Chapter One

1. INTRODUCTION

Productivity growth through process innovations resulting in efficiency gains, and product innovations resulting in the creation and satisfaction of new wants are all crucial for firm competitiveness and long term economic growth (Romer, 1990, Baumol, 2002, Bhide, 2011). Associated with the process of innovation in markets is the presence of market failures arising from: the partial-appropriability and public good nature of knowledge (Baldwin, 1969; Jaffe, 1998); information asymmetries (Rosenburg, 2004; Rodrik, 2009); and systems failures (Boschma, 2009). Consequently, the broad objectives of the research within this thesis are to analyse the process of innovation within firms, the firm innovation-productivity relationship and to examine the relationship between government intervention and firm performance in Europe. There are four empirical paper contributions made in this work. A brief summary of these contributions are outlined in the following section.

The first paper focuses on the process of innovation and the innovation-productivity relationship in a sample of Irish firms. This paper attempts to contribute to a number of gaps in the innovation-productivity literature. Firstly, in terms of the Irish case, there is a lack of studies identifying any significant economic geography pattern of firm innovation. In particular, the empirical support for the theoretical arguments that underlie the urban hierarchy model of innovation and productivity in the Irish case are limited. In terms of the international literature, the evidence on the benefits of innovation for labour productivity are not definitive. Some studies have found innovation indicators to have a positive effect on productivity (Griffith et al., 2006; Lööf and Heshmati, 2006; Mairesse and Robin, 2009) but some studies have found innovation indicators to have a negative effect on productivity (Roper et al., 2008). Thirdly, much of the focus in the literature has been on the observed effects of innovation on firm productivity. This paper uses an endogenous switching technique which allows us to utilise micro-econometric data allowing the construction of counterfactual scenarios of the innovation-productivity relationship in Irish firms, which allows the exploration of the treatment effect of innovation for both innovators and non-innovators. The introduction of this type of analysis is novel to the innovation-productivity literature.
The Irish sample from the third edition of the Business Environment and Enterprise Performance Survey (BEEPS) is employed for the analysis of the first paper. The principle purpose of the BEEPS data is to collect data on the business performance and business environment of firms operating in developing economies. In the third edition of BEEPS (2005), a reference category of developed economies from Europe were taken which included Ireland, Germany, Spain, Greece and Portugal. BEEPS collect detailed data on the characteristics of firms, their performance and questions relating to their location, and the environment within which they operate. In each country, sampling frames were constructed from National statistical institutes, Chamber of Commerce membership lists, industry registers and commercial sources such as the Yellow Pages (Synovate, 2005). The sampling methodology employed for BEEPS is stratified random sampling.

The first paper identified that a firm's innovation effort, capital intensity, firm size, location and its operating environment are key variables in explaining a firms' propensity to innovate. However, the importance of these factors differs across innovation types. There is an economic geography effect found where the results support the urban-hierarchy model where 'urbanisation' is very important for product innovation and less important for process innovations in the Irish case. We find mixed results on the effect of innovation on the productivity of innovators across innovation types. In particular, it is identified that the effects of technological and non-technological innovations on a firm's production performance are different. The results indicate in the counterfactual analysis that all types of innovation have a positive effect on the productivity levels of non-innovating firms which outlines a rationale for policy intervention that ensures inclusion of non-innovators as well as innovators for assistance, which could significantly improve market outcomes in the Irish case.

The second paper extends a similar analysis to that taken in the first paper, but to a wider European data-set. Again, it analyses the process of innovation and the links between firm innovation and firm productivity performance across a range of European economies, and in particular there is an exploration of the differences between countries which are primarily transition-driven\(^1\) and those which are primarily innovation-driven\(^2\) economies (as defined by the Global Competitiveness Report, 2005/2009). The majority of studies investigating firm innovation and productivity have been conducted in innovation driven economies. In the literature, cross-economy type analyses are less common (Griffith et al., 2006; Janz et al., 2004), primarily due to a lack of cross-economy type data. Another contribution of this paper to the literature is the analysis is split to compare results for the manufacturing and service sectors. The literature has relied on the innovation studies of manufacturing firms to predict patterns and understandings of the innovation process in service firms (Menor et al., 2002), however, the limited literature conducted on innovation in service firms has identified the drivers of innovation to be distinctly different from that found in manufacturing studies (Mina et al., 2014).

\(^1\) This included data from the third edition (2005) of BEEPS for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland and Slovakia.

\(^2\) This included data from the third edition (2005) of BEEPS for Ireland, Germany, Spain, Portugal, Greece and Slovenia.
To explore the above issues with respect to manufacturing versus service firms and in innovation driven versus transition driven economies, an endogenous-switching technique is employed, which allows us to utilise micro-econometric survey-based information from both innovating and non-innovating firms, and these techniques thereby allow us to construct counterfactual scenarios which overcome problems of self-selection in the data. We analyse data from the Business Environment and Enterprise Performance Dataset (BEEPS) which provides detailed data on the innovation and productivity performance of 4,082 European manufacturing and service firms. This allows us to undertake a detailed cross-economy comparative study of the links between innovation and productivity in different contexts. Our results suggest that innovation is found to have a positive effect on the productivity levels of firms across all innovation and economy types. Some of our findings provide support for the importance of traditional patterns driving innovation previously found in the innovation literature, in which innovation efforts and investments in physical and human capital are found to be important for product and process innovations in manufacturing and service firms and across all types of economies. However, notably manufacturing firms in transition economies rely on ‘softer’ (other than R&D) drivers of innovation. Other institutional factors including policy support are also found to be important for both manufacturing and service firms, while economic geography is found to be important primarily for service firms. Finally, our counterfactual analysis also allows us to outline a rationale for policy intervention towards non-innovating firms, depending on where the transitional heterogeneity effects are greatest.

The third paper explores product and service life cycles using the firm as a unit of analysis. A key objective of the paper is to compare the results between manufacturing and service firms. Our theoretical and empirical understandings on the patterns of product/service life cycles have only been applied to manufacturing firms. However, services accounted for 70 per cent of global output (GDP) in 2012 (World Economic Indicators, 2014). Hence, creating a better understanding around service life cycles is a key motivation for this third paper. Furthermore, the majority of studies examining life cycles have been conducted at the industry level examining the birth (entry) and death (exit) of firms (Dunne et al., 1988; Audretsch and Mahmood, 1995; Doms et al., 1995; Agarwal and Gort, 1996; Agarwal and Audretsch, 2001).

This paper is novel by examining life cycles using the firm as a unit of analysis and in particular to include a knowledge disruption stage to the Innovation Value Change (IVC) (Roper et al., 2008) in our understanding of the innovation-productivity relationship. Using the theoretical literature, five key hypotheses are developed and examined: (1) a replacement effect is likely to occur within the firm with new and improved products having a significant effect on the likelihood of a firm discontinuing products; (2) younger firms will be more likely to product innovate; (3) older firms will be more likely to discontinue products; (4) process innovation will be more significant at the end of the PLC and lastly; (5) a location effect, where product innovation is more likely to occur in more urban areas than in rural areas. A two-step production function approach which controls for the endogeneity concerns between product innovation and discontinuation is employed that firstly examines a firm's decision to innovate and secondly, a firm's decision to discontinue products/services.
The results indicate that product and service life cycles have similar patterns where innovation is significant for product/service discontinuation and process innovation is found to be important for product innovations. Similarly, monopoly power is important for innovation in both industry types. However, there are also some underlying differences, particularly in relation to firm age and economic geography effects. The conclusion of the paper is that it is not appropriate to assume that the process of innovation in manufacturing firms will be identical to the process of innovation in service firms.

The first three papers focus on exploring the relationship between innovation and productivity and life cycles, across innovation types, across sectors types and across different economy-contexts at the firm level in European countries. These papers provide a better understanding of the innovation-productivity and product/service life cycle within firms. A number of policy understandings can be taken from the studies. But, from the empirical literature, it is far from clear if government subsidies are good or bad in achieving long term growth (Bergstrom, 2000). Subsidies are found to have a positive and significant effect on firms innovating in the Irish case and in innovation driven economies, but not for firms in transition economies (evidence from Chapter three and four). However, the subsidies measure is a general measure of whether the firm received subsidies from EU, National and/or Regional sources – it did not indicate what type or purpose the subsidy was for. Hence, it is not clear if firms that receive subsidies have an overall better firm performance (other than for innovators in innovation driven economies) relative to firms that do not receive subsidies. There is also a lack of literature that focuses on government intervention in firms in European economies. Considering industrial policy is at the centre stage of Europe's 2020 new growth model strategy (European Commission, 2010), the fourth paper analyses the treatment effects of subsidies on firm performance in innovation and transition driven economies.

Market distortions arising from externalities, monopolies, capital market imperfections and incomplete markets are some of the arguments underlying the rationale for subsidy intervention (Pack and Saggi, 2006; Rodrik, 2009). The theoretical underpinnings of policy intervention in the aforementioned circumstances are strong. The objective of the fourth paper is to identify if subsidy intervention has a positive effect on the employment growth and productivity of firms in innovation and transition driven economies. A key objective of the paper is to identify if different policy intervention patterns are identified in innovation driven economies vis-a-vis transition driven economies.

The data source for this paper is the third edition (2005) and fourth edition (2009) of BEEPS. The sample of innovation driven economies consists of 2,917 manufacturing, service and construction firms and the sample for the transition driven economies is 1,446 firms. Due to simultaneity and self-selection bias with policy intervention and subsidy recipients, an endogenous switching model is also employed in the fourth paper. The fourth paper identifies that the targeted firms are larger, they export and are more high-tech – but policymakers are targeting the ‘weaker’ firms within this category of firms. There is evidence in this paper that a key motivation for government intervention
may be to balance regional growth both in innovation and transition driven economies. Furthermore, government intervention in innovation driven economies and transition driven economies has a positive effect on firm productivity. But, if they want to maximise market returns with respect to firm productivity, the evidence in the analysis suggests that policymakers in innovation driven economies and transition driven economies are perhaps choosing to intervene with the ‘wrong’ group of firms.

This thesis proceeds with a chapter providing a context on the economic and innovation performance for the sample of countries used in this thesis (chapter two). The following four chapters (chapters three to six) present a detailed account of the theoretical and empirical literature, the methodological approaches taken in each paper and a detailed account of the results and conclusions of each empirical paper. The third chapter presents the first empirical paper of this thesis – Innovation and Productivity in Irish Firms. The fourth chapter presents the second empirical paper – Firm Innovation and Productivity in Europe: Evidence from Innovation and Transition Driven Economies. The fifth chapter presents the third empirical paper – Explorations of Product and Service Life Cycle Patterns in European Firms. The sixth chapter presents the fourth empirical paper of the thesis – Government Intervention and Firm Performance in Europe. The thesis concludes with the final chapter on – The Conclusions and Discussions of the Research. This chapter focuses on the implications of the research: for business; for policy-making; for the theoretical and empirical literature; and finally focuses on the limitations of the research and outlines areas for future research.
REFERENCES


