide range of activities and processes and so it is appropriate to analyse several aspects of innovation including both input and output indicators. The econometric analysis will, therefore, examine three innovation related indicators: R&D spend, new product development and collaborative R&D.

* R&D spend is an input indicator which measures company’s total annual expenditure on in-house and outsourced R&D. This figure includes all costs included in the European Commission’s definition of R&D; “creative work undertaken on a systematic basis using scientific and technological means to create new and improved products, processes, services and other applications.”
* The new product development indicator is based on a question in the ABR survey which asks companies the proportion of their annual sales which were accounted for by products/services introduced by the company in the last 3 years. The indicator is a binary variable which equals 1 if the company has introduced new products in the previous 3 years.
* The third variable related to innovation activity is a binary variable which is based on company engagement in several forms of collaborative innovation. This includes companies receiving Innovation Vouchers/Partnerships which provide funding to undertake collaborative research with Irish research institutes with the aim of developing new and improved products, processes, or services. It also tracks company’s engagement with various Technology Centres, funded by EI and IDA, which allow Irish companies and multinationals to work together on market focused strategic R&D projects in collaboration with research institutions.

**Skill Levels:** Several studies have shown that staff skill levels can have an influence on the export performance of a firm. Skill levels can be difficult to quantify and a variety of indicators have been used in the literature. For example, Roper et al. (2006) analysed the determinants of export performance of approximately 1,500 manufacturing firms on the island of Ireland based on data from 1994 to 1999. They used the proportion of a company’s workforce which have a third level degree as an indicator of skill levels and found that “plants with more highly skilled workforces - particularly more graduate employees - tend to be more successful in export markets”. Similarly, studies analysing the impact of company management on export outcomes, mainly for small companies, often include specific managerial characteristics such as education and pervious experience (Lloyd-Reason and Mughan, 2002).

Unfortunately, this level of detailed information on staff education levels or managerial characteristics is not available from the ABR/AES surveys. Instead, the average wage level, measured as total payroll costs divided by total employment, is used as a proxy indicator for the general skill level of the workforce, an approach that has also been adopted in previous studies such as ESRI (2006). In addition, the ABR survey collects data on companies’ annual spending on training provided to management and staff. This includes the costs of formal, structured training provided both internally and off-site. Costs associated with apprenticeships and on-the-job training are not included. Companies’ annual expenditure on training is included in the analysis as an indicator of a company’s level of investment in skills development.

**Export Promotion Policies:** Export promotion is one of the main responsibilities of Enterprise Ireland and the agency provides a wide range of supports for companies seeking to grow their presence in existing export markets and expand into new markets. This includes a variety of funding supports administered in Ireland and in-market supports provided through a network of overseas offices in 40 international locations, or through a network of trade consultants in markets where EI does not have an office. For the purposes of this analysis, two composite indicators are generated to reflect both funding supports and in-market, soft supports provided by the EI overseas office network. Firstly, the export promotion funding indicator is based on whether a firm received funding from EI for market research and internationalisation (above a minimum threshold of €15,000). Examples of these supports include the Strategic Marketing Review Grant in which companies undertake an extensive review with an external consultant to identify and address persistent challenges and untapped opportunities that are impacting on their export growth, the Market Discovery Fund which aims to incentivise companies to research viable and sustainable market entry strategies in new geographic markets and the e-Marketing Improvement Assignment which supports companies to develop and enhance their capability to use digital channels as an effective strategy for business development.

The second export promotion variable is based on a set of key performance indicators gathered by EI to measure the level of engagement between the overseas offices and client companies. These KPIs cover a range of services and advisory supports provided by staff in the overseas offices. Some of these services are primarily aimed at companies entering into new markets, for example; there is a metric which tracks when market information has been provided to a client company and another metric which records visits by companies to a new market where EI was involved in setting up an itinerary. Other metrics are related to activities which may take place in either new or existing markets such as client buyer introductions in which EI brokers initial meetings between client companies and prospective customers. For the regression, a binary variable is generated which indicates whether or not the company availed of the services provided the EI overseas office network in a given year.

Lastly, firm age (based on the year in which a company first registered with the CRO) is included as an independent variable to examine the influence that experience levels have on export performance. In addition to the independent variables outlined above, annual sales are included as an independent variable to control for company size. Table 1 below provides a full summary of variables included in the analysis.

**Table 1: Summary and descriptions of dependent and independent variables**

|  |  |  |
| --- | --- | --- |
| Focus Area | Variable Name | Variable Description |
| Dependent Variables | Export Values  (Intensive Margin) | Total value of goods and services exports. |
| No. Export Markets (Extensive Margin) | The number of markets which a company exports to in the year. |
| Productivity | Value Added per Employee | A measure of productivity, calculated as sales less materials and services costs divided by total employment. |
| Capital/LEAN | Company received funding from EI for capital investment or projects aimed at improving productivity. (Dummy variable) |
| Innovation | R&D Spend | Total annual expenditure on Research and Development (including both in-house and outsourced) |
| New Product Sales | Company generated sales from new products which were developed in the last 3 years. (Dummy Variable) |
| Collaborative Innovation | Company engaged in collaborative research projects with external entities such as 3rd level institutions and industry-led networks. (Dummy Variable) |
| Skill Levels | Average Wages | Total payroll costs divided by total employment. Indicator of staff skill levels. |
| Training Expenditure | Annual expenditure on formal, structured training excluding on-the job training. |
| Export Promotion | Export Promotion Funding | Company received support from EI to conduct market research or review/develop their export strategy. (Dummy variable) |
| Overseas Office Support | Company received support from the EI overseas office network. (Dummy Variable) |
| Firm Age/ Experience | Firm Age | Number of years since the company was established, based on CRO registration date. |

# **Sectoral Characteristics and Trends**

This section outlines descriptive statistics which provide a detailed insight into the characteristics of the companies in the sample. This includes a broad range of indicators such as turnover, employment, average wages, and R&D expenditure. It shows trends in several key indicators such as average exports and R&D intensity from 2010 to 2019, as well as breakdowns by NACE sector and company size categories (based on annual turnover and employment). The sample contains 2,780 companies across a range of sectors. For the purposes of the econometric analysis, companies are divided into manufacturing and services sectors:

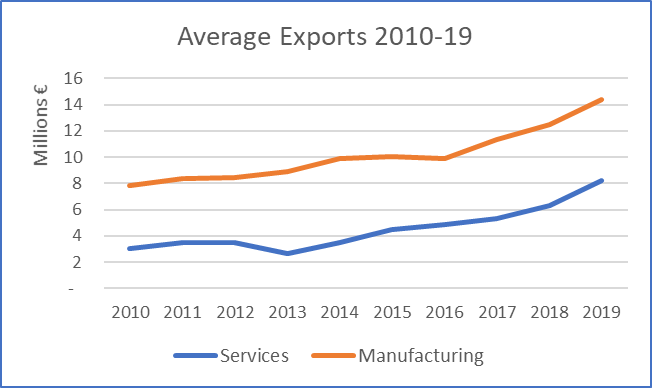
* **Manufacturing** (NACE Codes 01-33): there are **1,387** manufacturing companies in the sample. This includes manufacturers of a wide range of products such as food products, fabricated metal products, machinery and equipment, electrical equipment, pharmaceutical products, medical devices, and construction materials.
* **Services** (NACE Codes 35-52,58-86): there are **1,393** services companies in the sample. The majority of companies are in ICT Services and ‘Computer Programming and Related Activities’, which mainly consists of software companies, is the largest sector accounting for 534 companies. Other sectors include engineering services and professional, scientific, and technical services.

**Table 2: Sectoral characteristics based on 2019 figures**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sectors** | **No. Firms** | **Average Sales (€000s)** | **Employees** | **Export Intensity** | **No. Export Markets** | **R&D Intensity** | **New Product %** | **VA per Employee €** | **Average Wages €** |
| **Manufacturing** | 1,387 | 26,058 | 78 | 41% | 6.1 | 1.2% | 10% | 72,251 | 41,522 |
| **Services** | 1,393 | 18,383 | 59 | 49% | 4.5 | 3.1% | 12% | 104,249 | 56,867 |
| **All Companies** | **2780** | **22,404** | **69** | **45%** | **5.3** | **2.0%** | **11%** | **87,369** | **48,805** |

Table 1 provides an overview of the characteristics of the 2,780 manufacturing and services companies in the sample based on 2019 averages values. Manufacturers are larger than services companies on average with turnover of €26 million and employment of 79 owing to the presence of a small number of very large multinational food processors. Services companies, on the other hand, tend to be smaller with average sales of €18 million and employment of 59. This reflects the emergence of high-tech software sectors in recent decades and high levels of start-up activity with services companies accounting for 70% of all companies founded since 2005. In terms of company sizes, large companies make up approximately 9% of the total with medium and small companies accounting for 32% and 59% respectively (based on EU Commission definitions of company size).

**Exports:** While services companies tend to be smaller in size, they are generally more export focused with an average export intensity of 49% compared with 41% for manufacturing. This may reflect the lower barriers to exporting in services sectors relative to manufacturing and the early internationalisation of companies in the sector. The average export intensity of small companies in 2019 was 53% in services and 39% in manufacturing, which indicates that services companies are more likely to begin selling to international markets at an earlier stage. Despite lower export intensities, manufacturing companies tend to be more diversified, exporting to 6.1 markets on average while services companies export to an average of 4.5 markets. This gap is also present among small and medium enterprises with manufacturers selling into 5 markets on average and services SMEs selling to 4 markets. However, it is important to note that these averages are somewhat skewed by a small group of highly diversified exporters. The manufacturing figures, in particular, are inflated by a handful of multinational food and beverage processors which sell to a large number of markets. Two thirds of the companies in the sample export to less than 5 markets while 21% export to just a single market with many companies focusing primarily on the UK market.

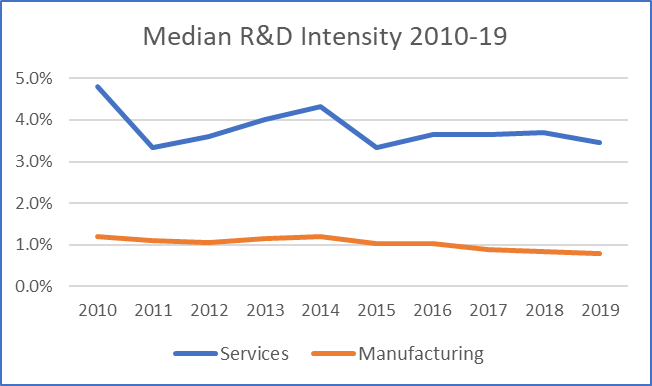
**Figure 1: Sector trends in average exports from 2010-19**

Exports in both sectors have grown strongly in the period from 2010 to 2019 coinciding with the general economic recovery following the financial crisis of 2008 and subsequent recession. Data from the Annual Business Review survey shows that total exports among EI client companies have nearly doubled in the past decade with an overall growth of 84% from €13.9 billion in 2010 to €25.6 billion in 2019. Services companies have experienced the fastest growth with a compound annual growth rate (CAGR) of 11.5% per annum in average exports. Exports have also grown strongly in the manufacturing sector with a CAGR of 7%. Figure 1 outlines the growth trends in average exports since 2010 for both sectors. In addition to the large increase in headline export figures, this growth has also been relatively broad based. Median export figures, which are less influenced by large outliers than averages, have increased significantly with a compound annual growth in median exports of 11.2% for manufacturing companies and 9.9% for services companies. At a more granular level, all sectors have experienced growth in average exports over the period including Food/Drink Manufacturing (+5% CAGR), Modern Manufacturing (+10.1%), Traditional Manufacturing (+8.3%), ICT Services (+7.5%) and Business and Financial Services (+13.2%).

As well as increases in export values, companies have also become more diversified since 2010 with the average number of export markets increasing from 4.2 to 6.1 among manufacturers and from 3.2 to 4.5 in the services sector. Diversification of the export base of indigenous companies and a reduction in the level of reliance on the UK market has been a key objective of Irish industrial policy since at least the 1960’s. In recent years, these efforts have intensified in order to mitigate against any trade disruption caused by the UK’s departure from the European Union and the potential trade barriers including tariffs on goods exports and divergent regulatory requirements which may have arisen as a result. Enterprise Ireland’s 2017-2020 Strategy[[1]](#footnote-1) clearly outlines this ambition with a target of “increasing the diversification of client company exports into new markets, with two-thirds of exports going beyond the UK” and a strategic focus on growing sales to Eurozone markets. This policy objective is reflected in the declining share of UK exports as a proportion of total exports which has reduced from 40% in 2010 to 31% in 2019.

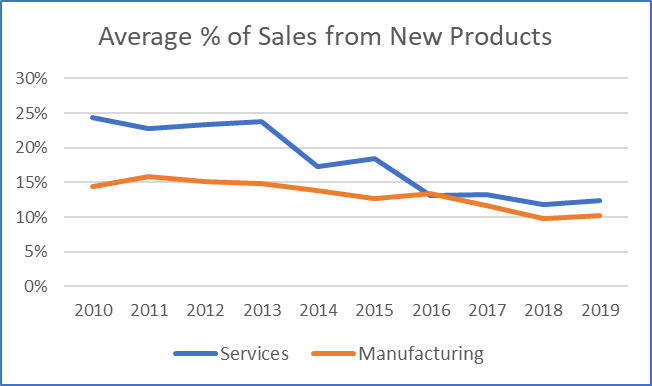
**Innovation:** Services companies have the highest levels of R&D intensity (3.1%) and a slightly higher proportion of sales generated from new products (12%). This reflects the need for companies in high-tech ICT sectors to continually invest in innovation with many start-ups investing heavily in product development before entering the market. While the services sector has higher overall investment in R&D, there is significant variance among different services sectors in terms of R&D intensity and new product sales. ICT companies have an average R&D intensity of 9% and new product percentage of 17% whereas the construction services sector has an R&D intensity of just 0.2% with 7% of sales from new products. Manufacturing companies generally invest less intensively in R&D and spend an average of 1.2% of revenue on R&D with 10% of sales generated by new products. Companies in the ‘Computer, Electronic and Optical products’ and the ‘Basic Pharma Products’ sectors have the highest levels of R&D investment with intensities of 5.9% and 8.8% respectively. Small companies have relatively higher levels of innovation with R&D intensities of 12% in services and 3.4% in manufacturing. They also generate 14% of sales from new products compared with an average of 7% for medium and large companies. This may indicate that smaller companies have more of a requirement to develop new products and create unique selling points which allow them to gain market share and compete with their larger, more established rivals.

**Figure 2: Sector trends in median R&D intensities 2010-19**



An analysis of the trends in R&D intensity and new product development suggests that there has been a decline in both R&D investment levels and outputs from innovation over the past decade. It is important to note that this is a relative decline. Absolute levels of investment in innovation have increased since 2010 with average R&D expenditure up by 31%. However, this is less than the growth in average sales which have increased by 90% over the same period, hence the relative decline of R&D expenditure as a proportion of overall sales. Figure 2 above shows that both sectors have seen declines in median R&D intensities from 2010 to 2019. Manufacturing has experienced a significant decline from 1.2% in 2010 to 0.8% in 2019. The trend in services, on the other hand, has been more volatile with a large fall from 2010 to 2011 followed by annual increases in 2012-14 and another fall in 2015.

**Figure 3: Sector trends in average sales from new products 2010-19**

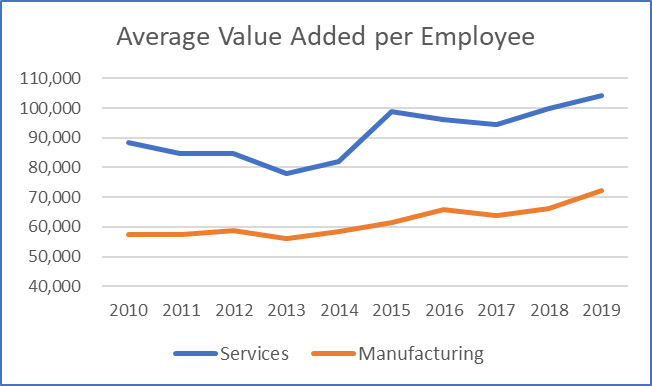


A similar trend is also observed in the level of new product development across both sectors as outlined in Figure 3 above. Services companies have seen the largest declines with new products accounting for 12% of sales on average in 2019 down from 24% in 2010. Manufacturing is down from 15% in 2010 to 10% in 2019. One possible reason for the declines in both R&D intensity and new product development is that the level of investment in innovation increased after the onset of the recession in 2008. With a particularly severe contraction in the Irish economy, indigenous companies sought to increase their exports to offset sales losses in the domestic market (domestic sales of EI client companies declined by 24% between 2008 and 2012). This meant that, in order to survive in a very challenging economic environment, many companies needed to develop new and improved products suitable for export markets as well as undertaking process innovation to drive efficiencies and reduce their cost base. Overall, this ensured that the levels of innovation remained high and even increased during the recessionary period with median R&D intensity going from 1.3% in 2008 to 1.9% in 2010.

Over the course of the decade, as economic conditions improved substantially both at home and in international markets, companies no longer had such an urgent requirement to undertake innovation and both R&D intensities and new product development may have declined as a result. On the other hand, the number of companies engaging in collaborative R&D projects has generally been increasing year on year since 2010. This has coincided with a growing policy focus on promoting collaborative R&D and increased funding for collaborative research centres with several technology centres opening in recent years such as the Dairy Processing Technology Centre (DPTC) in 2015 and CeADAR, Ireland’s national centre for Applied AI and Data Analytics, in 2013.

**Productivity:** Value added per employee (with value added calculated as sales minus the costs of services and materials) is used as a measure of productivity at the firm level. Productivity levels are higher among services sectors with an average VA per employee of €104,000 in 2019. Manufacturing companies generally have a higher cost base and tighter operating margins with average productivity of €72,000. As well as the sectoral split, there is also a disparity in productivity levels among different size categories. Large companies have much higher productivity levels than SME’s, which may be due to their ability to generate economies of scale. Sectors with the highest levels of productivity include ICT services and financial services. Food and drink manufacturers, on the other hand, have the lowest average productivity levels mainly due to tight operating margins and the labour-intensive nature of the processing industry.

**Figure 4: Sector trends in average value added per employee 2010-19**



Average productivity has increased over the last ten years along with sales and export growth. Productivity levels from 2010 to 2013 remained stagnant in the manufacturing sector while services companies experienced a decline of 12% in average value added per employee over the same period. However, since 2013 both sectors have seen strong growth with an increase of 29% in average productivity for manufacturing companies and 34% for services. Median productivity levels have also grown strongly since 2010 which indicates widespread growth among all companies.

**Average Wages:** The average annual wages for employees of EI client companies was €48,805 in 2019. This is closely aligned with CSO statistics on the average annual earnings for all full-time employees in the wider economy which stood at €46,000 in 2019. Employees in the services sector tend to earn more with average wages of €56,867 versus €41,552 for manufacturing. This reflects the relative scarcity of employees in sectors such ICT services which has the highest average wage levels. As with most other indicators, earnings have increased over the last decade with 11% overall growth since 2010. This is slightly ahead of the rate of growth in the CSO figures for the wider economy where average full-time wages have increased by 9% over the same period. In terms of training expenditure, manufacturers tend to invest more in staff training relative to the services sector with average annual expenditures of €27,371 and €21,518 respectively. The level of spending has grown substantially in both sectors since 2010 with an increase of 68% in average annual training costs for services companies, while manufacturing companies have increased their expenditure by 40%.

# **Methodology**

This section provides an overview of several models which are commonly used to analyse panel data. It also outlines the steps taken to identify the appropriate model for this analysis based on the characteristics of the dataset and potential issues which can arise when analysing panel data. Panel data (also known as longitudinal cross-section data) refers to datasets containing repeated observations of the same units (individuals, companies, countries etc.) over a period of time. It involves at least two dimensions; a cross-sectional dimension of individual units and the time series dimension. Analysis of panel data has become increasingly prevalent in recent decades, particularly in econometrics. This is due, in large part, to the wider availability of such data with international organisations such as the OECD publishing time series data on a wide range of country level economic and social indicators which can be used to construct a panel dataset. In Ireland, the CSO’s Annual Services Inquiry and Census of Industrial Production can be used to construct a panel dataset with a variety of performance indicators for companies in Ireland.

This type of data provides several advantages over cross-sectional datasets which consist of observations on multiple entities at a single point in time (i.e. t=1) as outlined by Hsiao (2005). An obvious advantage is that it provides a larger number of observations. This increases the degrees of freedom and reduces collinearity among variables and, therefore, improves the efficiency of econometric estimates. In addition, panel data allows researchers to analyse the dynamics of change and examine the effects of certain interventions or events on the individual units over time. One of the most common challenges faced in any regression analysis is omitted variable bias. This occurs when one or more relevant variables are not included in the model. This may occur where there is limited data available or where there is difficulty quantifying variables and it is, therefore, not be feasible to include them in a regression analysis. With panel data, however, it is possible to reduce omitted variable bias by controlling for time-invariant unobserved factors which affect the dependent variable but do not change over time. For example: proximity to a port or airport may provide companies with an advantage by giving them easier access to export markets.

Multiple linear regression of panel data is represented by the following formula:

yit = α + β1X1it + … + βkXkit + ui + εit

Where:

* i = 1,2,…..; N; are the individual companies (the cross-sectional dimension);
* t = 1,2,…..; T; denotes the time periods (the time series dimension);
* yit is the dependent variable observed for individual i at time t;
* X1…Kit represents one of k independent variable;
* Β1…k is the coefficient of the independent variables;
* α is the intercept term;
* ui is the unobserved individual-specific effects; and
* εit is the idiosyncratic error term.

In a balanced dataset, all companies are measured in each time period such that the total number of observations is equal to N\*T. In this case, however, the dataset contains missing values and the number of observations is, therefore, less than N\*T. Stata, the statistical software used for this analysis is equipped to handle missing values and, therefore, the unbalanced nature of the dataset does not present an issue.

When analysing panel data there are several models which may be used, the most basic of which is the Pooled Ordinary Least Squares (OLS) model in which all observations are pooled together and effectively treated as one time period in the regression, ignoring the panel structure of the data. Although computationally straight forward, pooled OLS relies on several strict assumptions and is rarely used in practice. The model is generally only suitable in cases where different samples are used in each of the time periods and it is, therefore, not possible to examine individual effects across time. Given that the dataset in this analysis consists of repeated observations on the same companies and the ABR survey is conducted on largely the same population from year to year, pooled OLS is not appropriate.

Two of the most commonly estimated models are the fixed and random effects models. The main difference between the two is in how they treat unobserved variables which make up the individual effects, μi. In a random effects model, the unobserved variables are assumed to be uncorrelated with (or, more strictly, statistically independent of) the explanatory variables such that Corr(ui, Xkit) = 0. Unobserved effects are effectively treated as part of the error term in the regression. The rationale behind random effects is that the variation across entities is assumed to be random and uncorrelated with the independent variables included in the model. However, this assumption is a strong one that is often unrealistic with non-experimental data. If there is correlation between the unobserved variables and the regressors in the model, which is generally the case, then the estimates will be biased and inconsistent due to the presence of omitted variable bias.

The fixed effects model differs from random effects in that the unobserved variables are allowed to have any association with the explanatory variables. The model is used when there are unobserved factors specific to individual companies that may impact or bias the dependent or explanatory variables and we need to control for this. The purpose of fixed effects is to remove the effect of those time-invariant characteristics so the net effect of the regressors on the dependent variable may be assessed. In order to do so, the model produces an estimate of the effects of unobserved, time-invariant variables for each company. These effects are then included in the intercept which is unique for each company. Therefore, the form of the fixed effects model is as follows:

yit = (α + ui) + β1X1it + … + βkXkit + εit

Another key assumption of the fixed effects model is that those time invariant characteristics are unique to each individual company and should not be correlated with others. Each company is assumed to be heterogeneous and, therefore, their error term and constant (which captures individual characteristics) should not be correlated with other companies. Substantively, fixed effects models are designed to study the causes of changes within an entity over time, referred to as ‘within’ variation. A time-invariant characteristic cannot cause such a change because it is constant for each person. Stock and Watson (2003) provide a succinct summary of the fixed effects model; “The key insight is that if the unobserved variable does not change over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics.”

**Model Specification:** In determining whether the fixed or random effects model is appropriate there are several factors to take into account such as the nature of omitted variables. If it is expected that there are no omitted variables, or that the omitted variables are uncorrelated with the variables included in the model, then a random effects model may be the best option as it will produce unbiased estimates and relatively small standard errors. If there are omitted variables and they are correlated with the explanatory variables, then fixed effects are appropriate as they can help to reduce omitted variable bias by controlling for time-invariant characteristics. Another important factor to consider is the degree of variability within subjects over time. As mentioned above, fixed effects cannot estimate the influence of variables that do not change over time. If there is little or no change in the explanatory variables for each company over time, the fixed effects model will not work very well, if at all. This is unlikely to present an issue in this case as the variables of interest vary significantly over time.

The specification test devised by Hausman (1978) is used to test the appropriateness of fixed or random effects models in panel data analysis. The Hausman test examines if the individual effects are correlated with other regressors in the model with the null hypothesis being that there is no correlation between them; Corr(ui, Xkit) = 0. If the null hypothesis is not rejected (p > 0.05), then both models are consistent estimators. However, the random effects model is preferred as it is a more efficient estimator with smaller standard errors. If the null hypothesis is rejected, i.e. the test detects correlation between the individual effects and the regressors, then the core assumption of random effects is violated, and the fixed effects model is, therefore, preferred as it is the only consistent estimator. In this case, the Hausman test returns a p value of less than 0.05 and the null hypothesis is rejected. The fixed effects model is, therefore, preferred due to the correlation between the regressors and the unobserved individual effects.

Another factor which needs to be considered when dealing with panel data is the possible influence of time-fixed effects. These are correlated shocks that affect all companies at a specific point in time. This analysis includes data from 2010 onwards so the prolonged economic downturn following the recession in 2008 is likely to have affected companies in this sample although overall export performance had begun to recover by then. Exchange rate movements may have also had widespread effects on export performance. The devaluation of the euro which occurred in 2014 as a result of the European Central Bank’s quantitative easing programme is likely to have improved the competitiveness of Irish exports. On the other hand, the sharp decline of sterling in the aftermath of the UK’s vote to leave the EU in 2016 may have had an adverse impact on exporters. Time fixed effects can be controlled for by including dummy variables for each year in the regression. A joint test for time-fixed effects is carried out using the ‘testparm’ command in Stata where the null hypothesis is that the dummies for all years are equal to 0. In this case the null hypothesis is rejected, and time-fixed effects are included in the fixed effects model. The standard errors are clustered at company level to make statistical inferences robust to heteroscedasticity (Cameron and Miller, 2015).

**Dynamic Panel Model:** While the fixed effects model is widely used in empirical studies of firm-level data, it is limited in dealing with endogeneity bias. In particular, the model does not address the related issues of simultaneity bias and reverse causality where the value of a regressor is influenced by the dependent variable. In the context of export performance, there are several channels through which reverse causality may occur. For example; exporting may lead to improved innovation performance through a ‘learning by exporting’ effect as outlined by Girma et al. (2008). In this case, the fixed effects model may identify a positive effect between the two variables, but the causality could actually be running from the dependent variables to the regressor instead of the other way around.

Another potential issue when analysing panel data is that dependent variables often display a high degree of persistence over time such that the present values are strongly influenced their own lagged values. Export values and diversification levels tend to remain relatively stable over time as companies grow their exports and develop a presence in overseas markets with repeat business from local buyers and multi-year contracts. A test for serial correlation in panel data developed by Wooldridge (2002) confirms the presence of this persistence in both the value of exports and the number of export markets. Static models such as fixed effects are not well suited to address this issue because the introduction of lagged values as regressors leads to biased estimates.

In order to address these endogeneity issues, the System Generalised Method of Moments (GMM) model developed by Blundell and Bond (1998) is also applied in which lagged levels of variables are used as instruments. This model allows for lagged dependent variables to be included as regressors which is important due to the persistence in export values and diversification levels over time. A two-step estimation process is used as it is more efficient than the one-step process in the presence of heteroscedasticity (Roodman, 2009). The finite sample correction devised by Windmeijer (2005) is also used to correct for downward bias in the two-step standard errors. In addition, the forward orthogonal deviation (FOD) transformation is applied which involves subtracting the mean of all future observations in the sample for each individual company. This process is a useful alternative to first differencing for unbalanced panels as it does not exacerbate gaps due to missing values which can lead to a lower number of observations. Hansen’s test of over-identifying restrictions is used to test the null hypothesis of joint validity of the instruments. The test fails to reject the null hypothesis in all cases and, therefore, the instruments are valid.

# **Results**

This section presents the outputs from the system GMM and fixed-effects panel models with export value as the dependent variable in Table 3 and the number of export markets in Table 4. System GMM is the preferred model – outputs from the fixed-effects model are also reported for robustness. The analysis is performed separately on three populations: manufacturers, services companies, and a combined sample with all companies. The tables show the estimated coefficients of the regressors with corresponding p-values in brackets below each coefficient. The dependent variables and continuous regressors, such as R&D spend and averages wages, are log transformed due to the right-skewed distribution of the data whereby a small number of companies have much larger values than the rest of the sample. Other regressors are dummy variables which take the value 1 if a certain characteristic is present or 0 if it is not. Coefficients of log transformed variables indicate the mean percentage change in the dependent variable based on a 1% change in the independent variable. For example: a coefficient of 1 indicates that a 1% increase in the predictor variable leads to a 1% increase in the value of exports. For dummy variables, the coefficient is interpreted as the percentage change in export value associated with having the relevant characteristic relative to the reference group which does not have that characteristic. P-values test the null hypothesis that the coefficient of each variable is equal to 0. A low p-value indicates that the null hypothesis can be rejected and that the regressor does, in fact, have an effect on the value of the dependent variable. The estimated coefficients are generally considered to be statistically significant when the p-value is less than 0.05.

# **Intensive Margin**

**Table 3: Regression Output – Dependent Variable is Export Values**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Dep Variable:** | **All Companies** | | **Manufacturing** | | **Services** | |
| **Ln\_Exports** | **GMM** | **FE** | **GMM** | **FE** | **GMM** | **FE** |
| **Ln\_VAperEmp** | -.026  (.002 \*\*\*) | -.003  (.478) | -0.01  (0.198) | -0.005  (0.313) | -0.023  (0.038 \*\*) | -0.001  (0.885) |
| **Capital/LEAN** | .369  (.012 \*\*) | .074  (.036 \*\*) | 0.21  (0.063 \*) | 0.038  (0.213) | 0.161  (0.558) | 0.282  (.082 \*) |
| **Ln\_RDSpend** | .041  (.003 \*\*\*) | .037  (.004 \*\*\*) | 0.042  (0.018 \*\*) | 0.032  (.069 \*) | 0.039  (0.022 \*\*) | 0.043  (.024 \*\*) |
| **NewProductSales** | .002  (.97) | .051  (.088 \*) | 0.111  (0.088 \*) | 0.088  (.023 \*\*) | 0.011  (0.879) | 0.012  (0.799) |
| **CollabRD** | .004  (.961) | .024  (.539) | 0.01  (0.916) | 0.032  (0.521) | -0.003  (0.983) | 0.013  (0.844) |
| **Ln\_Wages** | .156  (.138) | .056  (.315) | -0.078  (0.506) | 0.115  (0.165) | 0.196  (0.086 \*) | 0.017  (0.816) |
| **Ln\_Training** | -.023  (.309) | .035  (.029 \*\*) | -0.017  (0.491) | 0.033  (0.11) | -0.016  (0.626) | 0.039  (0.116) |
| **ExportPromo** | .07  (.518) | .059  (.085 \*) | 0.26  (0.018 \*\*) | 0.003  (0.942) | 0.136  (0.287) | 0.117  (.05 \*) |
| **OverseasSupport** | .256  (.003 \*\*\*) | .09  (.001 \*\*\*) | 0.216  (0.015 \*\*) | 0.108  (0 \*\*\*) | 0.285  (0.002 \*\*\*) | 0.074  (.082 \*) |
| **Age** | -.028  (0 \*\*\*) | .016  (.031 \*\*) | -0.014  (0.001 \*\*\*) | 0.019  (.034 \*\*) | -0.036  (0 \*\*\*) | 0.011  (0.399) |
| **Ln\_Sales** | .452  (0 \*\*\*) | 1.117  (0 \*\*\*) | 0.519  (0 \*\*\*) | 1.131  (0 \*\*\*) | 0.369  (0 \*\*\*) | 1.11  (0 \*\*\*) |
| **No. Observations** | 13,045 | 14,759 | 7,165 | 8,094 | 5,880 | 6,665 |
|  |  |  |  |  |  |  |
| **AR2 Test** | 0.856 |  | 0.638 |  | 0.983 |  |
| **Hansen Test** | 0.155 |  | 0.330 |  | 0.496 |  |

*Notes: The dependent variable is the natural logarithm of the value of exports.*

*Columns under the heading ‘GMM’ show the output of the preferred System GMM model. ‘FE’ columns show the output of the fixed effects model.*

*Coefficients for each variable are reported with corresponding p values in brackets below.*

*\*\*\*, \*\* and \* denote statistical significance at p<.01, p<.05 and p<.1 levels respectively.*

**Productivity:** Productivity, measured as value added per employee, is found to have a small, negative relationship with the scale of exports among services companies. There is, however, no evidence of a significant impact on manufacturing exports. This is somewhat surprising given the extensive literature identifying a positive relationship between productivity and exporting and there are several factors to consider when interpreting it. Firstly, it is important to note that, while these results may appear to be at odds with previous empirical studies, there is a key distinction. Previous studies in this area have primarily focused on the determinants of export propensity, i.e. whether or not a company is an exporter. This analysis, on the other hand, examines the relationship between productivity and a company’s level of exports.

The CSO’s ‘Business in Ireland’ publication provides statistics on the average levels of value added (VA) per employee for Irish-owned enterprises with a breakdown by size category. These figures are based on a large population of over 20,000 companies that responded to the Annual Services Inquiry or Census of Industrial Production surveys. A comparison between the EI client base and the CSO figures shows that average productivity levels are much higher among EI client companies relative to the wider enterprise base in the CSO surveys, the vast majority of which are smaller, domestically focused companies. Productivity levels among EI clients are 44%, 64% and 74% higher than the corresponding CSO figures for small, medium, and large companies respectively. Overall, these figures show that the EI client base is made up of a subset of highly productive, export-orientated companies. There is a slight caveat as the CSO figures include sectors which are ineligible for EI support and have lower levels of productivity such as retail and hospitality which are likely to reduce the average values. Despite this, productivity is likely to be a determinant of export propensity among all indigenous enterprises even if it has no effect or a slight negative effect on the scale of exports among companies within the EI client base.

An interesting dynamic that is present in the dataset is the strong negative correlation between R&D expenditure and the value-added per employee metric which indicates that companies that invest heavily in R&D tend to have lower productivity levels. This relationship may contribute to the negative influence of productivity on exports in the services sector, particularly among fast-growing, R&D intensive companies in the early stages of their international expansion. On the other hand, companies with low levels of R&D expenditure may have relatively higher productivity in the short run but will not grow their exports to the same extent. This effect is clearly demonstrated by comparing the export growth and productivity levels of services companies with the highest and lowest levels of R&D intensity at the beginning of the period under observation. In order to make this comparison, companies are divided into quartiles based on their average R&D intensity from 2010 to 2012. Services companies in the top R&D intensity quartile had a median productivity of €35,000 in 2010-2012 which is well below the median productivity of €64,000 among companies in the bottom quartile. In sharp contrast with productivity levels, companies in the top R&D quartile had much higher export growth from 2010 to 2019 with a median growth of 154% compared to 51% in the bottom quartile.

This relationship between investment in innovation and productivity levels may indicate that there is a degree of overlap between R&D expenditure and the costs data used to calculate VA per employee. Due to the lack of detailed costs data, it is not possible to determine the extent of this overlap. However, the negative relationship between productivity and the scale of exports among services companies is still observed if total R&D spend is excluded from the costs data.

While the system GMM model identifies a negative relationship between exports and VA per employee, it does indicate that companies which have received funding from EI to support capital investment or undertake LEAN projects have experienced a large, positive effect on their scale of exports as a result. The effect is statistically significant at the 5% level when all companies are included and significant at the 10% level in the manufacturing sector. This indicates that manufacturers experience subsequent export gains as a result of investing in new equipment/technologies to increase capacity and improve operational efficiency or by engaging in LEAN projects to identify and implement productivity improvements in various areas of business performance such as production, customer service and management structures. This effect is not identified in the services sector although this may be due to the very small number of such supports provided to services companies. The divergence in the effects of the two productivity-related variables on the scale of exports suggests that VA per employee may be somewhat limited as a measure of productivity as it does not account for capital intensity. This is likely to be more of an issue among manufacturing companies which tend to be more capital intensive.

The issues outlined above highlight the complexity of consistently measuring productivity at the firm level due to the granular level of inputs required and the general lack of consensus on which indicators should be used. VA per employee is a function of multiple inputs which can vary depending on a wide range of factors. Some of these factors may indicate a general decline in company performance such as reduced efficiency or falling revenues but others do not necessarily indicate poor performance. For example; VA per employee is likely to decline in the short run in a situation where a company takes on new staff or invests heavily in R&D to facilitate future growth.

**Innovation:** R&D expenditure is found to have a positive effect on the scale of exports with statistically significant coefficients in both sectors. This finding provides further evidence of the important role of innovation in driving export growth and is in line with the vast majority of previous studies examining the link between innovation and exporting, including several empirical studies of Irish firms such as Roper et al. (2006) and ESRI (2006). Investing in innovation allows companies to generate a competitive advantage through the development of new and improved products and services and also through internal process and technological innovation which can lead to lower production costs or better customer experience. In terms of innovation outputs, there is some evidence to suggest that new product development has a positive influence on the scale of exports in manufacturing companies. The coefficients of the new product development variable are statistically significant for manufacturers in both models although it is only significant at the 10% confidence level for the system GMM model. This indicates that by continually updating existing products and replacing obsolete ones, innovative manufacturers are better able to compete in international markets and can maintain and grow their overall level of exports. By contrast, non-innovators are less equipped to stay ahead of changing consumer trends and regulatory requirements and, therefore, are less likely to achieve sustained export growth in the long run. For services companies, on the other hand, new product development is not found to have a significant influence on export values. This may be partially due to the fact that, while some services sectors such as ICT invest heavily in new product development, it is less relevant for other sectors such as construction services. Such sectors are characterised as being project-based rather than having typical product life cycles. Companies in these sectors may develop and adopt new approaches and processes as they move from one project to another, but this would not necessarily be defined as new product development and it would generally not be possible to calculate the revenues generated from these innovations. It is also difficult to analyse these effects given the lack of a reliable output indicator for process innovations introduced by companies.

The analysis finds no significant link between companies engaging in collaborative R&D projects and export performance. This may be due to the relatively recent policy focus and increased resource allocation towards fostering collaborative R&D among client companies. This is reflected in the number of technology centres that have been established in recent years. Of the eight technology centres that currently receive funding from EI, only one of them was operating before 2010 while five of them were established between 2013 and 2017. Collaborative R&D projects also tend to be more experimental in nature and less commercially focused than in-company R&D and are, therefore, expected to have longer timeframes in terms of generating commercial outcomes for individual companies. For the reasons outlined above, it may be too early to properly evaluate the impact of collaborative R&D programmes on the export performance of companies in the sample. The indicator used to represent collaborative R&D activity is also quite broad. It includes both large scale research projects as well as smaller projects funded by Innovation Vouchers which are available to SMEs and provide grant funding of up to €5,000 to explore a business opportunity with third level institutions. Given the wide range and large disparities in the scope of the activities covered by this indicator, it may be difficult to draw strong conclusions from the analysis.

**Skill Levels:** Overall, there is limited evidence that average wage levels have a strong influence on export performance. The estimated coefficients for all companies and manufacturers are insignificant with the system GMM model. The model does, however, indicate that services companies which pay higher average wages tend to have higher exports although the coefficient is only significant at the 10% confidence level. A recent study on the determinants of exporting among Dutch enterprises by Brakman et al. (2020) produces similar findings with average wages found to have a positive effect on export propensity in services companies but no effect for manufacturers. In an Irish context, this result may reflect the intense competition for skills in certain services sectors over the past decade. In particular, ICT skills have been in consistently high demand even during the economic downturn in the early years. Globally, the sector has experienced huge growth in recent decades and Ireland has benefitted from this with some of the largest tech companies in the world setting up operations here and creating thousands of highly skilled jobs. Indigenous tech companies have also experienced rapid growth with annual average employment growth of 9% from 2013 to 2018. This growth has led to competition in the labour market with shortages of ICT graduates in Ireland and high levels of inward migration to address skills gaps. The ICT sector accounts for over half of all services companies in the sample and the results indicate that the export performance of these companies is influenced by their ability to pay higher wages in order to attract and retain critical skills. Expenditure on training, which is used as an indicator of company investment in developing skills within their workforce, is not found to have a significant effect on the level of exports in either sector. The fixed effects model indicates a positive effect at an overall level, but this is not observed at the sectoral level and the system GMM model produces no evidence of significant effects.

**Export Promotion Policies:** The analysis indicates a large, positive relationship between the services provided by the EI overseas office network (OON) and the export performance of client companies which receive those services. This effect is statistically significant in both the system GMM and fixed effects models and across both manufacturing and services sectors. It should be noted that Enterprise Ireland’s client engagement model takes a holistic approach to company development in which client companies work with their development advisors to diagnose organisational capabilities in specific areas such as sales and marketing, innovation, and finance. Based on this analysis, priority areas are identified and agreed with the company, a functional plan is put in place and tailored support is provided to the company depending on their stage of development. Support from the overseas offices is, therefore, primarily targeted at companies that are identified as being in a good position to extend or expand their export activities. This approach differs from many other countries where export promotion supports are provided through embassies and consulates and are not targeted in this way. In terms of the analysis, this approach may result in self-selection issues as companies with the greatest potential to grow their exports are more likely to receive support from the OON.

In 2017, an evaluation of the EI overseas office network was carried out by Technopolis on behalf of the Department of Business, Enterprise, and Innovation (DBEI). As part of the evaluation, a survey was conducted on a sample of companies that had received support from the (OON) during the period from 2005 to 2015. The responses to this survey provide some insights around company’s perceptions of the benefits they received and their level of satisfaction with specific supports. Overall, 53% of respondents indicated that support from the OON had made a difference in terms of sustaining or growing their exports or was expected to in the near future. Among the services provided by the OON, facilitating introductory meetings with potential buyers and overseas visits/trade missions were identified as the most valuable. The results highlight the important role of the overseas offices in supporting companies to overcome the barriers to exporting and identify new growth opportunities. Funding supports for market research and internationalisation are also found to have a positive impact on the export performance of manufacturers. This includes supports such as the Strategic Marketing Review in which companies carry out an extensive review of their export strategy to identify persistent challenges and potential growth opportunities. The effect is insignificant for services companies although there is a weakly significant positive coefficient in the fixed effects model. The findings here are broadly in line with the majority of international empirical studies which also identify positive effects of similar export promotion policies on firm-level exports (Van Biesebroeck et al., 2016).

**Firm Age:** A negative relationship is observed between firm age and export levels in both sectors after firm size and lagged export values are taken into account. This relationship is likely due to the presence of a large proportion of start-up companies in the EI client base which tend to be heavily export-orientated from an early stage. The sample includes over 600 companies which received equity funding from EI as part of the High Potential Start-Up (HPSU) fund. HPSU funding is provided to innovative start-ups no more than 5 years old that can develop new technologies, products or services and have the potential to sell into international markets. These start-ups generally fit the description of ‘born global’ companies as outlined by Oviatt & McDougall (1994). This cohort of companies had a median export intensity of 82% in 2019 compared with 28% for all other companies in the sample.

Previous empirical studies on firm-level export determinants in Ireland also outline a similar relationship between age and exporting. Roper et al. (2006) find that younger indigenous manufacturing plants in the Republic of Ireland have a higher export propensity than older ones and this effect is consistent across different size categories: “the consistency of this effect suggests that this is a population effect among Irish plants”. The results indicate that the process or stages theory of internationalisation first proposed by Johanson & Vahlne (1977) is less relevant in an Irish context. This theory outlines how companies first establish their position in the domestic market and then grow their international presence gradually, learning from their experience along the way. However, several factors such as the small size of the domestic market, the relatively easy access to neighbouring markets and the supports provided by EI to help overcome trade barriers allow Irish companies to be more export focused at an early stage compared with many other countries.

# **Extensive Margin**

**Table 4: Regression Output –** **Dependent Variable is the No. of Export Markets**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Dep Variable:** | **All Companies** | | **Manufacturing** | | **Services** | |
| **Ln\_Markets** | **GMM** | **FE** | **GMM** | **FE** | **GMM** | **FE** |
| **Ln\_VAperEmp** | -0.005  (0.057 \*) | 0  (0.966) | -0.001  (0.676) | 0.001  (0.736) | -0.001  (0.697) | -0.001  (0.736) |
| **Capital/LEAN** | 0.069  (0.202) | 0.019  (.097 \*) | 0.033  (0.441) | 0.015  (0.23) | 0.009  (0.935) | 0.042  (0.239) |
| **Ln\_RDSpend** | 0  (0.915) | 0.01  (.002 \*\*\*) | 0.005  (0.356) | 0.01  (.029 \*\*) | 0  (0.993) | 0.01  (.026 \*\*) |
| **NewProductSales** | 0.035  (0.078 \*) | 0.019  (.036 \*\*) | 0.059  (0.006 \*\*\*) | 0.034  (.005 \*\*\*) | 0.003  (0.905) | 0.004  (0.756) |
| **CollabRD** | 0.048  (0.156) | -0.005  (0.696) | 0.052  (0.154) | -0.007  (0.65) | 0.03  (0.539) | -0.002  (0.924) |
| **Ln\_Wages** | 0.029  (0.34) | 0.025  (.097 \*) | -0.036  (0.34) | 0.029  (0.175) | 0.062  (0.114) | 0.022  (0.293) |
| **Ln\_Training** | -0.007  (0.306) | 0.005  (0.294) | 0.001  (0.941) | 0.002  (0.668) | 0.001  (0.885) | 0.007  (0.298) |
| **ExportPromo** | 0.057  (0.229) | -0.002  (0.855) | 0.035  (0.479) | 0.003  (0.811) | 0.027  (0.566) | -0.008  (0.646) |
| **OverseasSupport** | 0.083  (0.005 \*\*\*) | 0.038  (0 \*\*\*) | 0.13  (0 \*\*\*) | 0.036  (.005 \*\*\*) | 0.093  (0.002 \*\*\*) | 0.037  (.003 \*\*\*) |
| **Age** | -0.005  (0 \*\*\*) | 0.014  (0 \*\*\*) | -0.003  (0.01 \*\*\*) | 0.015  (0 \*\*\*) | -0.008  (0 \*\*\*) | 0.011  (.001 \*\*\*) |
| **Ln\_Sales** | 0.055  (0 \*\*\*) | 0.242  (0 \*\*\*) | 0.078  (0 \*\*\*) | 0.229  (0 \*\*\*) | 0.052  (0.002 \*\*\*) | 0.252  (0 \*\*\*) |
| **No. Observations** | 13,036 | 14,754 | 7,160 | 8,091 | 5,876 | 6,663 |
|  |  |  |  |  |  |  |
| **AR2 Test** | 0.313 |  | 0.776 |  | 0.343 |  |
| **Hansen Test** | 0.294 |  | 0.384 |  | 0.251 |  |

*Notes: The dependent variable is the natural logarithm of the number of export markets.*

*Columns under the heading ‘GMM’ show the output of the preferred system GMM model. ‘FE’ columns show the output of the fixed effects model.*

*Coefficients for each variable are reported with corresponding p values in brackets below.*

*\*\*\*, \*\* and \* denote statistical significance at p<.01, p<.05 and p<.1 levels respectively.*

Table 4 above shows the outputs of the system GMM and fixed effects models where the dependent variable is the natural logarithm of the number of markets which a company sells into in a given year. The coefficients, therefore, represent the estimated effects of each of the regressors on a company’s level of export diversification. Overall, the p values are much larger and there are less significant coefficients when compared with the previous regression with export values as the dependent variable. This is likely due, in large part, to the lower levels of variance in the dependent variable as the majority of companies export to a handful of markets and the number of markets does not tend to fluctuate greatly from year to year at the firm level. In 2019, 33% of companies exported to just one overseas market while 73% sold into 5 markets or less. Despite the lower overall levels of significance, the model does identify several variables that have a strong influence on export diversification.

**Company Size:** Size, which is measured by annual turnover, is shown to have a significant, positive influence on diversification levels in both manufacturing and services companies. This may be as a result of growth opportunities becoming more limited in markets where a company has already developed a strong presence and generated high levels of sales over many years. These companies would, therefore, have a stronger incentive and capability to look further afield and expand into new territories as they represent the best avenue to future revenue growth. Achieving initial growth in a small number of local export markets also allows companies to develop organisational capabilities which, in turn, reduces the resources required and the level of risk involved in further expansion into new markets. This includes building up in-house skills and expertise which would be less prevalent among smaller, first-time exporters in areas such as international regulatory requirements and customs and logistics.

In addition, developing and sustaining relationships with large multinational buyers in a particular market may allow companies to expand more easily into other markets where those buyers also have a presence. It may also allow companies to build brand recognition in key markets which facilitates further expansion. The effect of company size on diversification levels is slightly larger among manufacturers which reflects the fact that it is generally less resource intensive for services companies to sell into multiple markets as they are faced with relatively lower trade barriers, particularly around logistics and tariffs. Beyond company size, productivity levels are found to have little effect on the number of markets which a company sells to. Value added per employee has a small negative impact on diversification levels in the system GMM model, but this is only significant at the 10% confidence interval and the effect is not observed at the sectoral level. Similarly, funding for capital investment or LEAN projects aimed at improving efficiency are not found to have a significant effect on exports at the extensive margin.

**Innovation:** The effects of R&D expenditure on the extensive margin of exports are somewhat mixed. The fixed effects model identifies a positive relationship which is statistically significant in both sectors at the 5% confidence level. However, this effect is not observed in the system GMM model where lagged values of the variables are taken into account. A potential cause of this difference between the two models is that, while R&D expenditure is positively linked with export diversification, the relationship may not be causal. New product development, on the other hand, is found to have a positive effect on the level of export diversification among manufacturers, significant at the 1% level in both models. This indicates that, for manufacturers, the ability to develop differentiated, high quality products is an important factor when entering into new markets. The results are in line with the findings of Lawless et al. (2017) on the importance of continually adjusting product portfolios for indigenous manufacturers to sustain and grow their exports. This effect is not observed among services companies which may be partly due to the presence of certain services sectors which are not characterised by product cycles as outlined in section 4.1.

A recent study by Elliott et al. (2020) on the relationship between innovation and export performance for a large sample of French manufacturing firms also produces similar findings. They find that overall expenditure on R&D does not have a statistically significant effect on the number of markets which a company sells to. However, product innovations, where companies introduce new or improved products or services generated through R&D activity, are found to have a significant positive impact on the number of markets which companies export to in subsequent years. As with export values, engagement in collaborative R&D projects is not found to have a significant influence on diversification at the firm level but, again, this may be due to the relatively recent growth in collaborative R&D in an Irish context.

**Export Promotion Policies:** Support from the overseas office network is found to have a large positive relationship with firm level diversification. The effect is strongly significant in both sectors at the 1% confidence interval and is slightly larger among manufacturers. Many of the services provided by the OON are primarily aimed at helping companies to enter new markets such as facilitating client visits to markets and providing detailed market information on potential export markets. The findings further highlight the critical role played by the overseas offices in supporting companies to overcome various barriers to exporting such as language/cultural barriers, costs of acquiring foreign market information and time taken to develop a network of contacts in market. These barriers are likely to become greater as companies expand their export base and attempt to enter into other markets with high levels of divergence from local markets in areas like product standards, legal and tax requirements, and business practices. This suggests that the services provided by the OON are particularly important for companies looking to diversify their exports beyond a handful of local markets with relatively lower trade barriers. This is consistent with the findings of the 2017 evaluation of the overseas office network by DBEI which outlined how companies entering into developing/emerging markets required more ‘hands-on’ support. On the other hand, the analysis finds no significant relationship between funding supports for internationalisation and diversification levels.

**Skill Levels and Firm Age:** In terms of skill levels, there is no indication that either average wages or annual expenditure on staff training have a significant impact on diversification levels. To date, there has been very little empirical analysis of this relationship and so it is not possible to compare and contrast these results with other studies. The effects of firm age on diversification levels are similar to those observed in section 4.1 with a small negative coefficient, statistically significant in both sectors. Again, this is likely due to the high proportion of young, export-orientated companies with high levels of export intensity in the EI client base.

# **Conclusions**

This paper provides novel empirical evidence on the drivers of export performance among indigenous Irish companies. A key feature of the analysis is that it examines two distinct aspects of export performance: the scale of exports and the level of market diversification. The granularity and size of the dataset allows for a wide range of variables to be analysed with multiple variables for each of the five key factors: productivity, innovation, skill levels, export promotion policies and firm age.

The research provides further evidence of the critical importance of innovation in driving export growth. The significant positive effects of R&D expenditure and new product development on export performance suggest that developing the in-house innovation capabilities of Irish companies can contribute to their future export growth. During the financial crisis from 2008 to 2010 the level of investment in R&D among EI client companies remained stable and actually increased for many companies and this contributed to their strong export growth in the following decade. This indicates an important role for public policy in incentivising and supporting companies to engage in innovation in order to generate export growth in the coming years and recover from the economic damage caused by the pandemic. This is particularly important given the general declines in both R&D intensity and the proportion of sales generated from new products over the past decade. The analysis finds no significant relationship between engagement in collaborative R&D and export performance. However, given the possible limitations in the indicator used, there may be scope for further research into the benefits of engaging in collaborative innovation.

The analysis finds no significant relationship between productivity levels, measured as value added per employee, and export performance among manufacturing companies. A small negative relationship is identified among services companies. These results may be due to the characteristics of the sample used in the analysis. Comparisons with external data sources indicate that EI client companies tend to have higher levels of productivity relative to all companies in the wider enterprise base. The analysis also highlights the complexity of measuring productivity at the firm level as it is a function of multiple granular inputs and can vary depending on a wide range of factors. Funding supports for capital investment are, however, found to have a positive influence on export levels in the manufacturing sector. This indicates the importance of continually investing in new equipment or technologies to increase capacity and improve operational efficiency in order to achieve sustained export growth. It also suggests that industrial policy should continue to incentivise and support capital investment in the indigenous manufacturing sector with a particular focus on supporting small companies where access to finance may be more challenging.

With regard to skill levels, there is limited evidence to suggest that average wage levels have a significant effect on export performance. There is some indication that ICT companies which pay higher wages tend to have better export performance, however, this effect is only significant at the 10% confidence level. Similarly, the analysis finds no significant relationship between expenditure on staff training and export performance. Due to data limitations, the variables used in this analysis as indicators of skill levels are somewhat limited and there is scope for further study on the effects of skill levels on export performance. One potential area of interest is the impact that the characteristics and experience levels of company founders and senior management have on exports, particularly among start-ups and small companies.

The strong positive relationship between export performance and supports provided by the overseas office network indicates the value of these services for companies entering new export markets and expanding their presence in existing markets. EI adopts a holistic approach in supporting company development whereby supports from the overseas offices are targeted at companies with strong export growth potential. This may, therefore, result in a degree of self-selection as companies that receive these supports would be expected to have high levels of export growth. However, the size of the estimated coefficients and the fact that this positive effect is observed in both sectors and across both models indicates the effectiveness of the overseas office network in helping indigenous companies grow their exports and expand into new export markets. The results also suggest that the current strategic objective of expanding the network’s footprint, as outlined in the Global Ireland strategy, can contribute to future export growth.

Several variables are shown to have a significant influence on company’s levels of market diversification. For manufacturers, new product development is found to have a positive effect on diversification which suggests that the ability to develop differentiated, high quality products is an important factor in successfully entering into new markets. Overseas office supports are also found to have a positive effect on diversification levels in both sectors which indicates the impact that soft supports, such as facilitating market visits and providing market information, have in assisting companies to enter new markets. Overall, company size appears to be one of the main determinants of diversification levels. This may indicate that larger companies are able to develop in-house capabilities in areas such as customs and logistics which reduce the resources required and the level of risk involved in entering new markets. The importance of company size, combined with the general lack of significance among the other variables, suggests that diversification is a gradual, long-term process and diversification strategies require long time horizons to have a significant impact. It also indicates the importance, particularly for small companies, of focusing on achieving growth and establishing a strong, sustained presence in a small number of markets before expanding into a broad range of export markets.

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# Appendix

**Annex 1 – Number of Companies by High Level NACE Sector**

|  |  |  |
| --- | --- | --- |
| High Level NACE Sectors | No. Firms | Average Firm Age |
| Business, Financial & Other Services: | 489 | 22 |
| Construction, Energy, Water and Waste | 126 | 25 |
| Food/Drink and Primary Production | 281 | 33 |
| ICT Services | 778 | 17 |
| Modern Manufacturing | 280 | 25 |
| Traditional Manufacturing | 826 | 31 |
| Grand Total | 2,780 | 25 |

**Annex 2 – Number of Supports Provided per Year**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Support Type | Sectors | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| Capital/LEAN | Manuf. | 32 | 44 | 41 | 48 | 44 | 83 | 97 | 97 | 102 | 80 |
| Services | 5 | 5 | - | 8 | 12 | 10 | 15 | 15 | 17 | 21 |
| Collab. R&D | Manuf. | 72 | 88 | 75 | 88 | 90 | 124 | 112 | 126 | 134 | 108 |
| Services | 71 | 75 | 59 | 92 | 114 | 128 | 117 | 140 | 132 | 73 |
| Overseas Support | Manuf. | 313 | 335 | 334 | 355 | 309 | 341 | 340 | 297 | 330 | 291 |
| Services | 446 | 428 | 428 | 432 | 434 | 415 | 374 | 359 | 413 | 385 |
| Export Promo | Manuf. | 43 | 65 | 73 | 76 | 65 | 80 | 55 | 55 | 57 | 54 |
| Services | 67 | 105 | 69 | 86 | 85 | 72 | 33 | 58 | 64 | 63 |

**Annex 3 – Breakdown by Number of Survey Returns**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. Survey Returns | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 |
| No. Companies | 713 | 262 | 243 | 300 | 273 | 309 | 432 | 126 | 122 |
| % of Companies | 26% | 9% | 9% | 11% | 10% | 11% | 16% | 5% | 4% |

1. https://www.enterprise-ireland.com/en/Publications/Reports-Published-Strategies/Strategy-2017-to-2020.pdf [↑](#footnote-ref-1)