Aspects of the Furniture Industry in Ireland

Kevin P. Heanue, BA, MA (Economics)

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Dublin City University Business School
Dublin City University

Supervisor: Professor David Jacobson

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I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of PhD, is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work

Signed:

ID No: 98971301

Date:

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As I embarked upon this PhD, two of my greatest supporters were my father and mother. Unfortunately, my father Paddy passed away before the dissertation was completed.

I dedicate this PhD to him.

Contents

Abstract

This dissertation examines aspects of networking, industrial organisation, innovation, and industrial agglomeration in the Irish furniture manufacturing industry. With its focus on firm behaviour, industrial organisation and industrial structure the research is located within the tradition of industrial economics.

Based on heterodox economic perspectives and utilising a variety of methods (albeit principally case study based), the dissertation provides new theoretical and empirical knowledge on this under-researched, resilient, predominantly Irish-owned and geographically dispersed low and medium technology industry. The dissertation consists of four thematically homogenous papers, the theme being the industrial economics of the furniture industry in Ireland.

The first paper, based on a case study of a network of three furniture firms, differentiates between two main situations in terms of the evolution of trust: where firms are geographically clustered and where they are spatially dispersed.

The second paper examines the development of the Irish furniture industry in the context of policy changes, and compares two different forms of industrial organisation in the furniture industry, the wooden furniture industrial district in County Monaghan and the TORC network in Dublin, Wicklow and Cork.

The third paper, drawing on case studies of four firms, examines the changing nature of embeddedness and innovation for Irish low-tech firms, focusing primarily on the furniture industry but also including data on another low-tech sector – fabricated metal products – as a comparison.

The final paper, using the methodology of standardised location quotients, addresses whether or not there is evidence of industrial agglomeration in the Irish furniture industry.

Findings and implications of the research are drawn together in the conclusion.

List of Tables and Figures

Introduction

What is the dissertation about?

This dissertation examines various aspects of networking, industrial organisation, innovation, and industrial agglomeration in the Irish furniture manufacturing industry. In doing so, it also explores dimensions of institutional learning, organisational proximity, industrial policy and embeddedness. With an emphasis on firm behaviour, industrial organisation and industry structure the dissertation is located within the tradition of industrial economics. The dissertation takes a heterodox approach to these industrial economics issues and uses a variety of research methods albeit principally taking a case study based approach. Given its overall concerns, the dissertation contributes to that body of industrial economic related research best described as 'industrial dynamics'. The dissertation consists of four thematically homogeneous papers, the theme being the industrial economics of the furniture industry in Ireland.

Theoretical frameworks and themes

The focus is on exploring various aspects of firm behaviour and organisation, industry structure and policy within the furniture manufacturing industry in Ireland. A variety of approaches and theoretical frameworks could be used for such an analysis. An orthodox industrial economics approach, for example, would focus on the application of neo-classical economic concepts, hypothetico-deductive methodologies and econometric data analysis tools to focus specifically on aspects of market structure, firm behaviour and firm performance and the interrelationships among these three elements. A new industrial economics approach focusing more on firm strategic behaviour would employ game theoretic methods. Moving away from such orthodox-inspired approaches, a variety of alternative perspectives including Austrian and Marxian, to name just two, could be employed.

This dissertation takes a heterodox approach in its attempt to focus on the industrial dynamics of the Irish furniture industry. The broad perspectives used are those of Neo-Schumpeterian Economics (e.g. Hanusch and Pyka, 2005; Smith, 2005; Laestadius, 1998), the Capabilities Approach (e.g. Zollo and Winter, 2002; Teece and Pisano, 1994; Penrose, 1959) and Regional Science (e.g. Stimson *et al.*, 2006;

Isserman, 1977). The key literatures focused on are those of industrial agglomeration, trust, networking, embeddedness, innovation and proximity[1]. In broad terms the concern is with the industrial dynamics of the furniture industry. Industrial dynamics describes and analyses how an industry is currently organised, but also how it differs from earlier periods, what forces have acted to bring about this reorganisation of the industry, and how these forces have been changing over time (Krafft, 2004a, 2004b; Dietrich, 2006). The aim is to better understand the dynamics of technical, structural and institutional change at the level of the single firm, as well as the inter-firm level and the level of the industry as a whole. As such, it utilises theories of innovation, economic organisation, competitive advantage, organisational competencies, economic evolution and growth (Danish Research Unit for Industrial Dynamics, see http://www.druid.dk/). The dissertation incorporates elements of many of these approaches. Such an eclectic approach to the dissertation was taken due to the variety of questions addressed in the four papers. Substantively, this dissertation examines various aspects of networking, industrial organisation, innovation, and industrial agglomeration in the Irish furniture manufacturing industry.

Paper 1 addresses a particular aspect of firm behaviour and industrial organisation – networking. More specifically, the paper focuses on the process of network formation through examination of a case study of a spatially diffuse network of three furniture firms called TORC, based in Counties Dublin, Wicklow and Cork. The research question addressed in the paper is *why geographically dispersed competitors with no history of personal relations might initially decide to come together, be willing to share sensitive commercial information and begin to engage in co-operative projects*. More specifically, in the absence of spatial proximity, what is the *origin* of trust that enables the emergence of these new arrangements, and how is institutional learning or trust-building facilitated? This article differentiates between the evolution of trust in two main situations: where firms are geographically clustered and where they are spatially dispersed. While the former has received a lot of research attention, the latter has not. Drawing on the theoretical literature on economies of agglomeration, economies of association, trust and social networks[2], it

[1] Full references to all these literatures are provided in appropriate places in the dissertation.
[2] Full references to all these literatures are provided in appropriate places in Paper 1.

is argued that organisational proximity is an alternative to spatial proximity as a context within which ascribed trust can develop, even in the absence of direct interaction.

Paper 2 explores the development of the furniture industry in the context of policy changes, and compares two different forms of industrial organisation – industrial networks and industrial districts - in the furniture industry in Ireland. After a brief review of Irish industrial policy generally, and networking policy particularly, the paper briefly describes and compares two examples of the organisation of production in the furniture industry, the wooden furniture industrial district in County Monaghan and the TORC network in Dublin, Wicklow and Cork. In so doing it builds on Paper 1 in which the TORC network was introduced. The theoretical context for the paper rests on such issues as the spatial limits of agglomeration in a small economy and the differences between agglomerations and networks. The implications for policy include support for networking in general and not just among spatially proximate firms. Finally, the implications of these two examples of industrial organisation for theory and policy in Ireland are considered.

Paper 3 is based on another aspect of firm behaviour – innovation. The paper is situated against the resurgent interest in the relationship between location and the innovativeness of firms[3]. The research question addressed in the paper is: *what role does location play in the innovation processes of low- and medium-technology firms?* The literature on innovation and geographic proximity combined with a reconceptualisation of the Granovetterian concept of embeddedness[4] provides the theoretical context. Case studies of four Irish low- and medium-technology firms, two in the furniture industry and two in the metal products industry provide the empirical setting. Among the issues addressed are whether deep, local embeddedness – common in the kinds of industrial districts discussed in Paper 2 – is essential for innovativeness and whether there is a pattern of change over time in the nature of the relationship between embeddedness and innovation. Interspersed throughout is discussion of the relevance of the research to rural industrial development, a discussion that reflects the dispersed nature of the industry.

[3] Full references to all these literatures are provided in appropriate places in Paper 3.
[4]Full references to all these literatures are provided in appropriate places in Paper 3.

Paper 4 focuses on spatial aspects of industrial structure. The paper is based on the literature on industrial agglomeration [5] and applies a statistical methodology to identify agglomeration in the Irish furniture industry. The main research question is *whether there is evidence of industrial agglomeration (and therefore agglomeration economies) in the Irish furniture industry*. Although the industry is widely dispersed there are some apparent local concentrations of furniture firms. Whether or not these constitute industrial agglomerations has not previously been formally explored, though it has been suggested, at least in County Monaghan, by the case-based approach of Mottiar (1997) referred to in Paper 2. Using and extending the methodology of standardised location quotients (O'Donoghue and Gleave, 2004), the paper identifies County Monaghan as a statistically significant spatial concentration of furniture firms suggesting that it may warrant the designation of industrial agglomeration. However, the analysis casts doubts as to whether this grouping of firms should continue to be recognised as an industrial agglomeration in the future as there appear to be less agglomerative tendencies in the location now than in the past.

Brief overview of the furniture industry

There are three main reasons why the furniture industry was chosen as the empirical setting for this research. Each of these reasons is briefly outlined here and then expanded in the following three paragraphs. First, partly due to a 'policy obsession' with high-tech sectors, so-called low- or medium-technology (LMT) industries such as furniture have received scant research and policy attention. Second, internationally and within Ireland, the evidence that does exist indicates that somewhat contrary to conventional expectations, the furniture industry is relatively resilient in terms of its contribution to economic activity. Third, the industry is dispersed around Ireland and, therefore, contributes in a concrete way to government objectives of balanced regional development as outlined in the National Spatial Strategy. Each of these reasons suggest that new theoretical and empirical knowledge is needed about, for example, the development path of the industry; the innovation strategies firms use to maintain resilience; the alternative types of industrial organisation that underpin firm activities; and the changing spatial features of the industry. This dissertation by

[5] Full references to all these literatures are provided in appropriate places in Paper 4.

addressing the specific research questions in the four papers attempts at least partially to fill that knowledge gap.

There is something of a 'policy obsession' with high-tech industries [6] (von Tunzelmann and Acha, 2003; Hirsch-Kriensen *et al.*, 2005). The high-tech focus has for a large part been driven within the discipline of economics by the emergence of New Growth Theory (Romer, 1986, 1990; Lucas, 1988) and the 'linear model of innovation' paradigm (Stokes, 1997). Based on a particular conceptualisation of technological change and the role of knowledge in economic growth, and the associated ideas such as the 'knowledge economy' and 'new economy', both research and policy-making attention has been distracted away from LMT sectors and their role in growth and development, towards a very small number of high-tech sectors especially information and communications technologies (ICT) and biotechnology. On empirical grounds, such a one-sided, uncritical emphasis on high-tech sectors is misplaced as most growth and employment in OECD countries still emanate from LMT industries (Kaloudis *et al.*, 2005). Even in Ireland which has a much higher share of total manufacturing employment in high-technology sectors than all other EU countries, LMT manufacturing still accounts for over 82 percent of manufacturing employment (Heanue and Jacobson, 2008). Importantly, research attention is slowly beginning to focus more on LMT sectors. On conceptual and theoretical grounds, alternative perspectives such as Neo-Schumpeterian Economics and the Resources-Based/Capabilities perspective employ broader understandings of key concepts such as technology, knowledge and innovation, such that the variety of sectors and types of activities opened up for analysis is broader than that suggested by the approaches outlined above. For example, they focus attention on non-science based innovation as well as research-based innovation; on the importance of practical knowledge as well as codified knowledge; on both patented and unpatentable innovations; on firm capabilities as well as firm resource allocation decisions; a variety of types of learning in addition to learning by R&D; and on LMT sectors as well as high-tech sectors.

[6] The definition of high-, medium- and low-tech is based on OECD (1986; 1994) and Hatzichronoglou's (1997) classification of the technological intensity of manufacturing industries, i.e. the percentage of turnover allocated to R&D. For high tech it is greater than 5%; for medium tech between 0.9% and 5% and for low tech, less than 0.9%.

Internationally, and especially in Europe, the furniture industry is considered a resilient sector (Hirsch-Kreinsen, 2003), and in comparison to other LMT sectors such as clothing, for example, still a strong performer in high-cost economies. This assessment of robustness has also been made for the furniture industry in Ireland (Cooke, 1996; Jacobson *et al.*, 2001). In terms of robustness, there are three pertinent indicators. First, according to the Forfás Annual Employment Survey, employment in the Irish furniture industry is 22 percent higher in 2006 than in 1973. Second, the overall number of firms in the industry is virtually the same in 2006 as in 1973 - a stability that masks an inverted u-shaped trend in the number of furniture firms[7]. Third, and as a direct consequence of the preceding two features of the industry, average firm size as measured by employees per firm has increased by 27 percent from 1973 to 2006. This general growth masks another u-shaped trajectory, in this case in average firm size over the period. The Irish furniture industry is not large. In 2006, the industry employed 5,602 persons in 298 firms, the vast majority of which are Irish-owned. Similar to the profile of the industry internationally, Irish furniture firms are predominantly small: in Ireland average firm size in terms of people employed, is 19.

According to Census of Industrial Production data, in 2006 furniture manufacturing provided 3.06 percent of manufacturing employment, 9.9 percent of manufacturing enterprises and 1.0 percent of manufacturing gross value added. Overall, the industry exports 18 percent of turnover compared to 88 percent of turnover for all manufacturing sectors. It contributes a disproportionately low 0.20 percent of Irish manufactured exports in value terms, though given its relatively low value-to-weight and value-to-volume ratios, this is not surprising. Similar to other industries, the Irish furniture industry is heterogeneous. As outlined in Table 1, it contains five sub-sectors - Chairs and Seats; Office and Shop furniture; Kitchen furniture; Other Furniture and Mattresses.

[7] Compared to the general economy-wide trends in employment (69 percent increase) and firm numbers (115 percent increase) over the period, the evolution of the furniture industry does not appear as impressive. However, the growth pattern of the furniture industry does compare favourably to the trends in other LMT sectors over the period; see the demise of the clothing (Mulvaney, 2004) and motor assembly sectors (Jacobson, 1989), for example.

Table 1: Summary of Irish Furniture Industry Sub-Sectors 2006[8]

	Percentage of Industry				
Sub-sector description and NACE Code	**Firms**	**Employment**	**GVA**	**Exports (€)**	**% of Sector Turnover Exported**
Chairs and seats (NACE 3611)	5	7	7	17	39
Other office and shop furniture (NACE 3612)	15	17	17	8	9
Other kitchen furniture (NACE 3613);	40	31	30	7	4
Other Furniture (NACE 3614) *	37	33	31	35	21
Mattresses (NACE 3615)	3	12	15	34	44

Source: Derived from Census of Industrial Production: Figures may not add due to rounding

The diversity of the contribution of individual sub-sectors to employment, gross value added and export propensity reflects the heterogeneity of market focus, innovation, strategic actions and scale of enterprises within the industry. Four of the case study firms used in the dissertation are from NACE 3614 'Other Furniture', the sector that produces living room, dining room and bedroom furniture and what is also described as occasional furniture, e.g. sideboards, coffee tables etc. This sub-sector is the largest contributor to industry employment, GVA and exports. The other furniture industry case study firm is from NACE 3611 'Manufacture of Chairs and Seats'. Although not a significant contributor to overall industry employment, GVA or exports, the sub-sector is nonetheless the second ranked in terms of export intensity.

Furniture manufacturing in Ireland is relatively dispersed spatially. Each of the 26 counties contained furniture manufacturers in 2006; this is a relatively stable pattern as all but four counties also contained furniture manufacturers in 1973. There also

[8] Data for NACE 3614 is an estimate and therefore overall industry figures are necessarily estimates also. From 2004, NACE 3614 (Other furniture) is not reported separately in the Census of Industrial Production. It is added to a composite group (for secondary confidentiality reasons) that is made up of non furniture related NACE categories such as 3621 (Striking of coins), 3622 (Manufacture of jewellery and related articles n.e.c.), 3630 (Manufacture of musical instruments), 3663 (Other manufacturing n.e.c.), 16 (Manufacture of tobacco products), 23 (Manufacture of coke, refined petroleum products and nuclear fuel). Therefore, it is impossible to compute a precise value for the output of the either subsector NACE 3614 or the furniture sector in total from 2004 onwards.

However, it is possible to make a simple estimate of the contribution of subsector NACE 3614 and therefore the overall size of the sector also. The method used was to calculate the proportional contribution of the subsector NACE 3614 to various measures (employment, GVA etc) in each of the years 2000 and 2004 and use the average contribution of NACE 3614 from those two years as an estimate of the contribution of NACE 3614 in 2006.

appear, however, to be localised concentrations of firms in some places. This spatial distribution is important for two reasons. First, in an attempt to redress the unbalanced pattern of economic and residential activity in Ireland a National Spatial Strategy was formulated in 2002 (see DOELG, 2002). Trying to operationalise a more balanced distribution of economic activity, however, is problematic when many existing high-tech sectors and other sectors identified as potential employment generators for the future tend to favour urban locations, and more particularly, locations within the Greater Dublin area. Therefore, it is important to gain an understanding of the dynamics of relatively dispersed industries such as furniture. This importance is accentuated by the long-term decline of employment in agriculture, and the reduction in rural-based construction sector employment that is a consequence of the downturn in the Irish economy since 2007 (Heanue, 2008). Second, the presence of localised concentrations of furniture manufacturing in certain locations suggests that agglomeration economies may be present in those locations. As such economies may contribute to the competitiveness and innovativeness of firms in those locations, it is an important empirical question to seek to identify whether such agglomerations exist.

Features of the furniture industry

In addition to those characteristics outlined above there are other features of the furniture industry that are important to be aware of in contextualising the sector. As a mature industry, furniture manufacturing is characterised as having low profit margins, low entry costs, limited market growth and intense competition between firms for market share (Hewitt-Dundas and Roper, 2001; Porter, 1980). The industry is highly fragmented in nearly all countries with the majority of firms in the small to medium sized category. Labour costs as a percentage of overall costs are high.

The industry is traditionally viewed as being supplier-dominated (Pavitt, 1984) and, therefore, not inherently innovative. Structural and institutional features such as low R&D expenditure and the absence of patent protection are often used to support such an assertion. The reality, however, is more complex. On the one hand, the absence of patent protection and the consequent widespread imitation of successful designs simultaneously reduce the life cycle of product innovations and the appropriability of innovation-based rents. On the other hand, however, there is evidence that for some

design leaders in the Dutch and Italian furniture industries private regulation in the form of reputational sanctions reduces the incentive to copy competitors' products and instead helps maintain adequate incentives to invest in innovative design (Gemser and Wijnberg, 2001; Gemser and Jacobs, 2002). These features are important as quality dimensions – especially design quality/design innovation and product improvement – are strongly related to business performance in the furniture industry (Forker *et al.*, 1996).

The sector is price-sensitive and labour-intensive (Seldon and Bullard, 1992). The industry has experienced rapid globalisation in recent years (Drayse, 2008) and in many European countries and the United States is subject to increasing competition in some market segments from intense low-cost competition from newly industrialising countries. Nevertheless, some European furniture manufactures are highly competitive in world markets due to their expertise in logistics, marketing, design, and product, process and organisational innovation. Therefore, somewhat paradoxically, the furniture industry is resilient in many high-cost European economies and countries like Italy and Germany consistently rank among the largest producers in Europe and are among the leading exporters of furniture on world markets (Florio *et al.*, 1998).

In terms of possible strategic responses for furniture manufacturers in an increasingly competitive and globalised market place, Schuler and Buehlmann (2003) argue that a strategy of cost competitiveness is either impossible or not sufficient. Instead, they argue, non-quantitative factors such as managerial ability and entrepreneurial spirit may be more important to secure global competitiveness. They point to the fact that in the U.S., some progressive furniture manufacturers are seeking improved efficiencies through componentisation and supply-chain management systems to support efficient assembly processes. Increasingly, they argue, furniture will need to be built to order in contrast to the current dominant model of building - warehousing - selling, so as to satisfy demand for customisation. Evidence provided in this dissertation suggests that some Irish furniture firms are already implementing such strategies.

Kennedy (2003) outlines many of the trends/challenges that are particularly pertinent for the Irish furniture manufacturing industry. First, Irish furniture manufacturers have lost out to imports in a growing furniture market since the mid 1990s. Second, there is little cooperation on production or marketing among manufacturers and most enterprises are slow to adopt new designs and technology. Third, although many companies are slow to react to market information, other more successful companies have specialised in office furniture or other lucrative niches such as contract work for hotels. Fourth, even with middle to top range furniture items, price is still a deciding factor for buyers; a feature that is likely to encourage the trend towards outsourcing by manufacturers to maintain a competitive edge. Fifth, notwithstanding the availability of inducements, the industry has been slow to adopt group-marketing schemes. Sixth, marketing and lack of scale are seen as big weaknesses resulting in a passive dependence on the home and UK markets and absence of branding, and inability to compete on price and compete in mass markets respectively.

Many of these are persistent issues that have been mentioned in almost every report on the industry since the Committee on Industrial Organisation in 1963 to the most recent all-Ireland report on the industry by Enterprise Ireland, Invest Northern Ireland and InterTrade Ireland in 2002. This dissertation provides an insight into how specific firms within the industry are reacting to these challenges.

Methodology

The approach to this dissertation is best described as that of heterodox economics due to the eclectic use of theoretical and conceptual perspectives and also the use of a variety of methodologies (Lawson, 2006). The approach, and the themes covered by the approach, are consistent with those used by other heterodox industrial economists (e.g. Andreosso and Jacobson, 2005; Edquist, 2005; Cooke, 2001; Laestadius, 1998). The overarching philosophical stance is that of pragmatic realism. This is explored in more detail below.

Heuristically, discussions about research in the social sciences are often framed in terms of the difference between quantitative or qualitative methods. The appropriate focus, however, is at a higher philosophical level and is concerned with which set of

alternative ontological and epistemological assumptions is used. Guba and Lincoln (1994) outline four major research paradigms in the social sciences – positivism, post-positivism, constructivism (or interpretivism) and critical theory – each with their own philosophical underpinnings. The answers to three fundamental and interrelated questions form the building blocks to the respective philosophical foundations of the paradigms. Ontologically, what is the form and nature of reality? Epistemologically, what is the relationship between the knower or would-be knower and what can be known? Methodologically, how can the inquirer go about finding out whatever he or she believes can be known about? These differences primarily centre on the nature of social reality and the relationship of the researcher to the researched (Clarke, 2006).

In terms of epistemology, the discussion in the social sciences has traditionally emphasised the positivism/interpretivism distinction, and that general disaggregation is sufficient for the purposes of the discussion here. Positivism is based on the ontological assumption that reality can be measured and accessed objectively. In addition, reality is characterised by stable causal relationships. Positivists usually use quantitative methods to try to identify these relationships and establish and describe general, objective laws about the event or phenomena they observe. Qualitative methods can also be used within a positivist approach to support quantitative findings and to isolate appropriate causes.

Interpretivism is an umbrella term for a variety of epistemological and anti-epistemological approaches including phenomenology, hermeneutic philosophy, critical theory, post-structuralism and postmodernism. Although distinct, these approaches share the common ontological view that reality can never be accessed directly. Instead, it is ‘constructed’ by social interaction. Therefore, the aim of research is to explore the subjective interpretations surrounding an event or phenomenon. Qualitative methods are best suited to exploring these interpretations. However, quantitative techniques such as content analysis are also used to examine patterns across individual interpretations.

It is clear from the previous two paragraphs that both quantitative and qualitative methods can be used within each of the broad epistemological approaches of positivism and interpretivism. In this dissertation, a variety of methods are used: the approach taken is to match the research question with the most appropriate method. Such a strategy, where the methodological approach, rather than being guided by an epistemological premise, is driven by the question that is asked, is best described as pragmatic realism.

Philosophical roots of pragmatic realism

Pragmatic realism is often associated with the work of historical figures such as John Dewey, William James and Charles S. Peirce (Hildebrand, 2003) and contemporary contributors such as Cherryholmes (1992), Murphy (1990) and Rorty (1990). Ontologically, realists accept that reality can be accessed objectively. However, unlike positivists, realists take the view that reality is not confined only to what can be seen. Therefore, they incorporate unobservable entities and concepts (for example, trust) into their theories. In addition, for realists, research can identify which of the unobservable entities actually exist. Epistemologically, for pragmatic realists practicality in data collection rather than focusing on maintaining distance and impartiality (as in the case of positivists) or closeness (as in the case of interpretivists), is a key feature of their philosophical approach (Crotty, 1998 in Creswell and Plano Clark, 2008, 24). Pragmatic realists are guided by choosing the best method in order to solve a particular problem. The focus is on the consequences of the research and on the primary importance of the question asked rather than the methods (Creswell and Plano Clark, 2007). More specifically, the pragmatic rule or maxim is to 'choose the combination or mixture of methods and procedures that works best for answering your research questions' (Johnson and Onwuegbuzie, 2004, 17). This means that rather than being theory focused, pragmatic realism is problem focused, where the method chosen depends on the problem. Therefore, as Creswell and Plano Clark (2007, 26) argue, a pragmatic approach 'draws on many ideas, including employing "what works," using diverse approaches, and valuing both objective and subjective knowledge: it is pluralistic and oriented towards… practice' (p.23).

How does a pragmatic approach differ from the philosophical underpinning of mainstream industrial economics?

Mainstream economics and its constituent sub-disciplines such as industrial economics are characterised by a positivist philosophical approach. Ontologically, mainstream industrial economics is based on the assumption that reality can be measured and accessed objectively. In addition, reality is characterised by stable causal relationships. Epistemologically, the investigator and the investigated are assumed to be independent entities, and the investigator is capable of studying the investigated without influencing it or being influenced by it. Within mainstream economics, research proceeds with theory being used to derive questions and/or hypotheses that are stated in prepositional form and subjected to empirical test to verify them. Replicable findings are "true". This positivist philosophy is reflected in the pursuit of a particular methodological approach throughout the discipline, described by Lawson (2009, 95) as an insistence upon mathematical-deductivist reasoning with a closed-system and atomistic ontology which results in a victory of technique over substance (Hodgson, 2009). Reflecting this view, but with wider application, (Guba and Lincoln, 1994, 105) note the historically heavy emphasis on quantification in all the sciences and formal modelling as the defining feature of the orthodox economic approach to research (Lawson, 2006).

Is pragmatic realism different from the philosophical underpinnings of heterodox approaches?

Heterodox economics is an umbrella term for a variety of separate economic projects or traditions such as post-Keynesianism, (old) institutionalism, feminism, Marxian, Austrian and social economics, among others (Lawson, 2006). Some argue that the key difference between heterodoxy and orthodoxy is ontological (e.g. Lawson, 2003) while others argue that epistemological concerns should be the focus (McFarling, 2009). In a more general vein, Davis (2009, 85) affirms the heterogeneity of heterodox economics by discussing the orientation of different heterodox approaches towards economics as a whole. For Davis, some approaches orient inwards towards the orthodox core of the field and some outwards towards the periphery of the field's boundaries and points of contact with other sciences.

Without delving further into such debates, it is, however, clear that the common feature of all heterodoxy is a rejection of the modern orthodox economic approach. In fact, Colander *et al*. (2004) argue that beyond the rejection of orthodoxy, there is no single unifying element that characterises heterodox economics. It is clear, however, that various traditions or projects within heterodox economics may have different philosophical approaches from each other. Lawson (2003, 2009) argues for a critical realist stance for heterodox economics – a stance that places heterodox economics within the post-positivist designation of Guba and Lincon (1994). Within the post-positive paradigm, ontologically, reality is assumed to exist but to be imperfectly apprehendable due to both humans' inability to intellectually comprehend reality and also because of the intractable nature of reality (Guba and Lincoln, 1994, 110). Due to its philosophical starting point, there is an increased utilisation of qualitative techniques within the post-positivist paradigm (Guba and Lincoln, 1994, 110). Research proceeds by the falsification (rather than verification) of hypotheses with research taking more account of contextual information than within a positivist framework. Replicated findings are *probably true* (but always subject to falsification).

By contrast, other heterodox approaches may take philosophical stances that place them within one of the other Guba and Lincoln (1994) paradigms, with different ontological and epistemological starting points to post-positivism. Colander *et al*. (2004) argue, however, that for all heterodox economic approaches it is because of their method, not their ideas, that they are considered by the elite of the profession to be outside the field (p. 492).

The relationship between pragmatic realism and heterodox economics is not straightforward. For example, to the extent that a heterodox economics perspective such as feminist economics (see Strassmann, 1994), exclusively draws on an interpretivist philosophical stance to guide its research, it differs from the maxim underlying pragmatic realism. In another example, some evolutionary economists, another group of heterodox economists, exclusively adopt a positivist or post-positivist philosophical stance to their research (e.g. Castellacci, 2006), and, therefore, also differ from the pragmatic approach. By contrast, other evolutionary economists take a more pragmatic approach (see Laestadius, 1998; Andreosso-

O'Callaghan et al. 2003). Therefore, being a heterodox economist does not necessarily mean that you are a pragmatic realist, if your research is exclusively guided by an alternative philosophy such as positivism or interpretivism. However, if you are a pragmatic realist, you are undoubtedly a heterodox economist in the sense that you do not universally subscribe to the notion that a single philosophical position (other than pragmatic realism) guides your research.

How does this translate into the methods used in this dissertation?

A variety of research methods are used in this dissertation. Within social science research, the benefit of employing a variety of methods is increasingly realised (Pawson, 1989; Doig and Littlewood, 1992; Bullock *et al*., 1995; George and Bennett, 2004). In this dissertation, Papers 1, 2 and 3 are explicitly based on case studies of either individual firm behaviour or forms of industrial organisation. By contrast, Paper 4 is based on statistical methods. Therefore, although a variety of methods are used, the main methodological approach is that of case studies.

Case studies are often viewed as a subset of qualitative approaches (George and Bennett, 2004, 19). However, Yin (1994) distinguishes case study research from both the stereotypical quantitative and qualitative approaches. He defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, addresses a situation in which the boundaries between phenomenon and context are not clearly evident, and uses multiple sources of evidence. For Yin (1994) a case study is different from traditional quantitative research due to the difficulty of using statistical analysis because of the 'degrees of freedom' problem. Although case studies are not appropriate for statistically based generalisations to larger populations, they are appropriate for analytical generalisations to theory. On this basis, Yin (1994) differentiates the case study approach from traditional qualitative research due to the former's ability to be used for explaining and testing theory; this is a stance that is generally supported (Flyvbjerg, 2006; Stake, 1995). Therefore, for Yin (1994) the case study approach can be used for explanation, exploration and description.

In general, case studies are the preferred social science research strategy when 'how' or 'why' questions are being posed, when the investigator has little control over

events and when the focus is on a contemporary phenomenon within some real-life context (Yin, 1994). More generally, Yin (1994) suggests that research strategies such as experiments, surveys, histories and case studies, may all be used for explanatory, exploratory and descriptive purposes. Which to use depends on three conditions: the type of research question posed; the extent of control the researcher has over actual behavioural events; and the degree of focus on contemporary as opposed to historical events.

Nevertheless, there are criticisms of the case study approach. Flyvbjerg (2006) explains these criticisms and outlines and comprehensively refutes five misunderstandings about case-study research. First, theoretical knowledge is more valuable than practical knowledge. He shows that although rule-based learning is important, it cannot be privileged over experiential learning in the process of acquiring skills and understanding. Second, one cannot generalise from a single case. This is to misunderstand that theory can and should change if it can be soundly refuted through a case study; Flyvbjerg (2006) uses the example of Galileo's single experiment – or case study – to revise the Aristotelian view of gravity. Third, a case study is most useful for generating hypotheses, whereas other methods are more suitable for hypotheses testing and theory building. Flyvbjerg (2006) shows that, on the contrary, the case study is an excellent means of generalising from falsification. Drawing on Popper (1959), he uses the example of the single identification of the black swan to test, falsify and change the theory according to which there are only white swans. Fourth, the case study contains a bias towards verification. Flyvbjerg (2006) refutes this through references to a vast range of researchers conducting case studies in which they found their preconceptions to be wrong, and, as a result had to be radically revised as a result of their findings from their case studies. Fifth, it is often difficult to summarise specific case studies. Flyvbjerg (2006) accepts that case studies are difficult to summarise. The misunderstanding here, he argues, is in the view that they should be summarised. The richness – and learning – is often in the whole story, and summarising can remove this.

Yin (1994) proposes the idea of a causal case study when arguing that cause-effect relationships can be researched with case studies. Such causal case studies favour the application of explanatory theories. In this context, the case study is characterised by

a hypothetico-deductive approach: theoretical frameworks and hypotheses are developed before data is gathering and analysis undertaken, and the research design involves the testing of hypotheses/research questions. This type of approach guided the case studies in this dissertation.

Case studies can consist of either a single case or multiple case design. A single case study design is used when the case is a critical case, an extreme/unique case or a revelatory case (Yin, 1994): in these circumstances, the single case is a complete study. By contrast, a complete study might also encompass more than one case. Such a multiple case study design facilitates the use of replication logic (either literal or theoretical) in the study. For Yin (1994), replication logic is analogous to the logic used in multiple experiments. For multiple case studies, cases should be selected so that they predict similar results (literal replication) or produce contrasting results but for predictable reasons (theoretical replication). Single or multiple case studies may have one unit of analysis (be holistic) or more than one unit of analysis (embedded).

Drawing on the philosophical approach of pragmatic realism, this dissertation uses case study methodology in Papers 1, 2 and 3 to address the specific "why" and "how" research questions posed in each paper. These questions centred on contemporary phenomena such as the formation and nature of trust among competitor firms in a network, the relationship between the innovation processes of firms and geographic location, and the interaction between industrial policy and different types of industrial organisation. These were situations where the boundaries between phenomenon and context were not clearly evident, where contextual information was clearly going to be important and multiple sources of evidence would be useful. In these circumstances, a case study approach best suited the research questions. Paper 1 is a single-case complete study, based on the unique case of a publicly stimulated formal network of three furniture firms. Paper 2 is an embedded single case study. The case study is industrial organisation in the furniture industry, with two sub-units, industrial networks and industrial districts within the case. Paper 3 uses a multiple case design focusing on four firms in two sectors, furniture manufacturing and fabricated metal products.

By contrast, Paper 4 sought to answer a "what" question in relation to the spatial distribution of furniture firms. Statistical analysis of the number of firms in particular locations, which facilitated the testing of hypotheses about the distribution of the data, was the appropriate method to address this research question.

The structure of the dissertation

The dissertation consists of four thematically homogeneous papers; the theme being the industrial economics of the furniture industry in Ireland. Structurally, the remainder of the dissertation consists of these four papers and a conclusion. The papers are presented chronologically. Three of the four papers that form the dissertation have been published already either as journal articles or book chapters[9]. More specifically:

An earlier version of the first paper, 'Organisational Proximity and Institutional Learning' was published as Heanue, K., and Jacobson, D. (2002) Organizational Proximity and Institutional Learning: The Evolution of a Spatially Dispersed Network in the Irish Furniture Industry, *International Studies of Management &Organizations*, 31, 4, Winter 2001-2002, 56-73.

An earlier version of the second paper, 'Industrial Districts and Networks: Different Modes of Development of the Furniture Industry in Ireland?' was published as Jacobson, D., Heanue, K., and Mottiar, Z. Industrial Districts and Networks: Different Modes of Development of the Furniture Industry in Ireland? in D. Felsenstein, P. McCann, R. McQuaid, and D. Shefer (eds) *Public Investment and Regional Economic Development*, London: Edward Elgar, 2001.

An earlier version of the third paper, 'Embeddedness and Innovation in Low and Medium Tech Rural Enterprises' was published as Heanue, K. P. and Jacobson, D. (2008) Embeddedness and Innovation in Low and Medium Tech Rural Enterprises, *Irish Geography*, 41, 1, (March), 113-137.

[9] The substantive text of the papers in this dissertation is the same as that of the published versions. The main differences are the updating of industry data and policy discussion in Paper 2 and the inclusion of quotations from interviews in Papers 1 and 3.

The final paper, 'Industrial Agglomeration and the Irish Furniture Industry' is not yet published but a version based on it and combining aspects of Paper 3 is being prepared for submission to *Regional Studies*.

Inevitably as part of the PhD process there is a sharing of ideas between student and supervisor. This necessary part of the PhD process becomes very apparent when research is published prior to the submission of the dissertation, as is the case with the papers outlined above. However, for all of the papers, the majority of the actual research and the writing of the articles were carried out by me, Kevin Heanue, the author of this dissertation. More specifically, for the first and third papers, my contribution was approximately 90 percent with Professor David Jacobson contributing the remaining effort. For the second article, my contribution was approximately 80 percent. Dr. Zeine Mottiar was accorded co-authorship on the basis that some of the material in the paper on the furniture industry in County Monaghan was drawn from her PhD, and allowed a comparison to be made with primary data I had generated on the TORC furniture network. On that basis although she did not physically contribute to the paper, it is fair to accord her about 10 percent of the effort. Professor David Jacobson's contribution to the second article consisted of the remaining 10 percent. For the final paper, Professor David Jacobson's contribution consisted of normal supervisory input. When published, it will have, as sole authorship, that of Kevin Heanue. Both Professor David Jacobson and Dr. Zeine Mottiar will confirm that they are in agreement with the description of their co-authorship efforts as outlined here.

In addition to the papers presented in this dissertation, other papers presenting broader perspectives on research carried out during the dissertation process have also been published. These include:

Heanue, K. and Jacobson, D. (2005) Globalisation and embeddedness in low–tech industries: Some evidence from Ireland, in Hirsch-Kreinsen, H., D. Jacobson and S. Laestadius (eds) *Low-tech innovation in the knowledge economy*. Frankfurt/New York/Oxford: Peter Lang.

Jacobson, D. and Heanue, K., (2005) Policy Conclusions and Recommendations in G. Bender, D. Jacobson and P. Robertson (eds), *Non-Research-Intensive Industries in the Knowledge Economy, Perspectives on Economic Political and Social Integration*, Special Issue I, Catholic University, Lublin/PL, 359-416.

Jacobson, D. and Heanue, K., (2005) Implications of low-tech research for policy, in Hirsch-Kreinsen, H., D. Jacobson and S. Laestadius (eds) *Low-Tech Innovation in the Knowledge Economy*, Peter Lang, Frankfurt/New York/Oxford.

Jacobson, D., Heanue, K., and van Egeraat, C., (2002) Industrial Agglomeration in W. Lazonick, (ed.) *IEBM Handbook of Economics*, London: Thomson.

Apart from the above publications there is another body of research output that is closely linked with this dissertation. Presentations of my initial research for this dissertation in a series of international workshops on LMT industry, led to an invitation to be involved in an eventually successful EU 5th Framework proposal that led to a three year project with the acronym PILOT (Policy and Innovation in Low-Tech Industries www.pilot-project.org). The outcomes from PILOT support the thrust of the findings from this dissertation on a broader European scale.

Paper 1: Organisational Proximity and Institutional Learning: The Evolution of a Spatially Dispersed Network in the Irish Furniture Industry

Introduction

The spatial proximity of firms, by increasing the likelihood of interaction within a shared socio-cultural environment, is accorded a central analytical role in explaining the economies which firms derive from being part of an industrial agglomeration (Malmberg and Maskell, 1997; Schmitz, 1999; Jacobson *et al.*, 2001a). The now vast industrial-district literature, for example, argues that geographic propinquity, particularly when combined with inter-firm networking, increases the opportunity for, and ability of, individual enterprises to reap both tangible and intangible efficiencies from their local industrial, social and institutional environment (Brusco, 1982; Pyke and Sengenberger, 1990; Best, 1990; Asheim, 1996). Moreover, modern innovation theory, which attributes a critical role to technological, organisational and institutional learning in the process of innovation, stresses that learning is an interactive and socially embedded process (Lundvall, 1992). Thus inter-firm co-operation, facilitated by spatial proximity, is seen as important in promoting interactive learning, innovation and the development of competitive advantage.

Within spatially-focused explanations of competitive advantage, research attention has focused on how the social embeddedness of economic relations (Granovetter, 1985) is required for the establishment of trust, or "the expectation that parties will work for mutual gain and refrain from opportunistic behaviour" (Cooke and Morgan, 1998, 30). In particular, it is hypothesised that the institutional thickness (Amin and Thrift, 1994) associated with many industrial agglomerations fosters *ascribed trust* that is based on the family, ethnic or other characteristics of the exchange partners (Humphrey and Schmitz, 1996, 14). Ascription is considered to be a relatively accessible and cost-efficient basis of trust in industrial agglomerations, and to perform an important role in both the initiation of co-operative relationships (Lorenzen, 1998, 24) and the initial development of trust (Humphrey and Schmitz, 1996, 14). However, an issue that has received scant explicit attention in the

literature is whether, in the absence of spatial proximity, it is possible for a qualitatively similar basis of trust to develop among firms.

Theoretically and empirically, it is clear that geographically dispersed firms may derive tangible and intangible benefits or economies of association (Cooke, 1996, 138) from being part of a network[10] (Foss, 1996; Capello, 1994; Teece, 1986). Trust may be conceptualised as a higher-order capability (Lorenzen, 1998, 9), a particular type of economy of association. As trust is an inductive process (Humphrey and Schmitz, 1996, 8) built through repeated interaction, it is evident that trust may be fostered over time among geographically dispersed firms, once they begin to co-operate. Moreover, studies of publicly-funded programmes to promote networking suggest that embeddedness, i.e., the interdependence of economic behaviour and social relations, (a necessary condition for trust) can be created among previously non-cooperating firms once they are brought together (Cooke and Wills, 1999, 232), thereby enabling them to benefit from economies of association.

The central question addressed here is *why geographically dispersed competitors with no history of personal relations might initially decide to come together, be willing to share sensitive commercial information and begin to engage in co-operative projects*. More specifically, in the absence of spatial proximity, what is the *origin* of trust that enables the emergence of these new arrangements, and how is institutional learning or trust-building facilitated?

We argue that geographically dispersed firms may become organisationally proximate or have "shared knowledge and representations of the environment within which the firm exists" (Hudson, 1999, 64), and that this alternative proximity may provide an institutional basis upon which firms can establish trust and initiate co-operation. Specifically, our hypothesis is that organisational proximity, fostered by the frequent interaction of firms in a geographically *diffuse* institutional framework, can lead to the development of ascribed trust among geographically dispersed competing firms, similar to that which may ’naturally‘ occur in a geographically

[10] A network involves a form of associative behaviour among firms that helps expand their markets, increase their value-added or productivity, stimulate learning and improve their long-term market position (Bosworth and Rosenfeld, 1992, 19)

concentrated group of enterprises. The research question is addressed using a case study of the evolution of a formal[11] horizontal network of three geographically dispersed Irish furniture firms.

Ireland is interesting as a setting for such a study because of the amazing turn-around in the economy in the 1990s - the 'Celtic Tiger' phenomenon (Sweeney, 1999). Much of the focus in explaining this success has been on the international competitiveness of multinational corporations located in Ireland and on Ireland's attractiveness as a location for these corporations. There is some evidence that Irish-owned manufacturing enterprises, particularly in traditional sectors such as furniture, are comparative under-contributors to the economy's performance (Killen and Ruane, 1998). However, studies to either confirm or contradict this general evidence in the case of particular sub-sectors are rare. Moreover, as a small, relatively culturally homogeneous country with small indigenous firms, at least some of the pre-conditions for horizontal inter-firm linkages are present; yet, there are very few cases of such linkages. Thus it is appropriate to study in depth the few that do exist such as the network of Irish furniture firms that is studied here.

There are two salient features of the Irish furniture industry in this context. First, it is small, accounting for less than two percent of manufacturing employment. Following decline in recent decades, it began to grow again in the mid-1980s. Second, although the industry is dispersed throughout the country, the sector is also characterized by several long-established concentrations of firms. It is unclear whether being part of a furniture agglomeration in Ireland is conducive to the development of the same type of competitive advantages attributed to spatial proximity in other furniture industries (see Maskell, 1998).

Previous research on an Irish wooden furniture agglomeration in County Monaghan reveals only low levels of informal co-operation. If it is to be defined as an industrial district, it is not on the basis of the kind of intense informal co-operation that exists in the Third Italy (Jacobson and Mottiar, 1999).

[11] By formal network, we mean a contractual agreement among a restricted number of firms to engage in a specific joint activity likely to result in mutual gains. In contrast, informal networks are characterised by non-contractual, often multiple relationships, which emerge and dissolve in a more organic fashion.

The need for co-operation among furniture firms to overcome their size and competitive weaknesses has been consistently highlighted (Committee on Industrial Organisation, 1964; Committee on Industrial Progress, 1973; NESC, 1996). Despite this, competition in the Irish furniture sector is characterised by aggressive price competition, denigrating competitors' products to buyers, rapid imitation of apparently successful designs, and significant 'black-economy' activity, i.e., cash-based transactions that are not reported to the tax authorities. Furthermore, unco-operative or market-oriented supplier relationships (Best, 1989) between furniture manufacturers and retailers exacerbate this form of competition (Heanue, 1995).

Our analysis is structured as follows. The next section presents the theoretical framework of economies of agglomeration and economies of association that examines the nature of the externalities that may be attained by firms which are, or are not, spatially proximate. *Organisational proximity*[12] (as opposed to spatial proximity) is introduced as an alternative analytical concept to describe the relationship among geographically dispersed firms. Following this, a case-study of the furniture network is introduced, and the involvement of the network firms in furniture-sector initiatives described. The discussion of the case study draws together the theoretical and empirical aspects of the paper, that is, the formation of organisational proximity and the process of institutional learning among the three firms in the network. The final section presents conclusions and suggests directions for further research.

Theoretical Framework

Economies of agglomeration

According to Malmberg and Maskell (1997, 31):

> Agglomeration economies are seen to have their roots in processes whereby links between firms, institutions and infrastructures in a geographic area give rise to economies of scale and scope; the development of general labour markets and pools of specialised skills;

[12] The notion of proximity reappears throughout this dissertation. For example, it underpins much of the analysis of industrial organisation in Paper 2. The role of proximity in relation to innovation is discussed in Paper 3. Finally, Paper 4 is directly concerned with identifying the spatial proximity patterns of furniture manufacturing firms.

enhanced interaction between local suppliers and customers; shared infrastructure; and other localised externalities.

This definition shows that there are a number of different ways in which economies of agglomeration may arise. In addition, Malmberg and Maskell (1997, 31) distinguished between the vertical, horizontal and territorial-institutional linkages that the firm may have with its wider industrial system. Attention has particularly focused on the intangible benefits of knowledge spillovers and information sharing, i.e., the territorial-institutional factors, in addition to the tangible cost efficiencies, that may accrue to a firm due to its location in an industrial agglomeration. Porter's (1998) more recent work on industrial clusters is an example of this approach.

In spatially-focused explanations of competitive advantage, institutional thickness (Amin and Thrift, 1994) derived from the underlying notion of the social embeddedness of economic relations (Grabher, 1993; Granovetter, 1985), reinforces the socio-cultural bonds that facilitate trust and therefore helps to explain competitiveness (Schmitz, 1994, 559). Trust, or the confidence that parties will work for mutual gain and refrain from opportunistic behavior (Cooke and Morgan, 1998, 30), is of economic value because it allows agents to initiate and maintain co-operation without building costly safeguards (Lorenzen, 1998, 9). Also, trust is crucial for the establishment of non-contractual inter-firm linkages (Asheim, 1996, 381). Since the basis of trust is inductive (Humphrey and Schmitz, 1996, 8), as long as interactive experiences among firms are positive, the trusting relationship deepens, leading to increased interactive learning and to the need for fewer safeguards in their dealings with each other. We are primarily interested in the origins of trust, or how an economic agent can identify whom it may expect to act honestly, when personal experience cannot be called upon.

Two particular origins of trust are associated with industrial agglomerations: ascribed trust and socially regulated trust. *Ascribed trust*, or trust that is based on the family, ethnic or other characteristics (e.g., membership of a social community, religion or profession) of the exchange partners (Humphrey and Schmitz, 1996, 14), is considered to be a relatively accessible and cost-efficient basis of trust in industrial agglomerations. Crucially, ascribed trust performs an important role in both the

initiation of co-operative relationships (Lorenzen, 1998, 24) and in the initial development of trust (Humphrey and Schmitz, 1996, 14). *Socially regulated trust* arises when the generally accepted set of rules or conventions governing the expectations of honesty among economic agents, is buttressed by sanctions. For example, an active trade or sectoral association that provides shared infrastructure (management, training, marketing, technical or financial help) or accreditation for member firms, can, by threatening the removal of its assistance, ensure that opportunistic behavior among firms is discouraged. In either of these trusting schemas, the risk of being ostracised for contravening local rules, cultures or norms of economic behavior has serious social and economic consequences. The institutional richness of industrial agglomerations facilitates and strengthens these two types of trust, so that the expectation of honesty from a potential co-operating partner is an externality.

According to Mishan (1971, 2): "The essential feature of an external effect is that the effect produced is not a deliberate creation but an unintended or incidental by-product of some otherwise legitimate activity." The benefits derived from external economies are due to the ’public-good‘ characteristics of externalities, which makes the advantages of the externalities non-excludable and non-rival in consumption. Schmitz (1999), in conceptualising the strength of clusters of firms, argued that positive local external economies in themselves offer an essential but not sufficient explanation for competitiveness. Joint action by local producers — either individual firms co-operating, or groups of firms joining forces in business associations or consortia — is also necessary to explain the sustained competitiveness of agglomerated firms (Schmitz, 1999, 469). Indeed, some writers go further and suggest that "the realisation of potential external economies is not automatic, but requires inter-firm co-operation" (Parkin, 1999, 65). Whatever the nature of the interaction among firms required to derive the benefits of external economies, the apparent dearth of significant and high levels of inter-firm co-operation in the Irish furniture industry is important. It is exactly such joint action, inter-firm co-operation, networks and/or organisational association that provide member firms of successful furniture agglomerations in other countries (for example, Denmark and Italy) with the specific benefits not available to those outside the immediate geographic area.

Economies of association

Cooke (1996, 138) suggested that "economies of association are 'club goods'[13] that economically rational and co-operatively minded actors seek from risking faith in each other's trustworthiness." These 'club goods'are the advantages derived from being part of a network and which belong exclusively to the network (Capello, 1994). These economies may take the form of tangible complementary assets[14] (Teece, 1986) and/or intangible higher-order capabilities[15] (Foss, 1996). Club goods are expected to yield rents to the club members. In contrast to a public good, a club good is *excludable* (i.e., it is possible to prevent its consumption by whole groups of people). However, like public goods, club goods are *non-rival* in that the consumption of the good by one person does not reduce the consumption of the same good by other persons (Pearce, 1983); and a club good is public (and non-rival) to the club members only.

Sustained competitive advantage from economies of association can only arise if the capabilities are not easily imitable by competitors. For example, drawing on the resource-based perspective, Foss (1996, 3), argued that causal ambiguity may sustain the rent-yielding potential of higher-order capabilities. Causal ambiguity makes it difficult for non-members of the club or network to understand the links between the higher-order capabilities and the competitive success of the club members. For sustained competitive advantage, according to Foss (1996, 13), in addition to imperfect imitability, the higher-level capabilities must have value, and be rare, specific and non-substitutable. Although Foss (1996, 13) conceptualised higher-order capabilities as being geographically bounded, there is no reason why this has to be the case. Geographic proximity[16] may facilitate the development of higher-order capabilities, but we would argue that systemic interaction among firms, whether geographically constrained or not, may also lead to the development of these capabilities.

[13] Also called mixed goods, semi-private goods and impure public goods.
[14] For example, marketing, competitive manufacturing and after-sales support.
[15] Higher-order capabilities may include, for example, standards, knowledge-sharing in R&D networks, and shared behavioural norms (Foss, 1996). Trust can also be seen as a higher-order capability (Lorenzen, 1998, 9)
[16] A conventional definition of geographical proximity is adopted: economic agents or individuals are considered geographically close when they are near enough to each other, or the transportation systems are good enough, so it is possible for them to have daily face-to-face relations.

If this is true, then even in the absence of spatial proximity, firms can attain tangible and in particular, intangible economies of association through networking. However, in order to embark on a strategy of inter-firm co-operation, the potential members of the network must at least share a common perception of the strategic choices available to them, and perceive that a supportive institutional environment for co-operative behavior exists. Trust is a club good that can be fostered through interaction. In the absence of spatial proximity, and more specifically in a situation of limited previous interaction among firms, how can trust originate?

Let us begin with three possible answers to this question: (1) ascribed trust associated with a rich institutional environment; (2) social regulation, and (3) legal regulation. The first is, as we have shown, primarily associated with geographical proximity (and the opportunity for face-to-face interaction). The question is whether organisational proximity in the absence of geographical proximity can lead to trust. Social regulation may provide the basis for trusting relationships, even when firms are not spatially proximate, provided a sufficiently strong institutional framework such as an active trade association exists. In the absence of an ascribed or socially regulated framework, and particularly if the firms have limited previous interaction, it would be reasonable to assume that the most probable basis of trust would be legal regulation. In this case, written legal contracts and agreements, by providing a framework for guiding the response of parties to unanticipated contingencies (Lorenz, 1999, 305) attempt to reduce the possible scope of opportunistic behaviour.

Organisational proximity

How can the idea of organisational proximity contribute to an understanding of the development of trust? Several interconnected yet distinct conceptualisations of proximity - including spatial, organisational, economic and cultural - have been suggested by various writers (Bellet *et al*., 1992; Burmeister and Colletis-Wahl, 1997; Hudson, 1999; Lundvall, 1992). Hudson (1999, 63) suggested that, particularly in discussions of networks, it is useful to draw a distinction between spatial and organisational proximity; while Burmeister and Colletis-Wahl (1997, 232) proposed organisational proximity as the central concept from which several forms of proximity are derived. Inter-organisational interactions rely on a combination of these different forms of proximity.

Organisational proximity is of a "non-material and non-market nature" (Burmeister and Colletis-Wahl, 1997, 235), and it "presupposes the existence of shared knowledge and representations of the environment within which the firm exists" (Hudson, 1999, 64). Through interactions in intra-industry relations, co-operation and collective learning processes, organisational proximity creates a capacity to assemble fragmented information, tacit knowledge and other non-material and non-standardised resources (Burmeister and Colletis-Wahl, 1997, 235). Information originating outside the network is received in a qualitatively better way, due to organisational proximity among the actors (Burmeister and Colletis-Wahl, 1997, 235). Organisational proximity is viewed as a prerequisite for collective learning processes, and for co-operation among different organisations in the creation of new resources and innovation (Lung *et al.*, 1996). While organisational proximity is a necessary condition for creating innovations and resources through processes of collective learning, it is also simultaneously a product of the process of collective learning. It may seem to be more likely where there is spatial concentration, but organisational proximity may be considered non-spatial from a conceptual point of view (Burmeister and Colletis-Wahl, 1997, 236). Although space exists as a physical constraint and organisational proximity requires spatial mediation, "the networks through which learning is enabled and expressed are not necessarily territorially defined" (Hudson, 1999, 64). Spatial mediation can take the form of either temporary geographic proximity (e.g., meetings) (Burmeister and Colletis-Wahl, 1997, 236) and/or an institutional framework that facilitates the flow of information and the exchange of goods and services. Spatial proximity may but does not necessarily facilitate organisational proximity by increasing the probability of encounters among agents in a system (Hudson, 1999, 63). However, spatial proximity is not necessary for interaction among individuals and groups.

In general, organisationally proximate firms are likely to be closely networked and to share views on the suitability of potential new partners in the network. As Gulati and Gargiulo (1997, 3) have argued:

> The production of inter-organisational networks is driven by a dynamic process involving both exogenous dependencies that prompt organisations to seek co-operation, and an endogenous embeddedness dynamic in which an emerging network progressively orients the

> choice of partners. New ties are influenced by the social network of prior ties in which they are embedded.

Research on networks has identified two mechanisms through which network structures, or inter-organisation linkages, can provide information about potential partners. Based on Granovetter's (1992) terminology, Gulati and Gargiulo (1997, 7) state that the first mechanism is *relational embeddedness* — namely, the probability that two organisations will build a partnership is a function of the intensity of their direct and indirect connections. This mechanism carries information on potential partners and promotes trust. The second mechanism, *structural embeddedness*, relates to the status or position that an organisation occupies in a network. This mechanism contains signaling messages about the reputation, quality and visibility of an organisation within a system (Gulati and Gargiulo, 1997, 9). The attractiveness of a potential partner can be gauged from its status, which in turn depends on the organisation (or type of organisation) already tied to this partner.

The three firms in the network to which we turn in the following section are not spatially proximate. We recognise that spatial dispersion is relative, and that the distances between our three firms, if they were in a large country with a better transportation system like the United States, would be less significant. Nevertheless, in the Irish context, the four hours by road travel between the furthest spaced of the three firms makes them clearly spatially non-proximate.

This dispersed network provides the empirical setting for examining our hypothesis that the evolution of organisational proximity can provide the basis for ascribed trust among geographically dispersed competitors with a limited history of face-to-face interactions. The information was obtained from interviews during July and October 1999 with the three furniture firms in the TORC[17] network, the Manager of the Pilot Network Programme from Enterprise Ireland,[18] and the TORC network manager. The interview guidelines are in Appendix A.

[17] Torc is the Irish word for a twisted metal necklace or armband in Celtic design.
[18] This is the state industrial development agency responsible for the promotion of Irish-owned industry.

The Case Study

The Furniture Network [19]

The case study furniture network consists of three firms: D.F. Caulfield in Dublin, Castlebrook Furniture and Design in Wicklow, and O'Donnell Designs in Cork. The companies range in size from 14 to 30 employees. Although D.F. Caulfield and Castlebrook Furniture and Design are located only 20 miles from each other, before becoming involved with the network in 1996 they had not previously co-operated in any way and the owners did not know each other personally. In contrast, notwithstanding the 200-mile gap between O'Donnell Designs and the other two companies, the owner of O'Donnell Designs personally knew the owner of D.F. Caulfield, and he had met the proprietor of Castlebrook Furniture and Design on an international trade visit organised by the industrial support agencies. This network produces hotel bedroom furniture on a contract basis.

The catalyst for the formation of the network was the participation of the three firms in a Pilot Inter-firm Co-operation (or 'Network') Programme initiated by Enterprise Ireland in November 1996. As a result of participation in the six-month facilitation phase of the Pilot Network Programme the three firms established a product-development and marketing company as a joint venture, which they registered under the trade name TORC. The three new ranges of products that were developed, which are aimed primarily at the UK market, have so far resulted in a six-percent increase in turnover for the network firms. In addition, TORC has identified the need to upgrade its management, marketing and computer-based skills in order to provide a centralised contract management capability for the network. To address this problem, the network firms have submitted a proposal to begin a SKILLNETS[20] initiative. The network firms regard each other as competitors on the Irish market (albeit in slightly different quality and quantity sub-sectors), but they have an informal agreement about the nature of competition. They pursue non-aggressive practices toward each

[19] Additional information on the TORC network is presented in Jacobson *et al*. (2001b).

[20] The SKILLNETS *Training Networks Programme*, funded by the Department of Enterprise, Trade and Employment and the European Union, encourages groups, clusters and networks of enterprises to collaborate in establishing business-led training processes for their workforce. The programme was established to encourage and add impetus to Irish business' drive towards the adoption of best-practice standards in human-resource development. The SKILLNETS approach, in contrast to existing training schemes aimed at individual firms, focuses on mobilising groups of companies to develop strategic answers to their joint training needs.

other and, for instance, pass on tender information if they feel it is more appropriate for one of the other firms.

Previous and Current Involvement of the Network Firms in Furniture-Sector Initiatives

All three companies have received capital and/or employment grant assistance in the past from Enterprise Ireland or its predecessor. In addition, O'Donnell Designs and D.F. Caulfield were involved with Link International,[21] a project initiated by the Irish Trade Board[22] in the early 1980s. All three proprietors have participated in trade visits abroad instigated by various industrial support agencies; most of these visits took place in the mid-to-late 1980s.

The owners of both O'Donnell Designs and D.F. Caulfield have been members of industrial advisory boards for the development of third-level education courses in The Furniture College, Letterfrack (County Galway); and both companies have employed students from this college either on work placement or as full-time employees. In addition, O'Donnell Design's proprietor has been a member of the advisory board for furniture-related courses delivered by the University of Limerick and the Dublin Institute of Technology. The advisory boards usually also include a representative of Enterprise Ireland. The owner of Castlebrook Furniture and Design has not been involved in any of these activities.

Apart from involvement in the Pilot Network Programme, the TORC network firms also individually have current relationships with Enterprise Ireland. D.F. Caulfield is involved with Enterprise Ireland in a Company Development project. For example, in July 1999, O'Donnell Designs obtained approval for an R&D project through the Company Development Programme. In addition, the firm is about to start a World-

[21] In this project, five Irish furniture companies, including two of the TORC network firms each produced a separate product from a range of complementary Danish style furniture, designed and marketed by a Danish company. The products were sold mostly in the United States. However, this project was not successful from the perspective of the Irish companies for two reasons. First, there was a collapse of demand for the products due to a downturn in the US economy, shortly after the Irish companies became involved in the project; since the Irish companies were the last into the market, they were hardest hit. Second, the Irish companies, by their own admission, got involved too quickly without an adequate understanding of what was required. Two of the other three companies that were involved with the Link International project have since gone out of business.

[22] Now incorporated into Enterprise Ireland.

Class Business Cluster initiative with Enterprise Ireland; and Castlebrook Furniture and Design has also applied to be involved in this initiative. All three firms are members of the National Furniture Manufacturers Association (NFMA). Some of the TORC members are involved in other professional networks. The proprietors of both O'Donnell Designs and Castlebrook Furniture and Design are participating in PLATO[23] – the Small Business Development network.

Discussion

The formation of organisational proximity

The assertion that the three firms in the network are organisationally proximate presupposes that they share values, meanings, understandings and tacit knowledge and a common set of institutions through which these features are produced. The TORC network firms are not spatially proximate. Nevertheless, the individual involvement of each of the firms over time in various industry initiatives with Enterprise Ireland not only contributed to the development of a shared 'worldview,' but it also enabled the firms and institution together to identify suitable partners for the current network. Caulfields Managing Director confirmed that:

> "all the companies had similar objectives and personalities"

and in fact, one of the reasons why they partnered with companies in Wicklow and Cork was that

> "No other company in Dublin had the same objectives"

Confirming the existence of this worldview, the TORC network manager stated that:

> "Although Enterprise Ireland approached the companies, there was already a willingness on the part of the companies to do something".

[23] PLATO supports owner-managers of small and medium enterprises (SMEs) to develop their management skills through the help of leading local companies. By August 2000, approximately 980 SMEs and over 90 of Ireland's leading firms were involved in PLATO networks across Ireland.

This is consistent with the earlier-quoted argument of Gulati and Gargiulo (1997, 3) about how networking ’progressively orients the choice of partners.’

In network analysis, the position an actor occupies in the structure is a function of the actor's relational pattern in this network (Winship and Mandel, 1983). Therefore, in our example, the more frequent each of the three firms' involvement had been over time with Enterprise Ireland (assuming no negative factors in this involvement), the greater its status or position within the common network with the state organisation. In addition, this individual interaction with Enterprise Ireland resulted in more information on themselves being available to potential partners and therefore provided a basis for the establishment of trust. Gulati and Gargiulo (1997, 9) argued that inter-organisational ties should be more common among firms that enjoy high-status positions in an emerging social network for two reasons. First, becoming a partner of other high-status organisations raises the status of one's own organisation; and, second, the higher one's own status in an existing network, the more likely it is that one will attract other high-status organisations as potential partners. None of this, it should be emphasised, is contingent upon geographical proximity.

The basic idea is that as long as co-operative experiences are positive, then "networks are the residual effect of past behavior and the driving force for future action" (Gulati and Gargiulo, 1997, 1). Although the owners of the three firms may have had little face-to-face interaction, in comparison with equivalent firms that are geographically proximate, their individual involvement over time with Enterprise Ireland provided them with status, and signaled their reputation, quality and professionalism. Furthermore, the frequent indirect interaction of each of the firms with each other mediated through Enterprise Ireland, led to the dissemination of information on each of the three companies within this common network, thereby providing a basis for the establishment of trust. We argue that the structural and relational embeddedness in this extended network provided an institutional framework supportive of trusting relationships. In addition, the common network’s institutional environment, by facilitating the flow and exchange of information, provided a mechanism for mediating the constraint of spatial dispersion among the three furniture firms, which precluded their direct interaction. For our purposes, the intriguing question is: What was the nature of the trust among the TORC network

firms, and what were the processes underlying the trust-building or institutional learning that occurred?

The process of institutional learning

We have argued that the organisational proximity of the three firms provided the basis of trusting relationships among the network members. As trust is rarely completely absent from most social settings, Cooke and Morgan (1998, 30) suggested that it is better to speak of "high-trust and low-trust relationships", the latter being closer to the opportunistic behavior of transaction-costs and agency theories. However, if our expanded network was simply the generator of low-trust relationships, then there would be nothing of interest to learn from it.

As we have shown, there are various perspectives on the origins of trust. The institutional origins of trust can range from legal or social regulation (firm-level contracts and society-level conventions) to cognition (ascription) (Lorenzen, 1998, 12). The former refers to the situation where opportunistic behaviour is not expected. This is where such behaviour breaches accepted behavioural conventions and negative sanctions are likely to be imposed on offenders. The latter implies that even in the absence of regulatory sanctions, economic agents expect honesty in their interaction with other actors possessing certain social characteristics, because those characteristics are identified as being synonymous with trustworthiness. The different origins of trust are often combined or operate sequentially; and a probable sequence for the development of trust, particularly in the absence of a high-trust environment (Cooke and Morgan, 1998), may be from a formal origin to a more ascribed basis. For instance, for a single firm, the initial trust needed for co-operation may be achieved on the basis of contracts and law. As the initial limited investments in the relationship are increased and the exchange of information grows, the basis of maintaining trust can be understood from a sunk-cost perspective, i.e., exit from the relationship would result in a loss of those transaction-specific assets that had been created. As the co-operating relationship continues and expands, there is increased information exchange between the agents so that there is a movement from a lower to higher trust relationship, through a process of learning. As a result, co-operative relationships are governed less and less by expensive contracts and by the need for monitoring. Of course, as Lorenz (1999, 305) highlighted, "there is nothing to

preclude that trust will be transformed into mistrust as knowledge and information are accumulated." However, if the initial trusting and co-operative experiences continue to be positive, the evolution of a less formalised, higher-trusting environment among firms is clearly a club good.

So, what was the nature of trust among the TORC network firms? Ascribed trust would be suggestive of a rich institutional environment, primarily associated with geographical proximity (and the opportunity for face-to-face interaction). In contrast, trust based on formal written contracts and agreements would indicate a "low-trust" environment and limited previous interaction among the firms, upon which to have established expectations of honesty. Finally, socially regulated trust would reflect the existence of a regulatory force such as a credible and active trade association.

Let us apply this idea to the TORC network. We have shown that the environment in which furniture firms operate in Ireland is for various reasons not conducive to co-operation; and inter-firm relationships are primarily characterised by low trust. More specifically, the Pilot Network Programme Manager stated that:

> "In Monaghan and Navan, there is too much rivalry due to spin-offs and poaching staff…firms are competing on cost…small companies are followers. The companies will attend courses for training, but not for business. The large firms in Monaghan are locked into the state agencies solely. They are independent with a high opinion of themselves and will not network"

Therefore, a priori, ascription would not provide a likely origin of trust among Irish furniture firms. Social regulation is not the basis for trust either. The main trade association, the National Furniture Manufacturers Association (NFMA), of which the three TORC firms are members, is primarily an advice-giving body, and it does not provide an accreditation or certification role for firms within the sector. Therefore, the NFMA is not a source of any regulatory sanctions that could be used to discipline opportunistic member firms. Furthermore, particularly in the facilitation phase of the network, no credible sanctions could be attributed to the involvement of Enterprise Ireland, such that firms would incur a social cost if they were seen as failures on account of the programme not being successful. Indeed, participation in earlier, failed, networks did not count against members in the TORC network. This suggests

that the origin of trust among our network members was more likely to be formal trust, based on written contracts and agreements.

This conclusion, however, is not consistent with the story of the origins and development of the TORC network. We argue that the decision of the three firms to enter the facilitation phase of the network was based on ascribed trust. The owner of D.F. Caulfield knew the proprietor of O'Donnell Designs and the two companies had been involved, along with the Irish Trade Board, in the unsuccessful Link International project in the mid-1980s. However, the two companies had limited interaction between that time and their subsequent coming together in the Pilot Network Programme. Castlebrook Furniture and Design had not worked with either of the other two firms, and it was only briefly acquainted with the owner of O'Donnell Designs. In addition, both D.F. Caulfield and O'Donnell Designs had more frequent involvement with Enterprise Ireland than Castlebrook Furniture and Design.

Over time, this sustained involvement with, and continued commitment to, various sectoral activities associated with Enterprise Ireland meant that the firms were part of an existing network. That this particular network was the source of a club good for the three case study firms, is demonstrated by the fact that although many other furniture firms had long-term involvement with Enterprise Ireland, the state agency contacted O'Donnell Designs and D.F. Caulfield to invite them to become involved in the Pilot Network Programme. In turn, these two companies individually identified Castlebrook Furniture and Design as a potential network member. As Caulfields Managing Director remembered:

> "Enterprise Ireland approached myself and O'Donnells and we originally suggested X as a network partner, but they weren't interested…didn't see anything out of it for themselves…we knew of Castlebrook as a competitor and through our customers, and Enterprise Ireland agreed that they were the right type of company"

It is clear that the relational and structural embeddedness of the three firms in an ongoing relationship with Enterprise Ireland over time facilitated indirect contact among the firms and the transfer of signaling messages concerning the reputation,

quality and status of each organisation. For example, in terms of discussing network participants, the decisions centred on assessments such as:

> "He is exceptionally honourable…they are quality producers"

In other words, in contrast to what may have been expected, the origin of trust for the three firms was ascriptive, being mediated through Enterprise Ireland. For example, Castlebrooks Managing Director reported that:

> "I had concerns about joining the network because the other two companies knew each other better…my concerns were addressed by Enterprise Ireland who vouched for the other two companies…

Caulfields Managing Director confirmed this:

> "Castlebrook needed a bigger leap of faith to get involved in this…Enterprise Ireland was crucial here"

Trust, as a club good, already existed prior to formal networking and was not undermined by any subsequent negative experiences. The trust to initiate co-operation was ascribed (to each of the firms) on the basis of professionalism, including business reputation and quality of work. A similar basis for ascribed trust was recorded in a study of furniture makers in the Salling district of Denmark by Lorenzen (1998, 18), where craftsmanship and entrepreneurship rather than mere ties of kinship or personal friendship were the key factors. Reflecting this in the TORC network, Castlebrooks Managing Director recorded that:

> "I was happy to lose tenders (for contracts) to Caulfields and O'Donnells, they produce quality products"

This is an important point as one of the main gains of the facilitation phase of the network was that each of the companies for the first time discussed company specific strategic business issues with competitors. In addition, although with reluctance at first, individual company financial information was discussed. Signifying that ascribed trust existed, Caulfields Managing Director recalled that:

> "We discussed delicate questions, balance sheets and all that, but there was no need to watch your back with these guys"

When the facilitation phase ended, and the implementation phase began (initiation of network activities and investments), then formal arrangements were implemented to guide the co-operative process. It appears that the initial ascribed trust, which was buttressed by contract regulation in the investment phase of the TORC network is now deepening. This is evidenced by the fact that the three proprietors have visited each other's factory, and that discussions are taking place among the three firms on the rationalisation of their joint stock of machinery, with a view to specialisation among the firms.

Conclusion

Closely related to Gulati and Gargiulo's (1997) description of relational and structural mechanisms in networks, are Burmeister and Colletis-Wahl's (1997, 236) dimensions of organisational proximity. The latter view the establishment of organisational proximity as a path-dependent process to which three dimensions of proximity contribute:

> The *relational* dimension of organisational proximity refers to the existence, frequency and quality of interactions between the actors . . . the *interpersonal* dimension derives from interactions between individuals that are simultaneous and parallel to the process of resource creation, without necessarily being directly related to it . . . the *institutional* dimension is the existence of rules and standards accepted by a community of actors (Burmeister and Colletis-Wahl, 1997, 236).

We have argued that the TORC network is an example of organisational proximity without spatial proximity. All three dimensions were present in abundance among the firms in our network. Enterprise Ireland and other government agencies that preceded it directly and indirectly facilitated the relational, interpersonal and institutional prerequisites necessary for the development of organisational proximity. Enterprise Ireland's Pilot Network Programme was only the final direct driver. Moreover, the trust essential for the development of networks was in this case initially ascribed trust, mediated through Enterprise Ireland, and subsequently

reinforced by contractual undertakings, namely, the commitment of resources by the members of the network to their joint venture.

The formation of organisational proximity and the process of institutional learning among the three geographically dispersed firms highlights two important issues. First, it suggests that, at least in a small economy which can increasingly be considered as a region within the European Union, research attention may be too focused on proximate clusters of enterprises. Second, as with industrial districts (but without their spatial agglomeration), it takes time for organisational proximity to evolve. For the three dimensions of interaction among firms to lead to organisational proximity, an institutional framework which is reasonably consistent over time is required: the gestation period of the TORC network was at least ten years. While acknowledging that spatial proximity in certain circumstances accelerates the processes of learning and innovation among firms, *our central argument is that it is possible for similar qualitative processes (and their associated efficiencies) to occur among geographically dispersed firms*. Although spatial proximity plays an important role in such processes, it would be unwise to ignore what firms can achieve in the absence of spatial propinquity.

Much research remains to be done on organisational proximity where the associated firms are not located close to one another. This is not to say that everything that can be said about trust in spatially proximate firms has been said. However, it does follow from our study of just one network of only three firms that much less is known about how trust evolves in the absence of agglomeration than where it is present. After a period of time, the TORC network should be revisited to trace its development[24]. In addition, other dispersed networks, both sectorally homogeneous

[24] In 2004, the TORC network was amicably dissolved. Preliminary interviews with personnel from Castlebrook and Enterprise Ireland during July/August 2009 concerning how the dissolution came about suggest that the network was viewed by the participants as a success, in that it allowed each of them to establish a presence in the UK market and use that as a springboard for exports into other countries, a feat that the network members feel would have been more difficult to do without the TORC framework. It appears that the two former members of TORC that are still trading, O'Donnells and Castlebrook, (Caulfield's owner exited the furniture manufacturing business and sold the premises) do not cooperate on any activities now. There is some confirmation that TORC was never perceived by the network members as being a permanent venture, but rather a transient organisational innovation appropriate to a particular set of market circumstances; an interpretation that is consistent with the original formal nature of the network. On the other hand, there are also indications that there was some tension among the network members over a prestigious UK contract, a situation that may have

and heterogeneous, both national and international, both small and large, need to be studied so as to further the ideas examined in this article.

lead to a reduction in the trust-based relationship among the firms, which may in turn have undermined the continuation of the network. This outcome, where competitiveness and opportunism reasserts itself in place of collaborative arrangements even when activities are geared towards exports, is suggested by the interviewees as commonplace among Irish companies. However, this assertion is only based on the preliminary gathering of data (although expert opinion) about the life-cycle of the TORC network and, therefore, subject to verification.

Paper 2: Industrial Districts and Networks: Different Modes of Development of the Furniture Industry in Ireland?

Introduction

The Irish economy has obtained in the last few years the title "Celtic Tiger". Not all experts agree with this. Sweeney (2000), among others, has argued in favour of the notion but O'Hearn (1998) is more sceptical of the appropriateness of the implied comparison with the East Asian tiger economies. There is general agreement that Ireland has successfully attracted foreign direct investment (FDI), particularly from the United States, and particularly in industries like electronics (including computers), software and pharmaceuticals, all industries in which there are relatively high R&D expenditures. There is less agreement on such questions as how technologically advanced the activities of the multinational corporation (MNC) subsidiaries in Ireland are. It is also unclear as to how embedded they are into the Irish economy. These uncertainties exist, notwithstanding a great deal of attention to these issues in the popular press, among state institutions and in the academic journals (Barry and Bradley, 1997).

Among the doubts about the Irish economy is the extent to which indigenous firms are capable of surviving in the increasingly open trading environment in Europe. Employment in Irish-owned manufacturing firms declined by 32 per cent between 1973 and 2006 (while employment in foreign-owned manufacturing firms increased by 89 per cent - see Table 2.2 below). Table 2.1 provides some clear evidence of this decline in one such industry. It also shows, on the other hand, what appears to be an arresting of this decline from the 1990s onwards. The increase in 1991 is largely accounted for by the change in the NACE[25] category, plastic and metal furniture having been excluded from "furniture" up to then and included from then on. But there is clear decline up to 1990 and increase from 1991 onwards[26].

[25] NACE is the Eurostat "activity nomenclature", or system for classifying industrial activity.
[26] The increase after 1991 is based primarily on wooden furniture production; metal and plastics as a proportion of total furniture in fact declines from 25 per cent in 1995 to 8 per cent in 2004.

Table 2.1: Employment in the Furniture Industry in Ireland, selected years 1982-2006

	1982	1986	1990	1991	1994	1998	2006 (e)
Employment	4,360	3,505	3,119	3,776	4,037	6,130	6,680
No. of Estabs./Units	403	253	212	245	269	315	441
Empl. per Estab./Unit	10.8	13.9	14.7	15.4	15.0	19.5	15

Source: CSO, *Census of Industrial Production*, various years.
Note: NACE 467 from 1982 to 1990, NACE Rev.1 3611-5 from 1991 on. NACE Rev.1 3611-5 includes plastic and metal furniture. The reason why 2006 data is an estimate is outlined in the Introduction to this dissertation.

Given the relative paucity of work on "traditional" sectors[27] we concentrate in this paper on an example of such a sector, namely the furniture industry. We begin with a brief outline of Irish industrial policy in general. Towards the end of this section we turn to a specific aspect of recent industrial policy, namely network policy. In the next section we briefly describe and compare two examples of the organisation of production in the furniture industry, the wooden furniture industrial district in County Monaghan and the TORC[28] network in Dublin, Wicklow and Cork. Finally, we consider the implications of these two developments for theory and policy in Ireland. The main aims of the paper are to examine the development of the furniture in the context of policy changes, and to compare two different forms of industrial organisation in the furniture industry in Ireland.

The County Monaghan example is an industrial district while the TORC network is more widely dispersed. The theoretical context is therefore one resting on such issues as the spatial limits of agglomeration in a small economy, and the differences between agglomerations and networks.[29] Implications for policy include support for networking in general, and not just among spatially proximate firms.[30]

[27] Jacobson and O'Sullivan (1994) on printing and Jacobson and Mottiar (1999) on furniture and printing are among the exceptions.
[28] Torc is the Irish word for a twisted metal necklace or armband in Celtic design.
[29] The literature on the potential economies and diseconomies of industrial agglomeration is reviewed in detail in Paper 4. The definition of networks and the benefits from networking are outlined more fully in this Paper.
[30] Policy support for networking is also identified in Papers 1 and 3

Irish Industrial Policy

There have been three main broad development strategies adopted in Ireland over the period since independence in 1922. Each was closely related to the types of policies that were being adopted by other countries. Between independence and 1932 the policy was one of agriculture-led growth. This was basically a free trade policy. Opposition to this grew over the decade and, together with a shift to protectionism in the early 1930s in all Ireland's trading partners, led to a change in government and policy in 1932. From 1932 until around 1958 Irish governments followed a policy of import-substituting industrialisation (ISI). Virtually anything that could be produced in Ireland was given protection, and industrial output and employment grew. This was true for most traditional industries like furniture, clothing and footwear, but also for relatively new industries like car assembly. Where there were significant increasing returns to scale either the government should have been more interventionist, and selected a small number of firms to support, or less interventionist, allowing efficient foreign firms access to the Irish market. Car assembly, for example, although assembling some 40 different models by the 1960s, ceased as soon as possible after the removal of protectionism.

During the 1950s protectionist policies reached their limit. With the exception of one or two larger companies, indigenous firms were in general producing only for the protected local market. Capital goods and manufactured sub-assemblies in virtually all sectors were imported. Industrial stagnation led to unemployment and emigration. However, the absence of strong, competitive firms in the traditional manufacturing industries - like furniture, and clothing and footwear - resulted in reluctance to open up the economy.

Eventually, responding both to the internal stagnation and to the external availability of mobile capital, new, outward-looking policies were introduced in 1958. A strategy of export-led growth (ELG) was adopted, based on encouraging foreign direct investment (FDI), gradually removing protectionism, and providing incentives for firms to export.

The ELG policies - particularly low corporate profit tax rates and capital grants - were generally successful, in that they attracted FDI, reduced unemployment, and arrested the deterioration in the balance of payments. They also paved the way first for entry into an Anglo-Irish Free Trade Agreement in 1966, and subsequently into the European Economic Community (EEC) in 1973. However, over the decade or so following entry into the EEC, it became clear that while employment in subsidiaries of MNCs was increasing, employment in indigenous firms was declining. (This trend has broadly continued since then - see Table 2.2).

Table 2.2: Employment in Manufacturing in Ireland, by Ownership

	1973	1980	1991	2000	2006
Irish	166,000	161,000	107,632	131,357	112,429
Foreign	56,000	82,000	86,801	122,778	105,658
Total	222,000	243,000	194,433	254,135	218,087

Source: O'Malley, 1985, Table 1.1; CSO, *Census of Industrial Production; 1991, 2000 and 2006.*

The decade of the 1970s was marked globally by oil crises, but these were not identified as the cause of the problem. Both international consultants (Telesis, 1982) and some local experts (e.g. O'Malley, 1985) were convinced that what was required was a shift in industrial policy, to favour MNC subsidiaries less and indigenous firms more. A White Paper on Industrial Policy in 1984 did indeed lead to change, though not as substantial a change as had been suggested. A National Linkage Programme - which had mixed results - and a Company Development Programme were introduced. Sector specific policies began to be adopted, aimed at identifying already successful firms in each sector and assisting them, rather than providing blanket assistance at lower levels, for larger numbers of firms. These new policies were applied both to traditional sectors like furniture, and to advanced technology industries like electronics.

A second consultancy exercise to examine Irish industry and industrial policy was published in 1992. The Culliton Report's major recommendations included the reorganisation of the industrial development organisations into two main agencies, one of which should specifically address the development needs of indigenous, Irish-managed industry (Culliton, 1992:371). The report also contained an innovative proposal, informed by the work of Porter (1990), to change the focus of industrial

policy towards promoting the growth of industrial clusters around niches of national competitive advantage. These recommendations have to varying extents been adopted. Crucially, for our purposes, together with a new national focus on innovation systems and learning (STIAC, 1995), they led to the adoption of a Pilot Inter-firm Co-operation Programme (the 'Pilot Network Programme') in 1996[31].

The policy changes since the mid-1980s have had some impact. O'Malley (1998) argues that since 1987 the performance of Irish-owned firms has improved considerably, relative not only to Ireland's own historical experience but also compared to that of industrial countries in general. (Others, including O'Hearn, 1998, remain doubtful about whether there has been a fundamental change in the strength of the indigenous sector.)

The promotion of clusters (and networking) first aspired to in the Culliton Report of 1992 was reiterated in the most recent industrial policy review, the Enterprise Strategy Group (ESG) report of 2004. More generally, the ESG report proposes a new enterprise model for Ireland, one that instead of being investment-driven and production-based as in the past would now be market-led and knowledge-based. In addition, although not explicitly focusing on low-tech industries, the ESG report is the first examination of industrial policy of any importance in Ireland in which there is a clear awareness of the importance of non-research based innovation. The concern with the differential performance of indigenous and foreign owned sectors remains.

In the next section of this paper we examine the furniture industry, focusing in particular first on the wooden furniture industrial district in County Monaghan, and then on a small network, established in the Pilot Network Programme.

The Furniture Industry in Ireland

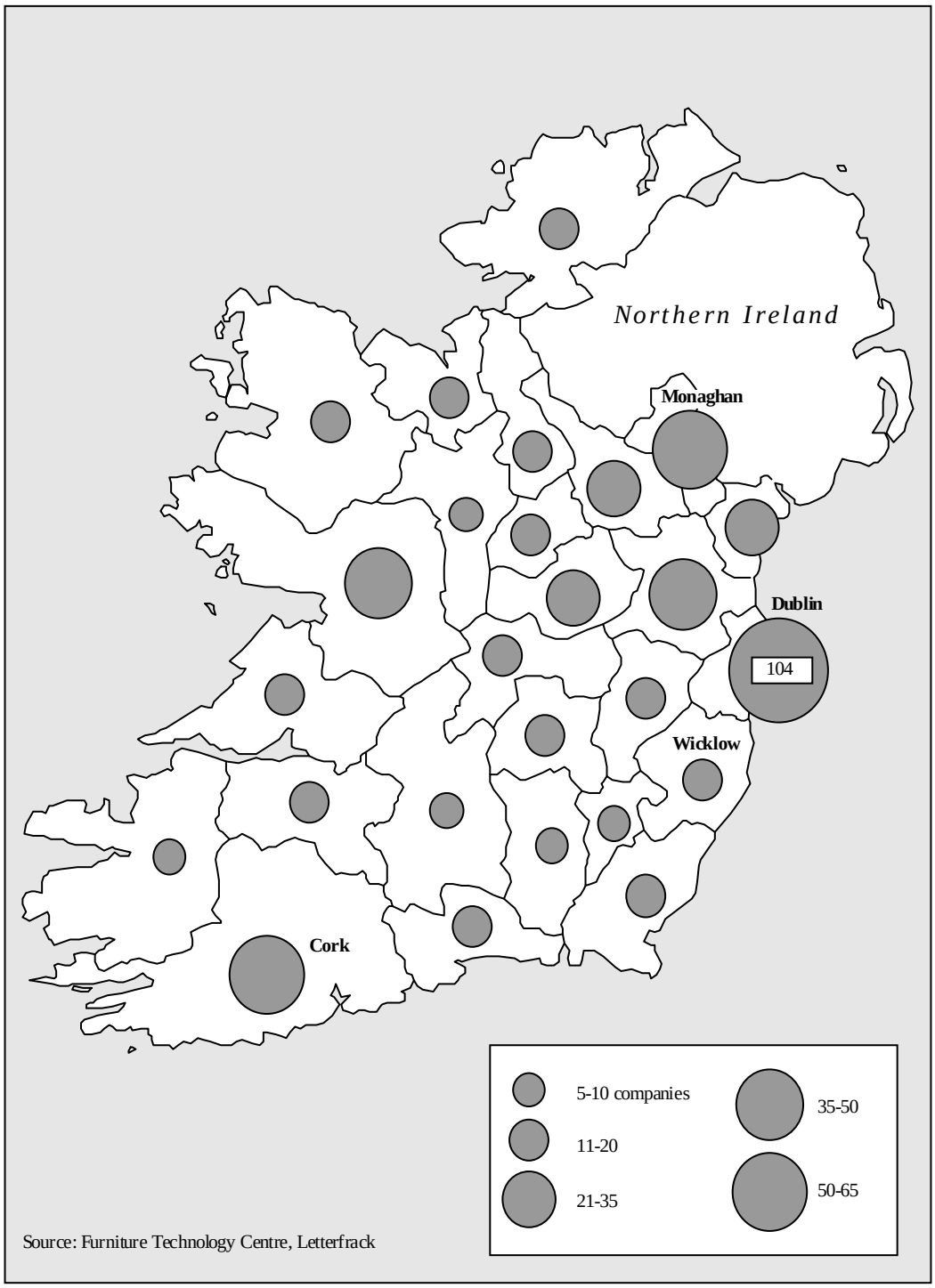
Table 2.1 shows that there were in 2006 441 firms providing employment for 6,680 people. The Census is based on firms employing three or more people, so very small firms of two or less are excluded. The following map, Figure 2.1, shows the distribution of wooden furniture firms, including very small ones, by county. (The

[31] The Pilot Network Programme is discussed in detail below.

numbers are estimates, based on a database kept by the Furniture Technology Centre in Letterfrack.) Dublin, in the middle of the eastern seaboard, is by far the largest population centre, and is also the location of the largest number of furniture firms (104). Other large population centres include County Cork (the southernmost county) and County Galway (in the middle of the western seaboard) which also, as expected, have relatively large numbers of furniture firms. The main surprise is County Monaghan, a border county with Northern Ireland. Ranking 21st in terms of population, County Monaghan ranks third after Dublin and Cork in terms of the number of furniture firms.

Figure 2.1: Distribution of Furniture Companies in Ireland, by County, 1997

Distribution of Furniture Companies in Ireland, by County, 1997



The Industrial District in County Monaghan[32]

There has been a concentration of wood-working in County Monaghan for hundreds of years (Mottiar, 1997). The current cluster of firms, mainly in or near Monaghan town and its northern hinterland, originate in large part from the firm John E. Coyle, established in 1936. A total of more than 75 per cent of the furniture firms in the district are run by men who served apprenticeships in Coyles, or in firms set up by men who had served their apprenticeships in Coyles.

There are varying levels of co-operation among furniture firms in the district. The best known formal co-operation in the district occurs between McNally and Finlay, and Sherry Brothers, two of the larger firms. These firms jointly manufacture the Rossmore range of furniture. Their jointly employed designer designs products for each firm. Instead of specialising in particular products for the range, they each produce the same goods and then compete on the market. Thus they co-operate to have the products designed, sell under the same brand name and in Ireland use the same agents (in the UK they are more competitive and have different agents). This arrangement appears to be successful for both parties. Moreover, the difficulties of altering such a long-standing agreement would be complex and are likely to encourage continued compliance.

Most of the smaller firms produce inputs for the two or three larger firms. In some cases this is based on a 'putting out' relationship, where the larger firm supplies the materials, and the subcontractor machines them into the required shape and size and returns them as completed components to the larger firm. Informal co-operation includes lending machinery (particularly hand-tools) and sharing information about customers who have not paid their bills. In one case, where two firms both produce a similar product, they both refrain from poaching each other's customers.

Close proximity, competition as well as formal and informal co-operation[33], close inter-firm relationships - both horizontal and vertical - and people having been trained in one firm then establishing their own firms, are all characteristics of the

[32] The material on the furniture industrial district in County Monaghan is based on Mottiar, (1997).
[33] On the importance of the presence of both competition and co-operation see Best, (1990).

industrial districts of the 'Third Italy', about which so much has been written in the last 20 years (see Jacobson and Mottiar, 1999, and references therein). These industrial districts are based on industrial agglomeration and are embedded in various institutional and commercial ways into their local environments. Jacobson and Mottiar (1999) have shown that while some of the normal characteristics of industrial districts are absent from the County Monaghan furniture industry, the elements described above, together with a professional milieu and an awareness of mutuality of interest, are sufficient to designate this agglomeration as an industrial district.

How did the furniture industry - and the Monaghan industrial district in particular - respond to the changes in industrial policy? Following two decades of protectionism, the furniture industry was virtually untraded by 1960 (see below, Table 2.3). In the new, more open market, some firms declined or went out of business, some start-ups came into the industry, and the more efficient of the old firms grew. By 1980 a quarter of the output of the Irish industry was being exported (Table 2.3). At the same time the local market became more import penetrated, following the shift to ELG. Import penetration coupled with a reduction in export propensity is a feature of the industry up to 2006. This intra-industry specialisation is typical of trade development following liberalisation (Jacobson and McDonough, 1998). It is explained by the fact that certain types of furniture - not manufactured locally - are popular in the local market, and other types of furniture - manufactured locally - are marketed primarily in the Northern Irish and British markets. A disproportionately large part of the exports have been accounted for by the Monaghan industrial district, and this has been at least in part a consequence of the substantial grant aid received by the Monaghan firms from the development agencies.

Table 2.3: Performance of the Furniture Industry in Ireland, Selected Years 1960-2006

	Imports as % of furniture market	Exports as % of output	Exports/ Imports
1960	1.0	6.8	8.00
1973	23.0	8.0	0.29
1980	44.9	24.5	0.40
1985	48.4	31.7	0.50
1990	63.8	54.1	0.67
1996	41.3	35.3	0.77
1998	42.3	28.4	0.54
2000	44.7	21.4	0.34
2004	46.1	15.9	0.22
2006*	50.6	19.5	0.24

Sources: CSO, *Trade Statistics of Ireland*, Division 82; CSO, *Census of Industrial Production*, various years; Authors calculations.
*Note: for 2006 the output of the furniture sector is only an estimate as outlined previously.

Grant aid to firms was, and still is, conditional upon those firms being exporters. The Monaghan companies - particularly the larger ones - being relatively successful, obtained state support and became the main sources of exports of furniture from Ireland. Enterprise Ireland (whose remit is to focus on the development of indigenous firms) has provided substantial grant aid, particularly to the largest of the Monaghan companies, John E. Coyle. The purpose of the most recent grant package was to assist the firm in developing new processes and products in the modular furniture area, particularly for the British market. These developments have, however, not yet had the expected results in that modular furniture by Coyles has not yet broken into the British market.

In relation to quality and design, it should be pointed out that the main Monaghan products are relatively low-priced reproduction furniture, based on panel material such as MDF (medium density fibreboard). Technology is advanced but not fully utilised due to skill shortages. Innovations are based primarily on small design changes - for example in the colour of the veneers.[34]

Among the important questions are whether there are limits to growth in the Monaghan industrial district, and what if any the relationship is between these limits

[34] There are also a small number of firms producing solid, hard wood products, including bar counters manufactured and exported for Irish pubs all over the world.

and industrial agglomeration. In addition, are there opportunities for growth for the Irish furniture industry outside the Monaghan industrial district?

The most recent data suggest the timeliness of such questions. As Table 2.3 shows, by the mid 2000s the proportion of output exported was less than in 1980, and given the rise in imports the export-to-import ratio is at a level last seen in the 1970s. Undoubtedly, the rapid growth of the Irish market from the mid 1990s may be absorbing the local industry's capacity for expansion. Moreover, the Irish market at that time was growing much more rapidly than the target markets abroad, so it would be surprising if there was not a decrease in the proportion of Irish output being exported.

Fundamental questions are timely because the policies appropriate under conditions of stagnation and unemployment may be different from those appropriate under conditions of rapid industrial growth. Just as stagnation shows weaknesses in industrial production systems, so may incapacity to respond rapidly and flexibly to growing markets.

The TORC Network[35]

A possible alternative (or addition) to the support for existing agglomerations and in particular the successful firms within those agglomerations, is to support firms to develop networks. As mentioned above, the Irish government - through the local development agency - introduced a Pilot Network Programme (PNP) in 1996. The PNP - involving 17 networks and a total of 31 SMEs (small and medium enterprises) - aimed to encourage small firms to co-operate in activities they were unable to undertake individually due to their small scale. The objective of the PNP was to put in place some of the resources needed to facilitate and establish formal networks of the 'Danish' type (Rosenfeld, 1996), to help the networks devise joint solutions to common problems and to evaluate the results. The general principles guiding the Pilot phase of the programme were:

1. Networks should consist of at least three firms (SMEs) and not more than eight. A network could include one multinational or large-scale Irish firm, or one foreign firm or third level college.
2. Networks could be developed on a sectoral basis, in customer/supplier chains, or in a technology or market sector.
3. The objective of each network should be to create new business or to increase the competitiveness of the firms involved.
4. Once established, the activities to be undertaken by the network would be a matter for agreement among participating firms.

Funding was provided to cover the costs of training network brokers, the participation of Danish experts in the formation of a network, network set-up costs, publicity and management of the programme. A manager and three network brokers were appointed within Enterprise Ireland to run the programme. SMEs were identified for potential inclusion in the programme using a number of sources. Although some of the SMEs had been involved previously in formal or informal co-operation arrangements, they were not selected on that basis.

[35] The information in this section was obtained from interviews during July and October 1999 with the three furniture firms in the TORC network, the Manager of the Pilot Network Programme from Enterprise Ireland and the TORC network manager. The empirical instruments on which the TORC network information is based are contained in Appendix A.

There were few networks in Ireland prior to the introduction of the PNP and those few were characterised by low levels of interaction. The main benefit of the PNP for SMEs was that it enabled the companies to work together as a team on the strategic development of new business opportunities. Although a high proportion of SMEs are interested in participating in a network programme of longer duration, companies from the same industrial sector frequently have difficulty co-operating because of competitive rivalry between them. Notwithstanding this, and in spite of a weak history of inter-firm co-operation in Ireland, the PNP demonstrated that networking could be advanced by following the 'Danish' model. The use of trained network facilitators was found to be the most important feature of this method.

One network of furniture firms was included in the PNP. Having been set up under this programme, it now continues to grow. It consists of three firms: D.F. Caulfield in Dublin, Castlebrook Furniture and Design in Wicklow and O'Donnell Designs in Cork. Although, Caulfields and Castlebrook are located only 20 miles from each other, they had not previously co-operated in any way and the owners did not know each other personally. In contrast, notwithstanding the 200 mile gap between O'Donnells and the other two companies, the owner of O'Donnells personally knew the owner of Caulfields, and had met the proprietor of Castlebrook on an international trade visit organised by the industrial support agencies. The network operates in the hotel bedroom furniture sub-sector.

All three firms were established in the 1970s or early 1980s, all are small, employing 14 (Caulfields), 25 (Castlebrook) and 30 (O'Donnells) people, and all have been producing hotel bedroom furniture in recent years. As independent entities, the three firms are heavily dependent on the Irish market. A small part of their output is exported primarily to the United Kingdom, with even smaller amounts to Germany, Russia and Estonia.

The network was initiated by Enterprise Ireland, the state agency responsible for indigenous industrial development. First O'Donnells and Caulfields were invited to become involved in the Pilot Network Programme. Following some discussion these two identified a third participant - Castlebrook - which joined the network. Both

O'Donnells and Caulfields were aware of this company by reputation alone, particularly in relation to its professionalism and the quality of its work.

The three firms, after participating in the facilitation phase of the network programme, agreed to set up a product development and marketing company as a joint venture, which they registered under the trade name TORC. Following market research, three new hotel bedroom product ranges were designed and copyrighted, promotional material was developed and the products were launched at a London show in December 1998. A part-time manager for the network, who works two/three days a month was appointed and is paid for by the network. There is also a sales manager, who works as an agent and is paid on a commission basis. Each of the three companies has the capability to make the entire product range. As TORC is a product development and marketing firm rather than a production entity, an invitation to tender for business must be passed on to one of the three companies. Which particular company fulfils any particular order depends on availability although there is an understanding that the opportunity to fulfil an order will rotate among the three firms. Whichever particular firm is fulfilling a contract is the one that deals with the customer.

The network members suggested that there were three main reasons for joining the network[36]. First, the individual firms had already acknowledged that as separate entities they lacked the required critical mass and resources to enter the United Kingdom hotel furniture market in a significant way. Second, the firms felt that the three companies working together would be able to obtain assistance (grants for marketing, R&D, design etc.) from industrial support agencies that would be unavailable if they applied separately. This was particularly important for access to export markets. Third, there was a common perception among the companies that the recent expansion of the Irish contract furniture market, fuelled by the property boom of the past five years, was reaching its peak and therefore it was prudent to plan for

[36] These reasons are all consistent with the idea in network theory (see Economides, 1996) that there is complementarity among the partners that generates externalities in production networks. For TORC to be a network, as defined in theory, there must be greater profit through working together than there would be if the three firms operated individually. However, to realise the externalities, the partners must also be compatible. The extent to which the partners in a network are compatible can often only be shown over time.

market diversification[37]. O'Donnells had already begun an in-house programme to focus on the UK and had completed some contracts. Caulfield's experience outside Ireland was mostly in continental Europe and a particular concern of this company was in the development of marketing tools.

The members of the network meet face to face once a month to monitor progress and ascertain availability for work. One of the first items on the agenda for each meeting is what jobs should be priced, and who should price them. More frequent scheduled physical meetings only arise in exceptional circumstances. However, there is telephone, fax or email contact between the network members two to three times a week.

The network is so far successful, having obtained a number of contracts. The three partners have together developed a strategic plan, have submitted proposals to appropriate agencies for assistance - for example in training[38] - and have gained from each other's experience. The other two, for example, have gained from Castlebrook's experience in outsourcing components. Their activities within TORC represented an increase of 6 percent in the firms' total turnover.

All three companies - independently of the TORC network - have had and continue to have significant links with the relevant state and industry institutions. They have all received capital and/or employment grant assistance in the past from Enterprise Ireland or its predecessor. In addition, O'Donnells and Caulfields were involved - with three other Irish firms and a Danish design and marketing company - in a previous network project in the early 1980s[39]. It failed primarily due to downturns in the target markets. All three proprietors have participated in trade visits abroad instigated by various industrial support agencies; most of these visits took place in the mid- to late 1980s. The owners of O'Donnells and Caulfields have also participated in various ways in the development of training and education for the furniture industry.

[37] Note that the network was formed in 1997/8. The most recent information available on the growth of the industry is presented in Tables 2.1 and 2.3 above. However, it is clear that the building boom continued beyond the TORC firms' expectations.
[38] Under the government and EU-funded SKILLNETS programme
[39] Details on this initiative are presented in Paper 1

The current relationships of the TORC network firms with Enterprise Ireland include Caulfields' and O'Donnells' involvement in Company Development projects, the latter having obtained approval for an R&D investment. In addition, O'Donnells is about to start a World-Class Business Cluster initiative with Enterprise Ireland, and Castlebrook has also applied to be involved in this initiative. All three firms are members of the National Furniture Manufacturers Association (NFMA). The proprietors of both O'Donnells and Castlebrook are participating in PLATO[40] – the Small Business Development network.

This multiplicity of contexts in which the activities of the TORC firms intersect, does not imply an absence of competition. They continue to regard each other as competitors on the Irish market (albeit in slightly different quality and quantity sub-sectors) though they have an informal agreement about the nature of competition. Although the firms' main market is in the same geographic area, they pursue non-aggressive practices towards each other and, for instance, pass on tender information if they feel it is more appropriate for one of the others. Outside Dublin and the east coast, each of the firms tends to focus on particular areas of the country.

In relation to subcontracting, Castlebrook has been most active. Up to 50 percent of its manufactured content is outsourced, though it controls the finishing process itself. At least two small furniture making enterprises in a 10 mile radius owe the majority of their turnover to component production for Castelbrook. O'Donnells also engages to some extent in subcontracting, obtaining veneered panels from a number of suppliers in different EU countries and semi-processed panels and turned components from two Irish companies, one in Tipperary and one in Wexford, neither spatially proximate as conventionally defined. In addition, the TORC firms have begun to subcontract within the network. O'Donnells has some experience subcontracting for Caulfields, and Castlebrook is doing work for O'Donnells.

[40] PLATO supports owner-managers of SMEs to develop their management skills facilitated by leading local companies. To date, approximately 1,500 small companies and over 100 of Ireland's leading firms have participated in PLATO networks across Ireland.

Many of these elements of interaction among the three members of TORC suggest comparison with the Monaghan industrial district and industrial districts in general. There is both competition and co-operation, there is a range of organisational settings in which the proprietors of the network firms have interacted, and, not least, there is evidence of learning from each other. An aspect of industrial districts which is missing in the TORC network, but which is fundamental both in Marshall's (1890) original formulation and in the application to "the Emilian model" (Brusco, 1982) is close proximity.

Theoretical and policy implications

Industrial agglomeration is a process whereby firms cluster together spatially in order to derive certain benefits. These benefits are external economies - they arise from activities, relationships or developments outside the firm and outside the market (Jacobson et al, 2001b). They are untraded benefits. In the case of the Monaghan industrial district, for example, the proximity of the many furniture firms in the area is a key factor in their survival, and additional firms have set up there because it is already a concentration of furniture manufacturers. Many of the firms are spin-offs from Coyles; this suggests an element of serendipity - they set up in that place because they already lived there. However, the presence of up- and downstream firms and the availability of an appropriate labour force, are among the factors generating economies of agglomeration. In recent years new firms have been set up in Monaghan by proprietors who have come from other places in Ireland.

Economies of agglomeration are present in the case of the Monaghan industrial district; other externalities - such as the process of learning from each other's differences - have arisen from the shared experiences of the TORC proprietors both within the network and in the state agency and educational organisation contexts. These other externalities are usually associated with industrial agglomeration. Can the firms in the TORC network, even if up to 200 miles apart, be considered to be deriving economies of agglomeration? [41] The spatial limits of economies of

[41] At the workshop in Jerusalem at which the first draft of this paper was presented, an American participant considered 200 miles to be well within the range for industrial agglomeration while a British participant expressed the view that much smaller distances were required for industrial agglomeration.

agglomeration depend to some extent on the size of the industry, its technology and the nature of the production system, the types of raw materials and sub-assemblies, and the nature of the transport system. It may be that as technologies - especially information and communication technologies - change and transport systems improve, the range within which economies of agglomeration can arise increases. On the other hand, such Marshallian notions as knowledge about an industry being "in the air" and this resulting in rapid diffusion of innovations, may require the tighter agglomeration of a concentrated and homogeneous labour force.

Arita and McCann (2000) provide some recent econometric evidence on the issue of the spatial limits of agglomeration. They suggest that economies of agglomeration consist of both formal and informal information flows. Based on an examination of industrial alliances in the US semiconductor industry, they provide evidence that the strength of formal information flows is less geographically constrained than may be expected. Specifically, in their study, the strength of formal inter-firm information exchanges does not differ statistically between situations in which the firms are in the same place, and those where they are within one day's return journey by air. This is not to say that there is no distance effect; beyond a one-day return journey by air, increasing geographical distance is indeed associated with a falling intensity in formal information exchanges.

There are important differences between this case and the TORC example. In Arita and McCann's (2000) study, the technology, production and transport systems are quite different to the furniture industry. However, the evidence of a distance effect beyond one day's return journey in the US semiconductor industry, raises the possibility that there may be unexpected distance effects in other industries.

Ironically, this proposition is supported by a recent description of Italian industrial districts. Irrespective of the spatial limits of industrial districts, on which Lazerson and Lorenzoni (1999) are "agnostic", they show that "leading firms" in industrial districts forge relationships with other firms, both local and distant, and they suggest that this engenders increasing flexibility in the district's responsiveness to markets. They call for further "research into the combined effects of geography and relationships on firms". For our purposes, these arguments at least lend credence to the contention that the TORC network could be benefiting from economies of agglomeration.

Turning now to the implications for policy, the contrast is between first, the policy of assisting individual companies that have already shown evidence of success, and, second, the policy of encouraging networks. In the last few years the first has been applied in the case of Coyles, with mixed success; Coyles has not yet achieved the expected results[42]. The second has generated the TORC network which, so far, is successful. From a cynical perspective it could be argued that the proprietors of the TORC network have simply behaved as rent seekers. Indeed, from this perspective the very formation of the TORC joint venture could be seen as a consequence of rent seeking. Even if this is the case, however, if the consequence is the development of a

[42] This statement relates to the early 2000s. According to data from preliminary interviews with personnel from Enterprise Ireland and GMIT Letterfrack, carried out in July/August 2009, John. E. Coyles ceased trading sometime in 2008. In recent years, similar to the other case firms in this dissertation, Coyles had become increasingly subject to low-cost competition, particularly from China. Coyles sold mid to high priced products manufactured using a highly automated panel production system, geared to high volume output. As competitive pressures increased in recent years, Coyles tried to diversify into the contract furniture market (which the TORC firms operate in) and also opened retail outlets (which FURN2 in Paper 3 intends to do). However, the imperative of Coyles production system to produce high volumes did not suit contract manufacturing, which is primarily project-based, design intensive and customised. In addition, basing a retail operation solely on the sale of their own cost-challenged product range would not obviate the direct competition they were facing from low-cost imports.

successful network that would not otherwise have arisen, then the policy may be justified.

Conclusion

We have, in this paper, examined the development of the furniture industry in the context of policy changes, and compared two different forms of industrial organisation in the furniture industry in Ireland. What emerges is that there appears to have been an element of cumulative causation in the relationship between state support and the Monaghan industrial district. As the furniture industry grew in the area, and industrial policy changed to focus to an increasing extent on firms that already had provided evidence of competitiveness - particular in export markets - so the support for Monaghan firms grew. Other than the two-firm Rossmore example, however, there is no evidence of the type of inter-firm networking that has been the basis of the TORC joint venture. In addition, although individually many of the Monaghan firms have had dealings with the state agencies, TORC is a better example of firms being embedded in a rich institutional environment (Granovetter, 1985; Grabher, 1993). The TORC proprietors, as we have shown, have interacted - and, ultimately, co-operated - in such a wide range of organisational contexts that they have developed a shared perspective on strategy. They are, to use the language of networks, realising their complementarity potential by being compatible (see footnote 35).

While we are hesitant to generalise from the particular examples discussed here, it is at least appropriate to raise questions, such as whether support for individual companies within industrial agglomerations is a strategically correct policy. The organisational integration (Lazonick, 1991; Lazonick and West, 1995) expressed in the financial commitment of the three TORC companies to the network is not evident among the Monaghan firms. It may be a factor in the success of the network and may constitute a weakness in the Monaghan industrial district. We would agree with Lazerson and Lorenzoni's (1999) cautious conclusion: "Although we have no evidence, it is very likely that an individual firm's survival is very much connected to the relationships it has forged with other firms". This should, arguably, be recognised in all industrial policies.

Paper 3: Embeddedness and innovation in low and medium tech rural enterprises

Introduction

There has been a resurgence of interest in the role of location as an important explanatory factor in the innovativeness of firms. The threads of this concern can be traced from Marshall (1898) and his classic writings on 19th century British industrial districts to more recent contributions on contemporary Italian and U.S. industrial districts (Becattini, 1990; Saxenian, 1991; Scott, 1993) and to research on national (Lundvall, 1992; Nelson, 1993) and regional innovation systems (Braczyk *et al*., 1998; Cooke, 2001), learning economies and regions (Lundvall, 1994; Morgan, 1997), clusters (Porter, 1990; 1998), innovative milieus (Aydalot, 1986; Aydalot and Keeble, 1988) and industrial agglomerations (Jacobson *et al*., 2002) [43] These contributions all consider the location of a firm, its wider social, institutional, cultural, economic and industrial environment, and the type of linkages the firm has with its wider environment, to be important factors that may impact on the innovative performance of the firm. Unsurprisingly, different strands of this literature have different emphases. There are also different views on the relative importance of market and non-market factors.

Not all agree on the importance of location for innovation; some argue that location is becoming less important particularly in light of ubiquitous information and factor flows in an increasingly globalised knowledge economy (see for example, the discussion in Morgan, 2004 on the 'death of geography' thesis or more generally, some of the literature on globalisation (Ohmae, 1995; Friedman, 1999). Other critical contributions to the literature (Gordon and McCann, 2005) argue that to the extent that locality is important it is due to factors such as external economies rather than the strong inter-firm linkages and institutional environment advocated by proponents of the clustering, innovative milieu and new industrial district literatures, for example. [44] In this paper, we too are interested in the relationship between the

[43] Paper 4 outlines in detail the industrial agglomeration literature view of the link between location and innovation.
[44] External economies are the unpaid for benefits a firm derive from the existence of other firms.

location of a firm and its innovative performance. The main analytical construct we use to examine this relationship is the embeddedness of the firm.

The concept of embeddedness – or the importance of social relations and ties for economic behaviour (Granovetter, 1985) – is a key element in many of the explanations of the relationship between location and innovation (e.g. Simmie, 2005; Boschma *et al*. 2002; Uzzi, 1997). Granovetter's concept, some of the complexities added in subsequent research and our reconceptualisation of embeddedness for the research reported in this paper are discussed below in the section on the theoretical framework.

Our empirical setting is the Irish economy. More specifically, we focus on firms in two low and medium technology (LMT) sectors (defined below) – furniture and fabricated metal products. LMT sectors are focused on because of their continued importance to employment in the Irish economy. (Some evidence for this is shown below in the empirical section of the paper.) All of the firms are based in rural areas as defined by the Central Statistics Office, with the settlement size they are located in ranging from a village with just over 1,200 inhabitants to a small town with a population of 3,700. Rural firms are focused on because of the strategic need to upgrade 'old economy' (or LMT) rural firms in order to build a commercially successful rural economy (Rural Ireland 2025, Foresight Report, 2005). As upgrading depends critically on innovation and technological change, it is imperative to understand the factors impacting rural enterprise innovation. Previous Irish studies (discussed below) report conflicting conclusions about the relationship between location, innovation and embeddedness.

The key research question addressed here is: what role does location play in the innovation processes of selected LMT firms? This question is addressed by examining the embeddedness of the case study firms. The paper is not a direct test of whether deep, shallow or stretched embeddedness (which still emphasises the non-formal aspect of embeddedness but on a wider (trans-local, even global) geographic scale) is more important for innovation but rather an examination of the pattern of embeddedness displayed by the case study firms. Here we define these types of embeddedness as follows:

Deep - informal, non-market-based and local linkages

Shallow - formal, market-based and non-local linkages[45]

Stretched - informal, non-market-based, non-local linkages.

The remainder of the paper is structured as follows. The next section presents a theoretical framework that focuses on innovation in LMT firms, three critical dimensions of innovative processes – the type of network relationship, the interactive learning processes and the variety and sources of knowledge bases – and embeddedness. Next, the empirical context for the research is outlined. This includes the importance of LMT sectors for the Irish economy and a concise review of previous research relevant to the topic of location and enterprise innovation in Ireland. Following that, the research methodology and the case study firms are described. Then, in the penultimate section, the results from case studies of four innovative LMT firms in the furniture and fabricated metal products sector are used to substantively address the research question. Finally, conclusions and suggestions for further research are outlined.

This paper contributes to the literature on industrial location and innovation in several ways. First, it adds to the research in an Irish context on the impact of location or embeddedness on enterprise innovation. Second, as far as we are aware, we are the first to focus explicitly on Irish LMT manufacturing firms and industries or address innovation in such firms or the impact of location for innovation in such firms (see also Heanue and Jacobson, 2002; 2005). Third, by showing that for our firms a mixture of local and non-local linkages, market and non-market relationships, and formal and informal networks are important for innovation, our findings challenge those perspectives that focus primarily on the geographical boundedness of such connections.

[45] Formal linkages are defined here as shallow because 1) they are contractual (as opposed to relying on other regulatory institutions) 2) are usually focused on economic activity (as opposed to other spheres of social interaction). Therefore, in terms of the variety of dimensions they cover, they are shallow

Theoretical Framework

Innovation in low-tech firms

Innovation, or the generation of profitable novelty, allows firms to establish temporary monopolies relative to their competitors and therefore earn economic rents, or higher than average profits, for a period of time (Bender and Laestadius, 2005). A traditional Schumpeterian notion of innovation is adopted here in that five different types of innovation are considered – the introduction of new products, new methods of production, expansion into new markets, incorporation of new sources of supply, or the development of new ways to organise business (Schumpeter, 1983). In addition, following Nelson (1992), we are interested in such innovations as long as they are new to the particular firm that we are analysing, whether or not the products, processes, markets, raw materials supply or organisational forms are necessarily new to other firms in the same industry, or to the industry itself. This broad conceptualisation of innovation is now standard in much innovation related analysis, and is used by the EU Community Innovation Survey and forms the basis of the OECD Innovation Manual (1997). Taken together, innovation in the form of products, processes or ways of organising is the novel application of economically valuable knowledge (Feldman, 2003) and includes all creative activities which contribute to diversity and therefore generate profits (Hirsch-Kreinsen, 2005). LMT firms are no different to other firms in that most of their innovations are incremental and the bulk of economic benefits come from such incremental innovations and improvements (Fagerberg, 2005).

There is a variety of types of knowledge that underpin innovation. This diversity includes, for example, practical, engineering, design, marketing, logistics, production organisation, sales and distribution knowledge (Malerba, 1992; Faulkner, 1994) in addition to, or sometimes in place of, science-based knowledge. In LMT industries, there is usually little formal learning by science and technology, at least at the firm level, and instead innovation and adoption related learning activities operate in practical and pragmatic ways by doing and using (Von Tunzelmann and Acha, 2005). Therefore, particularly for LMT firms, non-science-based knowledges and the capabilities that underpin them are viewed as being critical to innovative activity (Hirsch-Kreinsen, 2005; Laestadius *et al*., 2005).

A firm is the key repository of productive knowledge (Morgan, 2004) because this is where the essential transformation of inputs into outputs takes place. However, external knowledge sources are also important for innovation. Developing this notion, the idea of distributed (i.e. inter-organisational or interdisciplinary) knowledge bases (Smith, 2002) and more generally a view of innovation as being a systemic process has characterised much recent literature (Edquist, 2005) such that technological knowledge is now viewed as the outcome of localised interactions among a variety of heterogeneous agents (Antonelli, 2005). In other words, linkages with external actors are crucial for innovation. In this context, there are three key dimensions of the innovative activity of enterprises which are central to our analysis – network relationships, interactive learning processes and distributed knowledge bases. Although these categories are not mutually exclusive, it is useful to separate the dimensions for analytical purposes.

Network Relationships – A central finding in the innovation literature is that a firm does not innovate in isolation but in collaboration and interdependence with other organisations (Fagerberg, 2005). Terms such as "system" and "network" have been introduced to enhance our understanding of this phenomenon (Fagerberg, 2005). A network involves a form of associative behaviour among firms that helps expand their markets, increase their value-added or productivity, stimulate learning and improve their long-term market position (Bosworth and Rosenfeld, 1993). Networks are a means by which organisations can pool or exchange resources, access specialised assets, benefit from interorganisational learning and jointly develop new ideas and skills (Powell and Grodal, 2005). The external organisations may include other firms such as suppliers, customers and competitors or non-firm entities such as universities, schools and government ministries (Edquist, 2005). The relationships between the firm and these other organisations may be either formal or non-formal and can be local or extra-local. There are varied views on the importance, scale and scope of networking. For example, traditional agglomeration theory, which views the firm as atomistic, has little to say about networking. In contrast, the new industrial district literature sees firms as deeply networked in both formal and non-formal

ways[46] (in terms of vertical upstream and downstream linkages with other firms and customers and horizontal, collaborative linkages with firms, institutions and agencies), generally within a given geographic space although more recent contributions have acknowledged that networks can reach outside the districts (Lazerson and Lorenzoni, 1999).

Interactive Learning – The modern discourse on innovation is to a large extent dominated by a learning perspective (Lundvall, 1994). In this perspective, non-linear, iterative interaction between users and producers represent the primary mode of innovation (Lundvall, 1988). In addition, in a learning economy, the competitive advantage of firms and regions is based on innovation, and innovation processes are seen as socially and territorially embedded, interactive learning processes (Asheim, 2000). Learning refers to building new knowledge, competence and skills and not just 'getting access to information' (OECD, 2000). Malerba (1992) identifies a taxonomy of learning with six elements, the first three of which – learning by doing, using and searching – are primarily internal to the firm. The remaining three – learning from advances in science and technology, inter-industry spillovers and interacting – are external to the firm. The latter encompasses interactions with either upstream or downstream sources of knowledge such as suppliers or users, or cooperation with other firms in the industry. The Kline and Rosenberg (1986) chain-link model of innovation stresses that innovation is a learning process involving such multiple inputs (Smith, 2005).

Concepts such as localised (Maskell and Malberg, 1999) and collective (Keeble *et al*., 1999) learning also reflect the notion of interactive and spatially bounded learning processes. Similarly, for Asheim *et al*. (2005) in a learning economy innovation increasingly depends on complex tacit knowledge that is embedded in a person, firm, network or local context (Polanyi, 1966/1997; Lundvall *et al*., 2002). It can be argued, on the other hand, that various forms of proximity (geographic, social, cognitive, institutional, organisational) facilitate interactive learning; geographic

[46] By formal network, we mean a contractual agreement among a restricted number of firms to engage in specific joint activity likely to result in mutual gains. In contrast, informal networks are characterised by non-contractual, often multiple relationships, which emerge and dissolve in a more organic fashion around joint production, marketing, training and investment issues, for example.

proximity is neither a necessary nor sufficient condition for learning to take place, though it does facilitate interactive learning by strengthening the other dimensions of proximity (Boschma, 2005).

Knowledge Bases – A knowledge base consists of all the sources and areas of knowledge that a firm draws upon in the process of innovation. It is easy to envisage that small firms with restricted internal resources may need to interact with external actors in order to compensate for such limitations (Fagerberg, 2005). However, the growing complexity of the knowledge bases necessary for innovation means that even large firms increasingly depend on external sources in their innovative activity (Pavitt, 2005; Powell and Grodal, 2005; Narula and Zanfei, 2005). The latter is an important point. The relevant knowledge base for many industries is not internal to the industry, but is distributed across a range of technologies, actors and industries (Smith, 2002). The complex and distributed nature of knowledge bases applies just as much (perhaps even more) to LMT firms (Smith, 2002; Hirsch-Kreinsen *et al*. 2005). A distributed knowledge base is a systemically coherent set of knowledge, maintained across an economically and/or socially integrated set of agents and institutions (Smith, 2002). For mature (i.e. LMT) industries these knowledge bases are cognitively deep, complex, and institutionally distributed (Smith, 2002). Knowledge flows within such bases typically take two forms, embodied and disembodied. Embodied flows involve knowledge incorporated in machinery and equipment. Disembodied flows involve the use of knowledge transmitted through scientific and technical literature, consultancy, education systems, movement of personnel and so on (Smith, 2002). For example, tacit knowledge represents disembodied know how that is acquired through interactive learning (Howells, 2002).

Embeddedness

The concept of embeddedness as it is used here is far broader than that popularised by Granovetter (1985). In that classic article, Granovetter argued that social ties or relations affect economic behaviour in modern industrial society; this was an insight that he felt was not being adequately captured by any of the prevailing theoretical perspectives. Expanding on this point, his basic argument was that although neoclassical economics tended to provide an under-socialised explanation of economic behaviour, alternative economic perspectives were inclined to over-

socialise their accounts of economic action (1985). Granovetter argued that ironically both of these theoretical extremes of under- and over-socialisation resulted in a common conceptualisation of action carried out by atomistic actors (1985). In the under-socialised account, actors behave or make their decisions outside any social context; atomisation results from a narrow utilitarian pursuit of self-interest. By contrast, in the over-socialised account, actors' actions are essentially dictated by their membership of various social categories; atomisation occurs because behavioural patterns have been internalised to such an extent that ongoing social relations can only have peripheral effects on their behaviour.

Rather than either the under- or over-socialised view of economic behaviour, Granovetter makes a case for an alternative economic sociology perspective by introducing the notion of embeddedness to capture the fact that social ties affect economic behaviour. He argues that such a perspective alters the theoretical and empirical approach to the study of economic behaviour (1985). Taking for example trust and malfeasance, Granovetter (1985) argues that with embeddedness, concrete personal relations and structures (or networks) of such relations generate trust and discourage malfeasance in economic exchanges. The argument that economic activity is also a social phenomenon is a recurring theme in different explanations of the relationships between innovation and space (Simmie, 2005).

In this article embeddedness refers to the connections that a firm has with other actors. These connections may be with customers and suppliers, other firms, institutions, agencies or other organisations. We are interested in whether these linkages are local or geographically distant, and whether the linkages are market-based (arms length interactions) or non-market-based (cooperative and/or collaborative). Any particular advantages conferred on the firm by the immediate locality – for example in terms of the availability of specialised labour pools, the presence of intermediate goods suppliers and/or the existence of specific local institutions – are also important in the conceptualisation of embeddedness used here. Our embeddedness concept is thus a composite one – acknowledging not only the importance of social relations for economic behaviour (á la Granovetter) – but also drawing, in general terms, on many of the issues surrounding local linkages that have been highlighted by diverse literatures such as those on industrial agglomeration,

industrial districts, innovative milieus, regional innovation systems and localised learning[47]. Therefore, for us, embeddedness is the complex web of connections – social, economic and institutional – that contribute to the innovative performance of LMT firms and industries and which, crucially, are not accessible by competitors.

Embeddedness is not always associated with competitiveness. Granovetter (1973; 1985) himself, in contrast to his own embeddedness idea, argues that weak ties (connections outside the locality in our terms) link a firm into new networks and social relationships outside of their current local networks and social relationships and, therefore, help expose the firm to new ideas, network partners and sources of information. Paradoxically, strong ties, where linkages are predominantly focused on existing local networks and social relationships may reduce the capability of firms to innovate. The most commonly cited problem is 'lock-in' – best described as inertia and lack of responsiveness of firms to new opportunities and stimuli, especially those outside the locale. One of the prime causes of lock-in is deep embeddedness. Boschma (2005) argues that either too much or too little proximity (we would argue deep embeddedness) may hinder interactive learning for firms. Reflecting this type of thinking, Uzzi (1997) and Boschma *et al*. (2002) more formally posit an inverted U-shaped relationship between embeddedness (in its Granovetterian sense) and innovative performance. What this means is that up to a point, there is a positive relationship between embeddedness and innovative performance, but this relationship may turn negative at a certain stage, due to factors such as lock-in. At that point, weak ties or "shallow" embeddedness (formal, market-based and non-local linkages) by stimulating access to new external knowledge, partners and ways of doing things, may improve innovativeness. Hence, Uzzi (1997) suggests, a more complex pattern of embedded and market relationships at the network level is optimal. As we suggest below, another form of embeddedness – "stretched" embeddedness – characterised by new, strong (though non-local) ties may also overcome problems of lock-in.

[47] For a detailed overview of the importance of networking, industrial districts and clustering to LMT firms see the section Localised Industrial Creativity in Hirsch-Kreinsen *et al*., (2003). See also Jacobson *et al*., (2002).

Both Hess (2004) and Dicken (2007) and his associates have considered ways of describing the complex reality of production entities incorporating different types of networks, linkages and associations. Hess (2004), through a close examination of embeddedness developed the idea of the rhizome as a metaphor for these eclectic production systems. This emerges from his identification of three major dimensions of embeddedness: societal, network and territorial embeddedness. All embeddedness has a societal aspect in that social, cultural and institutional backgrounds facilitate the binding among people and organizations that constitutes embeddedness. What we mean by "stretched" embeddedness is where the local, territorial links are weakened (disembedded) and other links formed with actors at a distance.

The perspective of Dicken (2007) and his associates is that of Global Production Networks (GPNs) or, as some prefer, Transnational Production Networks (TPNs). Of particular importance in the current context is the way in which this approach incorporates the reality of both territorial embeddedness and non-local embeddedness into the same evolving multi-organisational entity.

In sum, these concepts suggest the possibility of another form of embeddedness – "stretched" embeddedness – which still emphasises the non-formal aspect of embeddedness but on a wider (trans-local, even global) geographic scale, thereby putting less emphasis on immediate location. If organisational proximity can substitute for geographic proximity, particularly in terms of producing and diffusing tacit knowledge (Gertler, 2001a; 2001b), and if this knowledge is important for innovation, it follows that location (in terms of geographic proximity) may not be as important as other perspectives suggest. Similarly, if relational proximity (which is not synonymous with any particular territorial setting) as opposed to spatial proximity enables close social interaction and contributes towards firm competitiveness (Bathelt, 2005), then immediate location may be less important for firms. To this extent, embeddedness may be 'stretched' in geographic space if distantiated non-formal network best describes the type of trans-local or even global linkages that a firm has.

Empirical Context

LMT manufacturing in Ireland

Using the OECD (1997) classification of manufacturing industries based on technological intensity into high, medium-high, medium-low and low technology, it is possible to compare Irish industrial structure with that of other countries across the EU. As shown in Table 3.1, Ireland has a much higher share of total manufacturing employment in high-technology sectors than all other EU countries, most of which tend to have greater concentration in medium-high and medium-low technology sectors.

Table 3.1: Structure of Manufacturing Employment in Selected EU Countries, 2004, by Level of Technology

	High-Tech as % of Manufacturing Employment	Medium-High as % of Manufacturing Employment	Medium-Low & Low as % of Manufacturing Employment
EU25	6.4	30.5	63.6
Austria	7.1	26.6	66.3
Belgium	4.6	32.2	63.2
Finland	10.7	26.2	63.6
France	7.1	31.5	61.3
Germany	7.8	40.7	51.5
Hungary	11.3	24.8	63.9
Ireland	**17.6**	**24.8**	**57.5**
Italy	4.6	29.4	66.1
Netherlands	5.3	19.8	75.6
Portugal	2.0	15.8	82.1
Spain	2.9	25.3	71.2
Sweden	6.9	37.7	55.3
UK	8.1	34.1	57.8

Source: Felix, 2006, Table 1, OECD Classification of Sectors

Approximately 85 per cent of employment in the high-tech sectors in Ireland is in foreign, primarily US owned firms (*Quarterly Bulletin of the Central Bank*, Autumn 2003). A few sectors dominated by these multinationals companies (MNCs) account for the bulk of value added in production (Cerra *et al*., 2003). Most employment in LMT sectors is in Irish owned firms. It is clear from Table 3.1 that even for Ireland, which apparently has the largest high-tech sector, the rest of manufacturing accounts for over 82 percent of manufacturing employment.

Rural firms are focused on because of the strategic need to upgrade 'old economy' (or LMT) rural firms in order to build a commercially successful rural economy (*Rural Ireland 2025, Foresight Report*, 2005). As upgrading depends critically on innovation and technological change, it is imperative to understand the factors impacting on rural enterprise innovation.

Previous Research on the Relationship Between Location and Innovation in Ireland[48]

Roper (2001) examined the importance of locational factors on firms' innovative activities. He concluded that for Ireland, notions of agglomeration advantages, innovative milieus or an urban hierarchy of innovation have little empirical meaning. Interestingly, however, the study revealed a positive contribution of networking to the propensity to innovate; therefore, Roper (2001) argued that in the future, it would be useful to distinguish between firms' local and non-local network partners0.. Elsewhere, the Shannon region was deemed to have all the features of a local system of innovation in the mid-1990s (Andreosso-O'Callaghan, 2001) and the Border, Midlands and West region has pockets of knowledge creation capability (Andreosso-O'Callaghan *et al*. 2003). The spatial dispersion of innovation in human resource management in Ireland was investigated by McCartney and Teague (1997) who found that innovation was more likely among plants in urban locations. In Quinlan's (1995) study, based on 1991 data, R&D expenditure was concentrated in urban locations with the four largest cities in Ireland and their hinterland accounting for over two thirds of national expenditure (1995). Heanue and Jacobson (2005) examined the interaction between globalisation and embeddedness for LMT firms and found no clear relationship between the two variables.

What are the implications of this previous research in the context of this paper? Although the issue of embeddedness was not directly addressed in most of these studies, the findings of Andreosso-O'Callaghan *et al*. (2003) and Andreosso-O'Callaghan (2001), in relation to milieu in the Border, Midlands and West (BMW) region, and the description of the Shannon region as a local system of innovation

[48] We do not here review the extensive literature specifically on embeddedness of subsidiaries of MNCs, from the first, pioneering work of Stewart (1976) on linkages in the Shannon region (which shows very little MNC embeddedness) to such recent research as that of White (2004) on software MNCs in Ireland (which suggests some growth of embeddedness over time).

respectively, suggest that firms in those particular areas may exhibit embeddedness. In this regard, two of the case study firms in the present study are located in the BMW region and it will be interesting to compare the findings with those of these previous studies. The results of the two studies by McCartney and Teague (1997) and Quinlan (1995) in relation to urban locations also indicate the possibility of embeddedness of firms there. By contrast, low or no enterprise embeddedness may be implied from Roper's (2001) study. However, most of this research does not explicitly focus on LMT firms and industries and innovation in those sectors. The research that does (Heanue and Jacobson, 2005) suggests that a variety of embeddedness patterns are possible for these firms.

Methodology and case study firms

Methodology

In contrast to many of the studies mentioned above, the present study takes a case study approach. The empirical work was completed as part of an EU Fifth Framework project with the acronym PILOT[49], which comprised 11 partners in 9 countries. The criteria used for inclusion as a case study firm were that the enterprises had to be innovative, commercially successful and ideally employed more than 50 people. In the project, 44 case studies were carried out; four of these were in Ireland. The Irish companies were identified in consultation with industry experts from Enterprise Ireland and sector observers and/or representatives. Within the four Irish companies a total of 15 interviews were carried out over the period September 2003 to June 2004, with senior, middle and junior personnel in the selected companies. Two interview instruments were used. The first was a semi-standardised interview guideline containing nine thematic clusters. With this form of guideline the interviewer is free to alter the sequence of questions and probe for more information in reaction to the level of comprehension and articulacy of the respondent. The second was a standardised questionnaire[50]. In addition to the interviews, a tour of the enterprises was undertaken. To provide context for the information on the individual

[49] The full name of the project was "Policy and Innovation in Low Tech: Knowledge Formation, Employment and Growth Contributions of the 'Old Economy' Industries in Europe", a research project financed within Framework Programme 5, Key Action "Improving the Socio-Economic Knowledge Base" (HPSE-CT-2002-00112). The project ran from December 2002 to January 2006.
[50] A copy of the interview instruments is contained in Appendix B.

firms, interviews were also carried out with sector representatives in Enterprise Ireland and a review of company and industry documentation and reports was implemented.

Case study firms

Each of the partners in the PILOT project examined the fabricated metal products industry (NACE 28) as one of its case study sectors. Each partner had discretion in terms of picking their second sector. For Ireland, the furniture sector (NACE 361) was chosen because, although small, it has been categorised as a relatively robust sector (Cooke, 1996; Jacobson *et al*., 2001). In addition, Ireland exhibits a relative specialisation in furniture employment compared to the EU as a whole (O'Malley and Van Egeraat, 2000). Therefore, two firms in the furniture industry and two enterprises in the fabricated metal products industry were included in the study. Each of the firms was deemed by industry observers to be innovative and a good example for its respective sub-sector of successfully grappling, albeit in different ways, with competitive challenges and pressures. Before turning to the case studies, a brief overview of the industries is presented.

The Irish furniture industry [51]

Within Ireland the furniture industry is a relatively small contributor to economic activity. At the time the empirical work was carried out the industry employed 6,722 persons or 2.8 percent of manufacturing industry employment and contributed 0.6 percent of manufacturing gross value added. The industry contributed €123m or 0.13 percent of total exports. The overwhelming majority of the 428 firms in the industry are Irish owned. The activities of these firms range from the manufacture of chairs and seats to the production of mattresses. The sub-sectors to which the case study firms belong contributed 45 percent of the industry's firms, 44 percent of employment and 40 percent of turnover.

High operating costs resulting from rising wages, utilities costs, insurance and employer contributions are reducing many companies' competitiveness and squeezing investment in areas such as R&D, design, marketing and training

[51] The section draws on InterTradeIreland (2004) 'A Review of the All-Island Furniture Industry'

(InterTradeIreland, 2004). Although export levels have been maintained, imports now account for more than 70 percent of domestic Irish market sales. According to InterTradeIreland (2004) the internationalisation of design is viewed as an opportunity for Irish manufacturers to participate in the wider European market where previously the reproduction style furniture of Irish producers was unsuitable. (This reproduction style was aimed specifically at parts of the British market only.) The Eastern European market is viewed as an opportunity as well as a threat to the sector. As Asian producers are increasingly gaining a foothold in the high volume end of the market Irish furniture manufacturers will need to try to sustain competitive advantage through quality, innovation, design, market positioning and responsiveness.

The key markets for Irish furniture manufacturers are the domestic market and the United Kingdom. There has been limited market development beyond these locations. Generally, Irish furniture manufacturers have a good reputation for quality, modern production processes and a diverse product range. Where the industry is weak, however, is in relation to softer issues such as design culture and product development. There is, in addition, an absence of strategic thinking, poor cooperation within the sector and a lack of a shared vision/positioning within the industry (InterTradeIreland, 2004).

Furniture Industry: Case Study 1 – The first furniture case study, FURN1, is located in County Monaghan, on the border with Northern Ireland. The company produces living room, dining room and bedroom furniture. County Monaghan has traditionally been the location for some of the largest, most successful, and export oriented Irish furniture companies (partly due to a long tradition of furniture making in the area which conferred first-mover advantages on local firms in terms of scale, markets and enterprise support). FURN1 exports 90 percent of its output compared to an export rate of 24 percent for other firms in this sub sector. The company has consistently been to the fore in the Irish furniture industry. For example, in 1990 it was identified by IDA Ireland as one of the more competitive companies and one to support. In terms of employment size, the company is in the top 20 percent of Irish furniture firms.

Furniture Industry: Case Study 2 – The second furniture case study, FURN2, is a second-generation, family-owned private company located in County Meath. FURN2 produces upholstered furniture (e.g. sofas, armchairs). County Meath has traditionally been the location for a large number of upholstery firms, partly because of its proximity to the Republic's capital city of Dublin, and also its proximity to Belfast, the main urban centre in Northern Ireland. FURN2 exports 25 percent of its output, as opposed to an average export intensity of 30 percent for other firms in this sub-sector. The remainder of its output is sold on the Irish market (both the Republic and Northern Ireland). The company's brand is rated second among Irish brands in its market segment in terms of sales. In terms of employment size, the company is in the top 20 percent of Irish furniture firms.

The Irish engineering industry

Companies engaged in the fabrication of metal products are a sub-sector of the Irish engineering industry. At the time the empirical work was undertaken, the Irish engineering industry employed 58,799 persons or 25 percent of manufacturing employment. The industry accounted for approximately 15 percent of Ireland's total exports and Gross Value Added (GVA) for the industry was €3.5 billion or 11 percent of GVA in Irish manufacturing. The industry contains both indigenous and foreign-owned companies. More specifically, the sector contained 1,427 firms, including 170 multinationals. The activities of these companies range from aerospace technologies, to manufacturing equipment, and automotive components. The sub-sector – Manufacture of Fabricated Metal Products – to which the case study firms belong, contributes 45 percent of firms, 23 percent of employment and 12 percent of the Irish engineering industry turnover.

The Irish Engineering Enterprises Federation (IEEF) (2004, 1) argues that in addition to its sheer scale, the engineering industry makes a distinct contribution to the Irish economy in a number of ways. First, the engineering sector is a critical component of Ireland's economic infrastructure. Engineering companies are important suppliers to large indigenous and multinational companies in areas such as construction, IT, and pharmaceuticals. A significant proportion of Irish industry would be severely hampered by the inability to source locally a wide range of engineering intermediate and capital goods. Second, the sector is regionally diverse; engineering companies

are widely distributed throughout the country. Many engineering companies form the cornerstone of local employment. Third, the Irish engineering sector is characterised by the extent to which firms are embedded in the Irish economy and provide a significant local market for a wide range of indigenous industries. In particular, multinational companies within the sector source a large proportion of their inputs in Ireland and are a key market for many SMEs.

The engineering sector has come under increasing pressure in recent years (IEEF, 2004), with declines in employment, output and exports among both foreign and indigenous companies. The globalisation of competition is facilitating a trend by many key MNC customers of indigenous fabricated metal product suppliers to pursue global supply strategies. Together with rising cost bases, ongoing customer pressure to reduce prices and shorten design to production to market cycles, Irish engineering companies are increasingly losing out to lower cost competitors.

Fabricated Metal Products Industry: Case Study 1 – The first fabricated metal products case study, FAB1, is a private Irish owned company based in Co. Mayo on the West Coast of Ireland. The company is one of Ireland's best-known industrial subcontract companies and is engaged in the volume production of high quality precision turned components and special fasteners which it supplies to customers in the aeronautical, telecommunications, medical equipment and automotive sectors, among others. Therefore, FAB1 is part of what is known as the auto turned industry – an industry that uses machine tools and lathes in the production of precision turned parts. Relatively little research has been carried out on this industry in Ireland; there are probably less than 20 firms in the sub-sector. Export intensity is not a relevant metric for this firm as most of its customers are MNCs located in Ireland. Nevertheless, its export proportion is in line with the sub-sector average. The company has a record of consistently achieving high standards a capability that has been recognised with a variety of national awards and commendations relating to the quality of its products, training provision and supply capabilities. In terms of employment, this firm is one of the largest Irish owned firms in its sub sector.

Fabricated Metal Products Industry: Case Study 2 **–** The second fabricated metal products case study, FAB2, is a private Irish owned company based in Co. Cork in the south of Ireland. The company is involved in process engineering for the pharmaceutical, chemical, microelectronics and food & beverage industries. The firm comprises four separate but interlinked companies, A, B, C and D; we focus here on the first and last of these. Company A designs, installs and validates stainless steel process systems. The company manufactures atmospheric or pressure rated vessels – essentially large tanks that are able to accommodate liquids and/or gases under pressure – and also fits internal heating/cooling coils, limpet coil or dimple jackets, insulation, corrugated, aluminium or fully welded stainless steel cladding to any of its vessels. Many of these products are inputs for company D. This firm provides 'ready-to-operate' modular process systems for high purity applications. Companies A and D are the main focus of development within the group and the driving force of the process knowledge; we therefore focus on these two in the case study. The group of companies has a leading position in Ireland within some sectors with 90 percent market penetration in the dairy industry and 50 percent penetration in the pharmaceutical industry. Similar to FAB1, export intensity is not a relevant metric for this firm as most of its customers are MNC's located in Ireland. Nevertheless, its export proportion is in line with the sector average. In terms of employment, this firm is one of the largest Irish owned firms in its sub-sector.

Discussion

No firm is entirely atomistic in the sense that the only way it relates to other firms or organisations is through formal, market based, arm's length interactions (Jacobson, 1998). Therefore, all firms exhibit some element of embeddedness as we define it. Our primary interest is in ascertaining the extent to which firm linkages are locally or more distantly focused, non-market or market-based, or some combination of these elements. This section reviews each of the case study firms in terms of the embeddedness of the three key dimensions of network relationships, interactive learning and, distributed knowledge bases. We seek to identify the predominant pattern of embeddedness displayed by each firm.

Furniture case studies

Among all of the case study companies, FURN1 can best be described as strongly exhibiting stretched embeddedness – it is characterised by non-local, informal linkages. The company is highly export oriented and globally integrated and its strategy for the future is to maintain its export proportion and increase export volumes by continuing to globally outsource inputs and components.

The decision to maximise outsourcing started in the 1980s. At that time, like many other Irish furniture companies, FURN 1 had a factory that was inefficiently processing solid wood into furniture. As the company's Design and Production Consultant recalled;

> "There was more waste than finished product coming out of the solid wood end of it (the production process)".

So the company embarked on a strategic reorientation of its manufacturing strategy

> "Two things were very important. First, what would be appropriate for the company to do in terms of their internal skills and what aspects could we outsource. We started that at a very earlier stage and it began with chairs. Traditionally people in Ireland made their own chairs, but it is difficult to make any money producing chairs because it is a sophisticated business and it was always done much better in places like Yugoslavia at that time, and Hungary…" (Design and Production Consultant)

One of the key changes to emanate from this reorientation this was a concentration on the use of panel material for furniture manufacturing, with solid wood components being outsourced. As the company's Design and Production Consultant outlined:

> "…one of the fundamentals was that this company would never do anything (manufacture in-house) that required solid wood"

In addition, the emphasis on making furniture out of composite board material which is cut, covered with veneer, moulded, drilled, jointed and finished reduced reliance on craft skills:

> "I mean, there are no craft skills it is all machine-engineering skills if you can call it that. There isn't anybody that can decipher a drawing. At this stage now, I know their competence levels to

> such a degree that I can almost tailor specifications/prototypes/products; I now what is possible, given the equipment they have and the one or two key personnel (with craft skills) in the place". (Design and Production Consultant)

Over time, this outsourcing strategy bedded down in the company:

> "As the company grew, the outsourcing aspect grew, with Italy becoming the major location, primarily because of the quality of the components. This marriage between what is appropriate to do in-house and what is appropriate to source elsewhere is a feature of most industries nowadays, and we have managed to do it extremely well" (Design and Production Consultant)

Presently, FURN 1 outsource as much as possible, while crucially maintaining control over design and finishing. The company's Design and Production Consultant succinctly explained the continuing rationale behind the strategy:

> "It's like high tech industry. Ireland is only a small country – a place where people exercise their creative ingenuity – the same as high tech industries. I have seen the evolution of the business. Now I spend about 50 percent of my time overseas trying to develop these other aspects of the business (i.e. outsourcing supply)".

In terms of continuing to expand exports to the UK, FURN 1 is successfully competing against low cost competitors from China and Asia through a competitive strategy that focuses on:

> "customer relations, service, value for money" (Joint Managing Director A)

> "It is primarily a service industry…"(Design and Production Consultant)

What service means in practice is that FURN 1 offers independent UK retailers a flexible source of supply by being able to manufacture a composite range of products to order, with a short lead time of four to six weeks, and also facilitating better cash flow for the UK retailers. As outlined by Joint Managing Director A:

> "If a UK retailer goes to Asia or Eastern Europe, probably has to pay by a letter of credit or something, up front, for a container(s) load of furniture. This stock then has to be warehoused (another cost). Then if there are problems with the furniture, he has already paid for it. With us, they only have to carry their showroom

> display...They have already have received a deposit on the furniture (once the customer orders it and before FURN 1 is paid)"

The ability to provide this level of service is underpinned by the fact that as far as FURN 1 is concerned:

> "UK is really a home market…export for revenue purposes only. Do not think of exporting to England as anything special" (Joint Managing Director A)

Network relationships - The company has a plethora of suppliers located in China, South Africa, Romania, Poland, Italy, Scotland, Algiers, Slovakia, Germany and Ireland. Although FURN1 does not consider geographic proximity to be important in relation to their suppliers, closeness in terms of 'organisational proximity' or trust-based and reciprocal relationships with the suppliers is extremely important[52], suggesting non-formal relations over long distances. To take a specific example, FURN1 has a very closely cultivated relationship with an Eastern European furniture company that produces prototypes, solid wood components and some complete pieces of furniture for FURN1. Personnel from each organisation have visited the other's premises, and workers from the Eastern European factory have been employed in FURN1. In one case, an Eastern European worker who previously spent two years with FURN1 now works full-time for FURN1 in Eastern Europe in a quality control function for components and products.

Interactive Learning – FURN1 has a relatively structured interactive process for product innovation and development that uses and integrates external knowledge from customers, sales representatives and competitors with internal design and production competence, which mainly resides at supervisory and management level, rather than among operatives. More specifically, the company generates new product designs from continually liaising with its internationally based sales force and independent external design consultant and adopts new process innovations as a result of repeated visits overseas to supplier exhibitions. Critically, by creating 'temporary clusters' of expertise in these processes (both by inviting sales personnel

[52] For a full description of the importance and role of organisational proximity see for example, Heanue and Jacobson (2002).

and customers to its premises regularly, and repeatedly attending trade exhibitions overseas), the firm further contributes to the overall stretching of its embeddedness.

Knowledge bases – Deep and stretched embeddedness characterise the company's knowledge base relations. FURN1 extensively uses and interacts with local and external repositories of knowledge, with whom it has long-standing relationships. Its involvement with Enterprise Ireland in the implementation of a World Class manufacturing programme, is one example. A second case in point is the impetus that came from the Environmental Protection Agency, to install a waste management and disposal system, that impacted positively on both process and product design. In addition, FURN1 engages in formal R&D. An independent consultant, who has worked with the company for many years, provides the main design expertise for FURN1. The company develops prototypes sometimes in-house and other times in cooperation with an Eastern European company with which FURN1 has close links, and with whom they have exchanged personnel, information and knowledge. FURN1 relies heavily on embodied knowledge in the form of investment in computer-numerically controlled machinery and other plant and equipment.

FURN2 mostly displays an evolving pattern of embeddedness similar to that suggested by the inverted U-shaped hypothesis of Uzzi (1997) and Boschma *et al.* (2002). The company is in a state of flux changing from a deep to a shallow pattern of embeddedness. Faced with increasing competition from furniture manufacturers in Central and Eastern Europe and the Far East, FURN2's response is to import completed products from low-cost locations and distribute them under the company name. FURN 2 arrived at this strategy after considering the competitive pressures the company was facing and examining it's asset base (premises and reputation) and how best to use them.

> "We are prepared to look at other businesses allied to what we do but not necessarily entrenched in production. We are asking ourselves how much sense is it making? Are there too many obstacles? Highly competitive market, easy entry, anyone can import, price focused a lot of the time, retail groups coming in offering three year interest free purchases etc. We have to evaluate whether or not it makes sense to stay in this business. Just because you are in it doesn't mean that you have to stay in it… We have had some great years, the business has been good to us and it spawned other companies that we have done well

> from. Therefore, we are prepared to innovate; we won't continue down this road – breaking even, keeping employment, working hard…The furniture company is going to go more into the distribution area, looking at retailing because we have assets and it is a question of how best to use these". (Joint MD/Marketing Manager)

This new strategy poses many challenges for FURN 2:

> "We are now going into the area of distribution – bringing in product from the east and distributing it under our own name – we don't have a brand as such. The most difficult aspect is product selection. The rest is quite tangible. If you identify…products that you can sell on a distribution basis and make a profit, then you have done the hard part – the intangible part…It is a logistical problem we have now. When you identify the product, the biggest problem is getting a good partner". (Joint MD/Marketing Manager)

However, this strategy will provide them with another competitive advantage when dealing with their existing and new customers

> "For retailers, this means that they can get a product but we have all the headaches – bringing it in, storage, damage etc. And if the retailer wants, for instance, one bedroom suite, we ship it". (Joint MD/Marketing Manager)

As with FURN 1, it appears that the ability to offer retailers a service that facilitates minimum inventory levels is a key component of FURN 2's future strategy.

This strategy is partly fuelled by the fact that the firm no longer derives any particular benefits from its location; these benefits up to the recent past included a pool of skilled labour and close subcontracting linkages. According to the General Manager:

> "Today, the benefits of being in Navan – it is quite well located, close to the centres of population on the East coast. Northern Ireland and particularly Belfast and the East Coast of Ulster is a good market for us. Therefore, our location is quite good".

In terms of other location issues, however, the Joint MD/Marketing Manager expressed the opinion that:

> "We have discussed locating in central Europe. Possibly we may look to do it. There is a labour supply here. And there is a sub-supply sector of sorts here but it is very, very weak…No, there are no advantages to being here. The labour laws are tough and this is not a well-paid sector

> but the costs of production compared to Eastern Europe not alone China are excessive. If I was setting up an upholstery company in the morning I wouldn't set it up in Ireland".

Confirming the skilled labour availability in the locality, the General Manager reflected that:

> "The history of the town with the furniture industry would benefit us alright as there are families that have always worked in the industry and their children would as well. We have a couple of families here with two generations working here. I don't know if there is a possibility of a third even though some of them have children of that age".

Network relations – For FURN2 these are a mixture of deep and shallow embeddedness. The company has benefited from local non-formal networks in terms of a local sub-supply sector and localised pool of specialised labour which, however, is increasingly less important for the company. FURN2 has also been involved in a mixed local and non-local formal network, specifically its participation in the late 1990's in a training-focused EU funded ADAPT project[53], which included a consortium of local SME's, FÁS[54] and transnational partners from France, Scotland, Greece, Germany and Italy. Proximity to important markets is the main benefit of this firm's current location. This, mostly downstream embeddedness, may be considered shallow.

Interactive learning – FURN2 has a relatively structured in-house procedure for generating new product ideas, supported by close input from its sales agents. In terms of upstream input, fabric suppliers are most active in terms of information on fashions and tastes. Nevertheless, FURN2 sees itself as a follower rather than setter of trends, and views itself as providing a unique service built on reputation, reliability, responsiveness, timeliness and flexibility, rather than unique products to retailers.

Its most recent process innovations – the adoption of machinery that was unique in Ireland and the upgrading of its manufacturing and management information systems

[53] ADAPT was a Human Resources Community Initiative supported by the European Union through the European Social Fund (ESF). For more information see http://www.adapt.leargas.ie/
[54] Foras Áiseanna Saothair (The Irish National Training and Employment Authority)

– arose from its participation in the formal ADAPT network mentioned previously. Enterprise Ireland has been instrumental in encouraging organisational and managerial changes within the company, with the implementation of World Class Management systems and initiatives like the Company Development Programme, which helps companies to develop a strategic approach to their business. FURN2 has also used a licensing agreement to manufacture an American company's designs for distribution in Western Europe.

Knowledge bases – Due to the labour intensive, handcraft nature of FURN2's production processes and the lack of automation, there is relatively little scope to embody knowledge in machinery. Unsurprisingly, therefore, for its production processes, the company relies heavily on the practical knowledge and tacit skills of its operative workforce, particularly in relation to sewing and cutting. The same is true of the firm's product design and prototyping capability; the knowledge of what constitutes a potentially successful design, and the ability to design a product to maximise its ease of manufacture, are based on experience and therefore are internal to the company, and based very much on practical knowledge. Complementing these essential internal knowledge sources, are the external sources that feed into product innovation (the input of sales agents, customers, suppliers) and product specifications (the parameters set by regulatory and safety standards in terms of flammability and toxicity).

Fabricated metal products case studies

Both of the firms in this industry are more deeply embedded in their locality than either of the furniture firms, although the nature of that embeddedness differs for each of the enterprises. FAB1 is characterised by deep embeddedness in terms of its institutional linkages and reliance on local labour skills and supply. By contrast, FAB2 exhibits deep embeddedness in terms of all three dimensions – network relations, interactive learning and knowledge bases – with relationships characterised by extensive local, non-market-based linkages. The absence of stretched embeddedness for either of these two firms is probably a reflection of the fact that for both companies, their suppliers and customers (mostly MNC's) are predominantly located within Ireland. FAB1's strategy is to progressively move up the value chain in terms of the types of components and the sectors that it supplies into. Having

started supplying components to sectors with relatively low quality control requirements such as agricultural machinery, FAB1 has progressed to providing components to more quality conscious sectors such as aeronautical and medical products.

> "We need to get into complex jobs…we started off doing bits for tractors. Then you move up into something a bit better, then automotive – there are two sections in this industry – you can make something for sunroofs but not for brakes or engines. Where we need to get into – the higher end of the automotive industry and medical. We have done stuff for medical such as knee joints, pacemaker, stents and things like that. After that, you are going up into aerospace…so we are somewhere in the middle. We started at the bottom that is where everyone starts. The Chinese are getting the bottom, the Poles – the middle bottom. We need to be where quality, not price, is the key". (Personnel/Training Manager)

This movement up the value chain is seen as critical to insulating the company from competition originating in lower wage economies.

> "If you looked at our customer list 10 years ago you would have seen a lot of agricultural companies…To supply these companies you don't need quality standards - their purchasing decisions are based mainly on price. If you have a guy set up in a garage, with no overheads, he is an ideal candidate to supply that type of firm. We want to move up to doing things for more critical applications…Parts with a more critical application won't go to China; they (customers) are concerned about quality. That is the big advantage that European based companies like us have. China is suitable for certain products, not everything". (Operations Manager)

Network relations – FAB1 participates in two local formal networks. The first, the North Mayo Skillnet[55] Training Network was devised as an approach to filling common skill gaps and training needs for a group of 19 companies in North Mayo/South Sligo. The second local formal network is FAB1's involvement in the development, and now the management through an industry organisation, of a dedicated Training Centre for the needs of the auto turning industry. FAB1's relationship with its subcontractors, most of whom are Irish-based, is best described as long-standing market-based relationships. Speed of supply (in terms of quick

[55] The SKILLNETS Training Networks Programme, funded by the Department of Enterprise, Trade and Employment and the European Union, encourages groups, clusters and networks of enterprises to collaborate in establishing business-led training processes for their workforce. For more information see http://www.skillnets.com/

flexible response) rather than geographic proximity per se is the important criterion in choice of suppliers, most of whom are located in Dublin .

Interactive learning – FAB1's innovations are mostly incremental process innovations that are carried out on a reactive rather than proactive basis. To an extent this is unsurprising as 1) the general production processes and technology used by FAB1 are well-established and relatively stable and 2) the specifications for components are generally provided by the customer thereby reducing the opportunities or need for product development on the part of FAB1. For process innovations, the solutions are primarily generated internally by the engineers, team leaders and maintenance people, assisted at times by external expertise. External assistance is usually obtained on an informal basis, from equipment suppliers, sales representatives and even from competitors, with whom they have a good relationship.

Knowledge base – FAB1 is located on the fringes of a cluster of tool-making firms located in the North West of Ireland. Although not directly in the same business, there is a certain degree of overlap in terms of critical metalworking and machining skills in these two sectors. FAB1 has developed its absorptive capacity as evidenced by the adoption of various quality systems and also by its progressive movement up the value chain. Within the company itself this accumulation of practical knowledge, rather than anything particular about its location, is seen as crucial. Nonetheless, this firm is deeply embedded in its locality and although location is not necessarily important for the firm, FAB1 has been a catalyst for institutional development in the region. For example, it has been pivotal in establishing a training centre in the locality to cater for the needs of the auto turning industry.

FAB2 is strategically trying to use its relationships with its MNC customers as a conduit into becoming the preferred supplier for their other subsidiaries located around the world. This company is probably the most deeply embedded of all the case study firms, a fact that is reinforced by the presence of a cluster of pharmaceutical firms, many of whom are customers, within the Cork region. This is true for Company A. In addition, for Company D, most of its subcontractors are within the Cork and Limerick region. FAB2 is one of the Irish fabricated metal product companies that have developed a 'proprietary product' (a ready-to-operate

modular process system) that enables it to add value and target export markets. The movement towards developing a proprietary product came about due to an obvious need to add value:

> "No matter what you do in an organisation like this, you cannot run it on a shoestring. Your overhead levels are going to be reasonably high so you have to get away from just doing basic piping or making a basic tank". (Managing Director)

and also as a competitive strategy:

> "We were selling in the UK…quoted for a job…tank and agitation for mixing soup. We priced the job and it come out at about £30-35,000 sterling. The price against us was £50,000 sterling. The difference was that the competitor was guaranteeing the product. They were not just selling the tank and agitation they were selling process knowledge. So we realised, if we want the extra margin, you can't just be selling tanks – you need to sell process knowledge". (Managing Director).

These proprietary products make a huge difference to the company's turnover compared to individually selling the basic elements such as piping, vessels, valves and pumps that the company manufactures and supplies:

> "So a job that had come in as a vessel enquiry ended up as a skid (ready- to-operate modular process system), which we sold for €250,000 as opposed to the €30 or €40,000 that we would sell a vessel for". (General Manager)

This competitive strategy builds on a core competence developed by FAB2:

> "Ability to understand customer's requirements and to meet those requirements rather than meeting the strict request for a product. Being able to supply a solution rather than a product or string of products, which others might be able to supply but not across that range". (General Manager)

Therefore, now FAB2:

> "…adds value to standard market product. What I mean by that is that we make vessels, we supply pumps, we supply valves, we supply all these different components. What I try to do is sell them all together as one unit. We try to sell a system and therefore make a better margin". (Sales and Marketing Manager)

Network relations – Deep embeddedness is relatively important for FAB2, not so much in terms of suppliers but rather for subcontractors. The location of suppliers is

not all that important logistically because most of what they supply is custom made; this means that the time constraints that in other circumstances act as drivers of buyer-supplier proximity are not applicable in this case. Close proximity to subcontractors, however, is crucial, especially for Company D and most subcontractors are based in the region. The subcontracting companies are a relatively stable group of specialised companies. Proximity to subcontractors is important because it facilitates communication and the integration of different knowledge bases. For example, whereas in this context FAB2 has expertise in designing, building and testing the product, subcontractors contribute essential complementary engineering knowledge and expertise that is not available in-house at FAB2.

Interactive learning –In order to develop its proprietary product ideas, FAB2 engages in formal R&D projects, often partially funded by enterprise support agencies. Most of the expertise used originates in-house as a result of a structured process of product identification and development. External resources in terms of customer's inputs are also used. R&D, however, is only one mechanism through which FAB2 engages in product or process innovation. For example, the company also delivers a cleaning system to its customers under licence from a US company. As outlined above for Company D, the development and production of its products is very much an interactive process involving subcontractors. FAB2 is very active in employing engineering graduates on work placement from the University of Limerick. Disappointingly, however, from FAB2's perspective none of these links with universities have resulted in the pursuit of R&D projects by the universities that would be of benefit to FAB2. FAB2 uses external consultants in various ways. One example concerns the implementation of a programme of R&D projects funded under Enterprise Ireland's Research, Technology and Innovation (RTI) competitive grants scheme. FAB2 obtains information on potential market opportunities from two sources; a lead generation company and general interaction with customers, suppliers and competitors.

Knowledge base – In FAB2, practical knowledge at supervisory level is considered critical for Company A. Typically, such supervisors have been with the company for a long time and have a lot of experience gathered from learning by doing. Few of

these personnel have third level educational qualifications and some do not even have second level education. Company A would struggle without this particular internal knowledge base. By contrast, at shop floor level, personnel could be relatively easily replicated and replaced. Nevertheless, there is a tradition of working with stainless steel in the area so the company does have access to a specialised local labour force. Among the small group of people at middle to senior management level there is very strong technical competence and good commercial competence in terms of understanding the market, dealing with customers, seeing the potential of new ideas and developing and implementing them. Within Company D, most of the key personnel have third level educational qualifications as the critical knowledge includes process engineering knowledge, mechanical engineering knowledge, a certain amount of automation controls knowledge, and a lot of instrumentation knowledge. Company D uses state of the art design software including a Thermal Design programme developed in-house.

The case studies show that a wide variety of relationships between embeddedness and innovation is possible, and the form that this takes is influenced by the heterogeneous array of firm responses to the challenges faced by globalisation, building on their existing and possible future business strategies. Successful firms in different industries – or sub-sectors of industries – can network in different ways; the same firm can even change the nature of its networking over time, as the industry, market and technology evolve. This variety and complexity is evident in relation to each of the three dimensions of innovative processes. The empirical research reported here thus supports, in a general way, those theorists like Uzzi (1997), Boschma (2005) and Maskell *et al*. (2006) who are critical of simplistic arguments about the advantages of clustering.

Conclusions

This paper examined the relationship between location and innovation for LMT firms in two Irish industries, by focusing on the pattern of embeddedness exhibited by firms in the process of innovation. The research was undertaken against a theoretical background that broadly recognises that innovation occurs in increasingly distributed

networks in terms of geographical dispersion, and through the integration of disciplinarily diverse knowledge areas (Fagerberg, 2005).

Both of the furniture firms tend to support the Uzzi (1997) and Boschma *et al.* (2002) inverted U-shaped hypothesis about embeddedness and innovation, but in different ways. FURN2 tends to directly support the hypothesis. This company provides an example of a movement from a deep to a shallow form of embeddedness in response to the competitive pressures it faces. The main advantage of its current location is proximity to its two biggest markets, Dublin and Belfast. The once important local specialised labour force and sub-supply sector are increasingly less significant, than sourcing complete products in the Far East that can be sold under the company name to its existing (and new) customer base, trading on its established reputation for service. In this way the company has developed a shallower form of embeddedness that will complement its existing manufacturing competence with an emerging logistics competence. For this firm, at this time, the development of a shallower embeddedness allows it to respond to the challenges it faces, given its capabilities and business model.

FURN1 also supports the notion that a type of embeddedness other than deep, local embeddedness may be important for innovation. However, FURN1 through its global interactions with suppliers, collaborators and customers, has evolved a stretched form of embeddedness that underpins its innovative activities. It appears that FURN1 has responded to the opportunities offered by globalisation by cultivating important non-market based relationships with other actors. Although Uzzi and Boschma do not directly address the notion of stretched embeddedness, it could easily be incorporated into their model as a third form of embeddedness. In so far as stretched embeddedness retains many of the social attributes of the deep embeddedness concept, yet operates on a different geographic and temporal scale, it contains elements of both other forms of embeddedness. Crucially, the notion of geographic proximity plays less of a role in linkages for those firms that display stretched embeddedness. A key question then becomes, when is shallow as opposed to stretched embeddedness likely to occur? We would argue that, particularly for relatively small firms like FURN1 and FURN2, the innovation necessary for competitive success requires firms to adjust the nature of their embeddedness in

response to competitive pressures. For example, the business model innovation by FURN2 to complement its existing production with ready-made products from lower cost locations, necessitates a mixture of deep and shallow embeddedness, with the latter being the key driver for its innovation focus at this time. Moreover, it seems to follow from our cases that the stage in the firm and industry life cycles and heterogeneous reactions to globalisation pressures may be factors in whether successful firms have deep, shallow or stretched embeddedness.

The findings for the furniture firms are interesting because both of these firms are located in industrial agglomerations (Heanue, 2007) and FURN1 is situated in an industrial district (Jacobson and Mottiar, 1999). An industrial district is a tightly agglomerated (often in a town or village) group of predominantly small, artisanal firms with extensive vertical and horizontal inter-firm linkages, often of a co-operative nature.[56] In addition, the social embeddedness of firms in an industrial district is often emphasised. Therefore, we might *a priori* expect deep embeddedness to be important for these two furniture firms. That we do not find deep embeddedness is consistent with the findings in Heanue (2007). Through a statistical analysis of the Irish furniture industry he shows that the attractiveness of counties Monaghan and Meath as locations for furniture firms has declined over the decade to 2006.[57] The absence of the deep embeddedness of firms in those locations may be either a cause or effect of such a reduced attractiveness of these locations.

Overall, the two fabricated metal product firms illustrate a traditional view of embeddedness and therefore contradict the hypothesis of Uzzi (1997) and Boschma *et al.* (2002). However, these two firms illustrate the traditional view in different ways. FAB1 exhibits a deeply embedded pattern, particularly in institutional terms due to its involvement with the local training centre, but also because of its reliance on local labour skills and supply. FAB2 on the other hand is deeply embedded as evidenced primarily by the depth and quality of its knowledge exchange with subcontractors.

[56] See Paper 2 for a further discussion of industrial districts in general and the furniture industrial district in County Monaghan in particular
[57] Paper 4 is the final version of Heanue (2007)

Both of the fabricated metal product firms are dependent on MNCs for their main markets and this linkage critically influences the form of embeddedness exhibited by the two firms. FAB2 is trying to use the links with its MNC customers to become the preferred supplier for their global operations. If this strategy is successful then it is likely that FAB2's embeddedness will change somewhat from its current deep to a more stretched variety. However, to the extent that FAB2 continues to interact in the same way with its current cohort of subcontractors this will likely mediate the extent that its embeddedness will stretch. By contrast, FAB1 is more likely to remain deeply embedded in its locality both due to its reliance on local labour and also because of the fact that its main MNC customers are located in close geographic proximity. Of course, FAB1's strategy of trying to move up the value chain both with existing customers and new customers in other sectors may alter the embeddedness dynamic for this firm.

Previous Irish research on location and innovation, although not directly addressing the issue, hints that some firms in the BMW region and Shannon area may be embedded in the locality (Andreosso-O'Callaghan *et al*., 2003; Andreosso-O'Callaghan, 2001). Two of the firms in the present study – FURN1 and FAB1 – are located in the BMW region. However, only the second of these would support the contention of deep local embeddedness.

What are the policy implications of these conclusions? The promotion of clusters (and networking) has been an aspiration of Irish industrial policy since the Culliton Report of 1992, and most recently reiterated in the Enterprise Strategy Group report in 2004. The research presented in this paper suggests that cluster promotion may not always be the correct strategy.[58] Clearly for the two fabricated metal product firms there is an element of clustering already, and until now, this has had a positive impact on their innovative capabilities. For the two furniture firms, although they are located in industrial agglomerations, the benefits of clustering are no longer clear. At a theoretical level, this is exactly the logic of the Uzzi and Boschma *et al.* view; at some stage less – rather than more – geographic clustering may be beneficial to a

[58] A similar reservation about the appropriate policy response is raised in Paper 2

firm's innovativeness.[59] However, the findings of this paper support a policy of encouraging networks and linkages – albeit not necessarily local – to enable innovation. That there is evidence to support calls for a network-based strategy in Ireland has also been reported by Roper (2001).

Such a strategy is especially pertinent given the rural location of the case study firms, their imperative to continue upgrading in order to maintain competitiveness, and the implications for rural enterprise and state development strategies. The furniture examples show how changing forms of embeddedness are important in sustaining innovation depending on the particular circumstances of the firm. Each of these firms responded in a different way to the pressures arising from increased global competition. Interestingly both of the responses include fewer connections with the local rural area. By contrast, the fabricated metal product examples show that deep embeddedness is at present more sustainable and perhaps even essential. They have close links with their locality. A key factor here is the role of Irish-based MNC customers for the case study firms, a stimulus that would change if the MNCs decide to relocate. In terms of appropriate rural enterprise strategies, both establishing global linkages and relying less on local connections on one hand and deepening the embeddedness and local linkages on the other, appear to be equally valid, for different firms, in different industries, at different stages in their development.

For national and local development strategies the conclusion is that rather than one, comprehensive industry or enterprise support policy, a much more complex variety of policies must be available. For deeply embedded firms that have ceased to innovate and adjust to changing demand and/or supply conditions, support for local clustering may exacerbate rather than ameliorate the problem. In such cases support for stretched or shallow embeddedness may be more appropriate. On the other hand, where firms with strong local connections are continuing to innovate, expanding product lines, output, exports, customer base and/or market share, then support for deep embeddedness is appropriate. For those deciding on the nature and extent of state support for industries and enterprises, there is no substitute for extensive knowledge about the industrial dynamic at the sub-sectoral level.

[59] The case presented in Paper 2 also supports this view such that for the organisational innovation presented there (the establishment of the TORC network) geographic proximity was not important.

Paper 4: Industrial Agglomeration and the Irish Furniture Industry

Introduction

Interest in understanding, explaining and identifying industrial agglomeration is primarily driven by the empirical fact that economic activity is often 'lumpy' (Harrison, 1992) and not evenly distributed throughout space. As a result, examination of the relationship between the relative physical location of firms and the competitiveness and/or innovativeness of such groupings of enterprises has attracted the interests of social scientists for a long time. The curiosity arises because in some circumstances economic benefits called agglomeration economies arise from the spatial concentration of firms. These agglomeration economies are the particular benefits that accrue to the firms in the grouping by the virtue of their common location, benefits that would not exist if the firms were not co-located. The concept of industrial agglomeration is traditionally used to describe such a grouping of firms that are subject to agglomeration economies. In seeking to understand the lumpiness of economic activity, a variety of competing theoretical and analytical perspectives on industrial agglomeration have emerged[60]. Some emphasise the cost reducing benefits of industrial agglomeration that arise primarily from pecuniary externalities. Others focus more on the innovation-promoting role of industrial agglomeration as a result of the existence of technological spillovers. Whether localisation economies arising from specialisation or urbanisation economies occurring from diversity are more important is another source of debate. Rather less attention is paid in industrial agglomeration research to understanding the negative aspects of the spatial concentration of firms. This paper does not set out to test different theoretical models of the causes or advantages/disadvantages of agglomeration. Instead, this paper conforms to another tradition within industrial agglomeration research, that of seeking to identify the existence of industrial agglomerations through various descriptive, statistical or econometric methods.

The empirical setting for the analysis is the Irish furniture industry. The main research question is whether there is evidence of industrial agglomeration (and

[60] Specific references are provided in the Literature Review section below.

therefore agglomeration economies) in the Irish furniture industry. In relation to Irish manufacturing industry in general, the evidence is that it has become more dispersed since the early 1960s (Strobl, 2004) although there is some heterogeneity in the distribution. The *a priori* expectations about industrial agglomeration in the Irish furniture industry in particular are mixed. On the one hand it has been suggested that the industry is characterised by industrial agglomerations. Localised concentrations of furniture producers have been identified in Navan, County Meath (Committee on Industrial Progress, 1973; O'Donnellan, 1994) and an industrial district uncovered in County Monaghan (Jacobson and Mottiar, 1999; Jacobson *et al*, 2001).[61] These designations are principally based on anecdotal, qualitative or simple quantitative data analysis. The assertion that these grouping should be designated as industrial agglomerations has not been examined formally or statistically.

On the other hand, there is some scepticism about the presence of industrial agglomeration in the Irish furniture industry. There are two, possibly related, forms of evidence for such scepticism. First, Heanue and Jacobson, (2002) suggest that it is unclear whether being part of a concentration of furniture firms in Ireland is conducive to the development of the same type of competitive advantages attributed to spatial proximity in other furniture industries. This finding is based partly on case study evidence of networking patterns among furniture firms and partly on anecdotal evidence that furniture companies especially in two of the traditionally strong furniture manufacturing locations – County Monaghan and County Meath – are independent and non-cooperatively minded[62] and are therefore not amenable to the type of joint business ventures[63] or cooperative activities that characterise furniture company interactions in other successful industrial agglomerations (see for example, Pyke and Sengenberger, 1992; Lorenzen, 1998; Maskell, 1998). Second, Heanue and Jacobson, (2005; 2008) show that Irish furniture firms are increasingly forging global,

[61] Paper 2 contains a discussion about industrial districts in general, and the furniture industrial district in County Monaghan, in particular.
[62] Interview with Forbairt's Pilot Furniture Network Facilitator, 1999
[63] This is a generalisation. Rossmore in County Monaghan, is an exception, and probably the best-known example of a joint venture in Irish furniture manufacturing. In another example of cooperation, Heanue & Jacobson (2002) outline the development of a formal network of three Irish furniture manufacturing firms, although interestingly none of the firms in the formal network were located in County Monaghan or County Meath, nor were they co-located.

in addition to, or sometimes in place of, national and local linkages in a bid to improve their competitiveness.

At an international level, the geographic concentration of furniture production appears to be quite common. Scott (2006) suggests that this it true of countries at all levels of development – both industrialised and developing. Maskell *et al* (1998), confirm that furniture production is highly concentrated in most Western European countries[64]. Moreover, specific examples of the positive impact of agglomeration for furniture companies' competitiveness within European countries is posited by Lorenzen (1998; 2002) and Maskell (1998) for Denmark, Becattini and Dei Ottati (2006)[65] for Italy and Jacobson and Mottiar (1999) for Ireland, to name just a few countries. Elsewhere, the positive impact of agglomeration for furniture companies is confirmed in Thailand (Scott, 2008), the Philippines (Fan and Scott, 2003) and the US (Rosenthal and Strange, 2004), for example.

However, internationally, there is also conflicting evidence on the potential benefits of the spatial concentration of furniture firms. In other words, co-location may not lead to the formation of agglomeration economies. Maskell *et al*, (1998, 105) argue that the Lahti area in Finland demonstrates that a regional agglomeration is no guarantee of success in the furniture industry. In addition, some formerly important furniture agglomerations like the one in London (Best, 1989) and in Southern California (Scott, 1996), have suffered from relocation or deindustrialisation, thereby losing whatever local dynamic they had. The general point here is that as well as the possibility of agglomeration economies emerging as a result of the concentration of industrial activities, agglomeration diseconomies associated with congestion, inertia and imitation may also arise. Moreover, although agglomeration economies may accrue to a grouping of firms at particular stages of its life cycle, these benefits may

[64] Maskell *et al*, (1998, 105) report that in Germany, furniture production is found mainly in North-Rhine Westphalia, Bavaria and Baden-Württemberg; in Italy, most furniture agglomerations are found in some geographically limited districts in the north of the country (for example Brianza, Cerea-Bovolone and Pesaro), but small agglomerations also exist further south (Poggibonsi in Toscana); in France, Brittany, Ile-de-France and Normandy account for a major share of production; in Denmark, Jutland dominates the scene as do Vestlander in Norway, Lahti in Sweden, the western part of Flanders in Belgium and North Carolina in the US. This location pattern suggests that spatial clustering provides firms with competitive advantage.

[65] This paper provides some measures of industrial agglomeration for all traditional sectors, including furniture.

disappear at a later stage, if firms and local institutions cannot react positively to changing circumstances. This in fact appears to be the case with the furniture agglomerations in London and Southern California. This is an important point to bear in mind because even if industrial agglomerations are identified in the Irish furniture industry, this does not by itself guarantee the long-term sustainability of those groupings of firms.

The remainder of the paper is structured as follows. The next section contains a brief literature review on the features and advantages of industrial agglomeration and why it is considered important. This section also highlights the difference between industrial agglomeration and spatial concentration, a distinction that underscores the usefulness of using a firm-based rather than employment-based methodology when trying to identify industrial agglomerations. The literature on industrial agglomeration in Irish industry is also outlined. Another section outlines the methodology and data used. Specifically, the technique of standardised location quotients (O'Donoghue and Gleave, 2004) is used to examine the relative concentration of Irish furniture firms over the period 1973-2006. Although location quotient analysis has its critics (e.g. Woodward and Guimarães, 2008), it is used here because of its strengths – simplicity of calculation, relatively low data requirements and established pedigree in regional economic analysis. The penultimate section contains a discussion of the results and the final section provides concluding comments.

Literature Review

Industrial agglomeration

Many studies have confirmed that the geographical distribution of economic activity is lumpy (e.g. Harrison, 1992, 470) and therefore it is unsurprising that clusters or agglomerations are a perennial source of theoretical and empirical interest (Phelps, 2004, 971). The theoretical explanations for such lumpiness encompass many disciplines and perspectives but usually draw upon the notion of industrial agglomeration. At its most general level, an industrial agglomeration can be defined as a spatial concentration of production. However, every concentration is not an agglomeration. What distinguishes an industrial agglomeration from a spatial

concentration of firms is the presence of agglomeration economies. Agglomeration economies are a form of external economies that are not under the control of the firm and the firm by itself cannot create them (Mukkala, 2004, 2420). Instead, such economies depend on the overall level of industrial specialisation or diversity in a location. In economic terms, agglomeration economies change the position and/or shape of the production function (and cost curves) for those firms deriving the benefits of the economies; these changes do not occur in competitors who are not subject to the agglomeration economies.

In terms of workable definitions, therefore, a spatial concentration of firms constitutes an agglomeration where the motivations for, and/or results of, being spatially concentrated are that individual units of activity are in some sense better off than they would have been if they were located in an industrially more isolated setting (Jacobson *et al*., 2002). This particular definition is used here as it is sufficiently broad so as to include both the potential cost-reducing and innovation-promoting advantages of being located in an industrial agglomeration (see below for more detail). However, spatial concentration of production can also impose costs rather than benefits on firms in the locality. These agglomeration diseconomies are usually associated with congestion, pollution or the existence of a particular socio-cultural environment that impedes innovation and change through inertia or lock-in. Over time it is possible that a grouping of firms may change from one displaying agglomeration economies to one exhibiting agglomeration diseconomies. In the latter case, we would expect to see a reduction in the success of firms in that area relative to firms in other areas, or a reduction in the performance of firms in that grouping relative to their own historical record.

Perspectives on industrial agglomeration

Marshall (1890) is considered by most commentators to be the originator of the concept of industrial agglomeration.[66] Subsequently, researchers such as Weber (1929), Lösch (1954) and Isard (1949) drew on this concept and attempted to devise a general theory of industrial location based on spatial variations in inputs, outputs, costs and prices. More recently, the voluminous literature on industrial districts,

[66] It should be noted, however, that Marshall never actually used the term. He referred, instead, to the "external economies" arising from the "localization of industry" (1920, 23).

industrial clusters and innovative milieu, among others, has once again rekindled interest in the notion of agglomeration. Taking a broad overview of the totality of industrial agglomeration research, it may be heuristically separated into two generic approaches. The first – or traditional agglomeration approach – uses formal, deductive models of the kind used in neoclassical economics and focuses primarily on the cost-reducing benefits of agglomeration. Examples of this approach are exemplified by the New Economic Geography literature (e.g. Krugman, 1991). The second – or heterodox agglomeration approach – uses case study methodology or qualitative approaches and focuses mainly on the innovation and learning-inducing benefits of agglomeration. Examples of this approach include that of Economic Geographers (e.g. Cooke, 2005); Malmberg and Maskell, 2002; Coe, 2001). This is an overly simple characterisation as some researchers (for example the New Industrial Geography literature as exemplified by e.g. Markusen, 1996; Best, 1990; Saxenian, 1994; Piore and Sabel, 1984) focus on both the cost-reducing and innovation-promoting element of industrial agglomeration as a process. In methodological terms also, the heuristic dichotomy outlined above is also overly simplistic as some researchers investigate innovation-related agglomeration issues using formal models (e.g. Baptista and Swann, 1998; Beaudry and Breschi, 2003). However, it is a reasonable generalisation that most researchers tend to focus more on one set of benefits (i.e. cost reduction or innovation promotion) than another and utilise one methodological approach more than another. Ironically, the two strands of emphasis within industrial agglomeration research – cost reduction and innovation promotion – were both present in Marshall's original conceptualisation where he discussed the cost reducing impacts of pools of specialised labour and shared infrastructure together with the innovation promoting effects of technological spillovers.

Internal agglomeration economies

Strictly speaking, agglomeration economies may be generated either internally or externally to an individual firm (McCann, 1995), although the former is often overlooked at the expense of emphasising the advantages arising from the common location of firms or industries (Parr, 2002a). Internal economies within the firm can

be viewed in terms of scale, scope and complexity (Parr, 2002b)[67]. At its most basic level, the orthodox theory of the concentration of economic activity begins with an explanation based on internal economies of scale – a reduction in unit costs that is associated with the increased scale of production facilities. By contrast, there is little acknowledgement in the literature that agglomeration economies per se may be based on internal economies other than those involving scale (Parr, 2002b). The other internal economies considered are those of scope and complexity.

External agglomeration economies

Of course, firms may also expand due to economies which are external to the individual firm but depend on other firms either in the same or different industries. It is in this context that the issue of industrial agglomeration is usually discussed, and this is the focus taken in this paper. External economies are economic benefits originating outside the firm that are neither created nor controlled by the firm itself. Agglomeration economies are a form of external economies (Mukkala, 2004, 2420).

Many core aspects of the industrial agglomeration literature and aspects of the nature of agglomeration economies are subject to vigorous debate. In the following paragraphs, some of the most fundamental of these contentions are outlined. For example, it is usual to distinguish between pecuniary (rent or market-based) and technological (real or pure) external economies (Viner, 1931; Scitovsky, 1954). Pecuniary external economies relate to market transactions and result in price reductions of particular inputs (Parr, 2002b).

Therefore, although they might not impact on output they always affect value-added. By contrast, technological external economies are transmitted outside the market system and do not reduce input costs. Instead, technological external economies impact on the innovativeness and productivity of a firm through, for example, the circulation of business ideas and knowledge often via personal exchanges in the labour market (Phelps *et al*, 2001). A technological externality affects the firm's production function directly rather than through the market. It is hotly contested

[67] By complexity, Parr (2002b) means that a firm engaged in the various stages or processes of production, rather than simply producing an end product. Economies of complexity include such advantages as improved managerial oversight and superior levels of coordination.

whether pecuniary mechanisms that enhance firm efficiency are more important than spillovers that facilitate technological learning and innovation as drivers of, and as generating benefits from, agglomeration. (For a good review of this debate see Caniëls and Romijn, 2005). This discussion is related to the frequent disagreements about whether agglomeration economies are static or dynamic, in other words the temporal scope of agglomeration economies. In general terms, static economies are viewed as cost reducing whereas dynamic economies are innovation inducing. However, there are disputes about this distinction also with (Malmberg and Maskell, 2002) arguing that static economies do not have an impact on firms' learning and innovation processes per se, whereas for others, this distinction is not as clear (Caniëls and Romijn, 2005).

Second, there is disagreement over the spatial scale that pecuniary and technological externalities operate at (Martin, 1999; Phelps *et al*, 2001). Some argue that pecuniary externalities, which are market-mediated, operate over a wider geographic area and to some extent promote the geographic dispersion of industry, particularly manufacturing (Krugman, 1998). By contrast, technological spillovers, which are non-traded and it is often argued, need face-to-face contact due to the important tacit component of knowledge, encourage more spatially restricted agglomerations. Therefore, in any specific empirical setting the relative importance of pecuniary and technological elements of agglomeration economies might influence the geographic reach of an industrial agglomeration. For example, static pecuniary economies could be expected to play a particularly significant role in supplier-dominated industries (such as traditional manufacturing sectors), since in those sectors product users are price sensitive and cost cutting is important (Caniëls and Romijn, 2005, 513).

Third, emanating from the work of Hoover (1934) the distinction and relative importance of localisation economies, which result from the specialisation of a single industry in a particular location, as opposed to urbanisation economies (Jacobs, 1969), which arise from the diversity of many industries in a particular place, is often incorporated into debates. Localisation economies are primarily a function of the scale of the industry at a given location (or more specifically, spatially constrained external economies of scale). These economies relate to specialisation of a single industry in a particular location. Marshall (1890) identified three sources of what he

called localisation economies – a pooled labour force with special skills; facilities for the development of specialisation inputs and services; and technological spillovers. The first two are static economies of specialisation whereas the third relates to a dynamic benefit - technological spillovers (Caniëls and Romijn (2005). Conventionally, such localisation or intra sectoral economies are often described as Marshall-Arrow-Romer (MAR) economies. MAR externalities include benefits of a pooled labour supply, access to specialised inputs and information flows between people and firms.

Urbanisation economies are not specific to firms within a particular industry: they are external to the individual firm and also to its industry but internal to an urban concentration (Jacobs, 1969). These economies relate to diversity (and may be thought of in terms of economies of scope (Parr, 2002b). Urbanisation economies include things such as a well functioning transport and communications infrastructure, proximity of markets and easy access to specialised services such as financial, legal or accountancy services, and access to a large flexible labour market (Mukkala, 2004). Urbanisation economies are therefore a function of city size - they are not related to the size of the individual firm or the industry cluster. Therefore, urbanisation economies generate benefits for firms throughout the city and not just those enterprises in a particular industry.

Of course, just as the spatial concentration of firms may lead to benefits (agglomeration economies) it may also lead to costs (agglomeration diseconomies) being imposed on firms in the locality. Agglomeration diseconomies are the economic and social costs arising from increased agglomeration and include congestion and pollution. In addition, the possibility of “lock-in” or inertia could also be included here as an agglomeration diseconomy if the grouping of firms generates a socio-cultural environment such that innovation activity, and more generally an ability to react to external stimuli is retarded rather than promoted.

This brief review highlights the hypothesised advantages and to a lesser extent the disadvantages of agglomeration rather than the causes or initial trigger for the formation of an industrial agglomeration in a particular location. Marshall (1890) identified the prime causes as physical conditions (raw materials, climate, energy

sources, topography), local markets (size, wealth and sophistication of market), and political/cultural influences (all kinds and levels of policy, character and values of people, social and political institutions, the nature of rules governing economic and social behaviour). Whatever the initial causes (natural, political, social, cultural, accidental or economic) of the location of an industry in a particular place, there may be cumulative advantages to its continued location in that place. It is these advantages that are agglomeration economies and distinguish an industrial agglomeration from a spatial concentration of firms.

Furthermore, the vast majority of most Irish furniture firms are single plant operations. This suggests that internal economies are unlikely to be a very important source of agglomeration economies among Irish furniture firms. Therefore, in this paper, the focus is on industrial agglomeration that is limited to the concentration of firms in the same industry – i.e. localisation

Industrial agglomeration in Ireland

Bradley and Morgenroth, (2000) argue that although a lot is known about manufacturing at the aggregate or national level in Ireland, less is known about the nature, causes, consequences and prospects of the spatial distribution of manufacturing in Ireland. To the extent that the relationship between the spatial location of firms in Ireland and their competitiveness or innovativeness has been examined in an Irish context, a wide variety of perspectives, spatial conceptualisation (for example, ranging from agglomeration to clusters to local systems of innovation) and methodologies is used. As a result, in the space available here, only the broad sweep of evidence can be outlined.

In general terms, Irish manufacturing industry has followed an inverted u-shaped location pattern since the 1920s first dispersing, then becoming more localised and then dispersing again from the early 1960's (Strobl, 2004), ending up with a more dispersed pattern than in the 1920s[68]. However, there is some heterogeneity in this pattern with sectors such as chemicals (NACE 25, 26, 48) becoming more dispersed, paper & printing (NACE 47) remaining relatively localised and wood & timber

[68] Strobl's (2004) analysis is based on the larger nine planning regions as opposed to the twenty six county-level analysis contained in this paper.

(NACE 46) moving from dispersed to more localised and back to dispersed again over the period 1926 to 1996 (Strobl, 2004). The birth of new firms (Barrios et. al., 2005), operation of regional policy (Boylan, 1996; Meyler and Strobl, 2000) and the rising cost of locating in core areas (Drudy, 1991) have been identified as promoting the dispersion or de-agglomeration of Irish industry. More generally, Strobl (2004) concludes that increasing returns are responsible for some of the localisation tendencies of more modern sectors, especially the clustering that is apparent between some FDI enterprises and indigenous intermediate suppliers. For traditional sectors, by contrast, Strobl (2004), echoing the interpretation of Boylan (1996) and Meyler and Strobl, (2000), argues that location, at least up until 1996, was determined predominantly by non-economic factors.

Apart from evidence on the general locational pattern of Irish industry, opinions on whether or not such a pattern results in benefits for firms vary considerably. For Roper (2001), notions of agglomeration, innovative milieu or urban hierarchy do not explain the innovative performance of firms in Ireland. By contrast, Andreosso-O'Callaghan (2001) and Andreosso-O'Callaghan *et al* (2003) argue that there is evidence of local systems of innovation, particularly in the Shannon region. Somewhat contradicting both of these findings, McCartney and Teague (1997) and Quinlan (1995) found that urban locations were more likely sources of innovation. Echoing this concern, O'Leary (2007) has recently called for more attention to be paid to the role of urbanisation economies by policy makers. In addition, he highlights the important role that internal agglomeration economies might play for some foreign-owned multinational businesses. Doyle and Fanning (2007) conclude that (due primarily to inadequate research and lack of appropriate data) there is little evidence that Porterian clusters have had a significant effect on productivity growth in Ireland. Earlier, O'Malley and van Egeraat (2000) also identified the lack of Porterian clusters among indigenous Irish industry.

Jordan and O'Leary (2005) in an examination of Irish high tech sectors reveal the absence of a strong interaction between firms and other institutions either locally or regionally for the purposes of promoting innovation. To the extent that they do occur, such interactions take place over longer distances. There is some support for a similar pattern of interaction in low-tech sectors such as furniture (Heanue and

Jacobson, 2005; 2008). On the other hand, it is argued that firms in some high tech sectors such as software are gaining additional benefits from their location (White, 2004), whereas there is evidence that others such as pharmaceuticals, are not (Van Egeraat, 2006).

It is clear from this brief review of Irish evidence that there is little consensus about the relationship between the location of an enterprise in a particular locality in Ireland and the existence of an 'external dynamic' (such as agglomeration economies) in that place. Such divergence is partly a reflection of the different methodologies and conceptualisations of agglomeration used in the various pieces of research. The situation addressed in this paper in relation to the furniture industry is somewhat clearer. Assertions of agglomeration have been made for two locations in Ireland – counties Meath and Monaghan. The remainder of the paper will examine formally whether or not this is the case.

Methodology - Measuring Industrial Agglomeration

A variety of techniques and methodologies to identify industrial agglomerations and agglomeration economies are used in the literature. One set of such approaches uses various indices of concentration (e.g. Ellison and Glaeser, 1997; Krugman, 1991; Maurel and Sedellot, 1999; O'Donoghue and Gleave, 2004) to try to identify the existence of industrial agglomerations. This strand of research usually implicitly assumes that if in fact an industrial agglomeration is identified on the basis of the chosen methodology then agglomeration economies are likely to be present in that location. By contrast, another branch of the literature has focused on explicitly trying to identify whether or not agglomeration economies exist for a given sector(s), country, or over a particular time period, by using econometric analysis based on either firms' production or cost functions (e.g. Mukkala, 2004; Feser, 2001; Caballero and Lyons, 1990). In this paper the first research tradition is followed. The aim is to explore whether or not there is evidence of industrial agglomeration in the Irish furniture industry. To do so, a relatively new measure – the 'standardised location quotient' (SLQ) proposed by O'Donoghue and Gleave (2004) – is used.

This paper extends the application of the SLQ technique of O'Donoghue and Gleave (2004) in two ways. First, it uses a different goodness of fit test, the Shapiro-Wilk test, rather than the Kolmogorov-Smirnov test advocated by O'Donoghue and Gleave (2004) to formally determine the approximate distribution of the data set. Second it uses the number of firms rather than employment as the key variable in the calculation of the SLQ coefficient. This latter adjustment is not a new approach for LQ analysis per se, but it does not appear to have been used in any analysis using the SLQ approach. The rationale for using number of firms rather than employment when trying to identify industrial agglomerations is well known and centres on being able to discriminate between industrial concentration and spatial concentration. In the former, a single large plant located in one location would be portrayed as a concentrated industry (industrial concentration) by LQs if the analysis were based solely on employment. As shown in a previous section of this paper, such a configuration may technically be called an industrial agglomeration if it is the result of internal agglomeration economies. However, in the spirit of the conventional understanding of the term, we are interested in identifying industrial agglomerations that are suggestive of external agglomeration economies. Moreover, as suggested by the theoretical framework outlined previously, localisation economies are the most likely type of agglomeration economy that might be present in the Irish furniture sector. This would be represented by a number of furniture firms in a particular place as opposed to a single firm. Therefore, it is more appropriate to use number of firms rather than employment as the key variable of interest.

The choice of technique for any particular piece of research is influenced by many factors including data availability, ease of implementation and required descriptive or explanatory ability. For this paper, the data that was readily available heavily influenced the precise choice of technique. Only total employment and the number for firms at county level for the furniture industry (NACE 361) and all other sectors aggregated were available for use from the Forfas database. Therefore, for example, it was not possible to utilise a concentration index that uses plant-level data such as those of Ellison and Glaeser (1997) or Maurel and Sedellot (1999).

The location quotient

Before turning to the SLQ methodology itself it is useful to briefly review the location quotient (LQ) technique upon which the SLQ is based. LQs are well-known measures of the relative importance of sectors compared to their importance in a larger frame of reference (Stimson *et al*, 2006, 107). More formally, an LQ is the ratio of an industry's share of the economic activity of the economy being studied to that industry's share of another economy (Isserman, 1977, 34). The specialisation of economic activity in the area may be measured by employment, income, value-added or number for firms, for example. Here, the LQ will compare the furniture industry's share of the economy of each Irish county to that of the furniture industry's share of the economy of the nation in total, using the number of firms as the key variable. The LQ may be expressed as:

$$LQ = \frac{X_i / X}{Yi / Y}$$

where

X_i = number of firms in furniture industry in county *i*

X = total number of firms in all industrial sectors in county *i*

Y_i = number of firms in furniture industry in the nation

Y = total number of firms in all industrial sectors in the nation

The conventional interpretation of an LQ is that the higher the value the greater the degree of concentration of the activity in question. For example, a value of 1.0 means that the furniture industry is represented in a particular county in exactly the same proportion as for the nation; less than 1.0 indicates that the furniture industry is under-represented in that county compared to the nation; and over 1.0 that the furniture industry is over represented in that county compared to the nation.

Despite its popularity, there are some well-established criticisms of LQ analysis. These are most clearly outlined in the context of the use of LQ's for economic base analysis (e.g. Isserman, 1977).[69] In those circumstances, Isserman (1977) outlined

[69] The economic base model separates a region's economic activity into two sectors: export (from the region), which responds to external demand and local, which responds to internal demand. Local

four general critiques of LQs. First, LQ analysis assumes identical productivity per employee in the region as in the nation. Second, LQ analysis assumes identical consumption per employee (or per capita) of the products of industry *i* in the region and the nation. Third, there is no cross-hauling (i.e. both exporting and importing the products produced by industry *i*. Often called the homogenous product assumption, this means that the product of industry *i* in the region is identical to the product of industry *i* in the rest of the nation. Fourth, there are no net exports by any industry in the nation. In other words, international impacts are not taken into consideration.

Notwithstanding these shortcomings, LQ analysis is still extensively used in empirical work to identify industrial agglomeration as it is easy to use and interpret, simple to calculate, is applicable at different geographic scales and relies on relatively accessible data. The general criticisms of LQ analysis outlined above also apply to the SLQ. However, in the context of this paper, the assumption of identical production functions is the most pertinent critique (see below in concluding comments).

The standardised location quotient

Given the positive features of the overall LQ approach, and notwithstanding the drawbacks associated with the technique as outlined above, O'Donoghue and Gleave (2004) argue that the LQ should continue to be used for identifying industrial agglomerations providing another weakness associated with it is overcome – the fact that there is no conceptually satisfactory LQ cut-off value for defining an agglomeration (O'Donoghue and Gleave, 2004). The usual rule of thumb is if a LQ value exceeds one then it is indicative of industrial agglomeration. O'Donoghue and Gleave (2004) argue that such a rule of thumb is not satisfactory and a method of standardising the choice of LQ cut off value needs to be developed.

To address this shortcoming, O'Donoghue and Gleave (2004, .422) propose the use of a 'standardized location quotient' (SLQ) to provide a satisfactory LQ cut-off value for defining an agglomeration. The idea behind this measure is that agglomerations should have statistically significant rather than arbitrarily defined LQ values. The

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activity (sometimes called residentiary, service or nonbasic) is assumed to depend on export activity (sometimes called basic) and be proportional to it (Isserman, 1977, 33)

proposed SLQ identifies those locations that have exceptional concentrations of activity as represented by statistically significant residuals (outliers) at the 5% confidence level. The SLQ is calculated in three steps as follows[70]:

1) Calculate LQ values for the industry or activity under analysis, at the desired level of spatial and sectoral aggregation.
2) Check that the LQ values are normally distributed at the 5% confidence level using the Kolmogorov-Smirnov test for normality (readily available on software such as SPSS). The distribution of LQs will tend to be skewed positively, i.e. if 1 is considered the national average, it is possible to have values greater than 2 but no less than 0. If such asymmetry is severe (if the distribution does not approximate normality), it is recommended that the LQ values should be transformed logarithmically.
3) Convert the LQs (or logarithmically transformed LQs) into z-values. Identify those locations, which have *exceptional* concentrations, or agglomerations, of activity by examining residual values that lie beyond 1.96 standard deviations from the mean. This cut-off is not arbitrary as it represents the 5% level of statistical significance so commonly used by researchers in the social sciences. Alternatively, due to the asymmetric nature of LQ distributions some might feel that a one-tailed approach might be more appropriate. In that event, locations with z-values beyond 1.65 should be considered as outliers.

Because of the way in which it is calculated, the resultant measures (the value of the z-score for each location) are called the 'standardized location quotient'.

Limitations of the SLQ approach

O'Donoghue and Gleave (2004, 423) identify two particular limitations of the SLQ approach. First, the initial or transformed LQ values from which the SLQ values are calculated are required to be normally distributed. If normality is not present, then SLQs cannot be calculated. Second, an SLQ based on employment data does not discriminate between areas, which have a large number of small and medium sized interlinked firms, and those which have a large single firm employing the same

[70] The following three points are reproduced verbatim from O'Donoghue and Gleave (2004, p.422)

number of workers (i.e. between industrial and spatial concentration). They propose an adjusted form of the LQ to be used in the calculation of the SLQ to control for the contribution of large firms to an area's overall workforce (in our terms, to control for industrial concentration).

$$AdjLQ_i = \frac{e_{sfi} / e_t}{E_{sfi} / E_t}$$

where *Sf* = small and medium sized firms; *i* = industry; *e* = regional employment; and E = national employment. This is indeed a valid adjustment. However, the Forfás data on which the research presented here is based does not permit this adjustment for industrial concentration to be used. However, as outlined above, another way of controlling for industrial concentration is to use the number of firms in the LQ calculation that feeds into the SLQ. That is the approach followed here.

Data

The analysis in this paper is carried out at county level and draws upon a limited dataset from the Forfás Annual Employment Survey. The dataset used for this paper includes total employment and total number of firms for the furniture industry, and total employment and total number of firms for the aggregate of all other sectors for each county for the period 1973 to 2006. The most comprehensive data source in Ireland for industrial activity is the Census of Industrial Production (CIP), which is produced on an annual basis by the Central Statistics Office (CSO). However, this data is of limited use if county-level detailed sectoral analysis[71] is the objective of research, because for confidentiality reasons, the CSO does not publish any data at county level for disaggregated NACE codes, although they do publish county level totals of employment, number of firms for highly aggregated NACE codes[72]. Therefore, the data that is used in this paper is drawn from a database compiled by Forfás[73] - the Industrial Policy Advisory Body. The data used in this paper covers the

[71] Not even at three digit level in some cases

[72] Access to micro data is, however, negotiable through being made an Officer of Statistics of the CSO, although the data at county level is still subject to confidentially constraints.

[73] Annual Employment Panel Survey covering all known active manufacturing and internationally traded service companies. The overall response rate to this survey has, on average, been extremely

period from 1973 to 2006 and contains county-level basic information - number of full-time equivalent employees, number of firms - on all companies who have received assistance from any of the state industrial support agencies - IDA Ireland, Shannon Development, Enterprise Ireland and Údarás na Gaeltachta (since 1984). There are, however, several limitations associated with this data. First, since 1993 County and City Enterprise Boards support micro enterprises (i.e. those with less than 10 employees) so these enterprises do not appear in the Forfás data, unless the firms were established prior to 1993. Second, although the Forfás data categorises firms according to four digit NACE codes, the totals do not seem to correspond with the number of firms in each four digit NACE category reported by the CIP for the furniture industry. Therefore, this portion of the Forfás data set cannot be reliably used to compile sub-sectoral analysis (i.e. at four digit level) of the furniture industry at county level. Therefore, detailed analysis for the five furniture industry sub-sectors[74] at local level was not possible. As a result, the analysis contained in this paper only uses the total NACE category 361 at county level.

Results

A spatial profile of the Irish furniture industry

Before turning specifically to the spatial features of the Irish furniture industry it is useful to briefly review some general features of the sector. The Irish furniture industry is often categorised as a relatively robust sector (Cooke, 1996; Jacobson *et al*, 2001). Table 4.1 confirms that in terms of its own history, and based on the limited number of variables presented here, such a categorisation has some merit.

high, generally over 99 percent of the plant population (Meyler & Strobl, 2000, p.115). The unit of observation is the individual plant. One particular structural break in the collection of data is worthy of mention. Plants covered by the regional agency Údarás na Gaeltachta were not included in the employment data set until 1984. The employment level of all these plants, regardless of whether they may have existed prior to 1984, appears as zero in the data set up until 1984.

[74] Chairs and seats (NACE 3611); Other office and shop furniture (NACE 3612); Other kitchen furniture (NACE 3613); Other furniture (NACE 3614); Mattresses (NACE 3615).

Table 4.1: The Furniture Industry – Selected Years 1973 - 2006

	1973	1977	1982	1987	1992	1997	2001	2006
Employment	4,586	4,640	5,691	4,371	4,616	5,483	5,615	5,602
Firms	296	339	566	554	430	398	353	298
Average firm size*	15	14	10	8	11	14	16	19

Source: Derived from Forfás dataset

* Average firm size is a proxy, albeit an imperfect one, for economies of scale

There are three main features of Table 4.1 that warrant recognition. First, employment in the Irish furniture industry is 22% higher in 2006 than in 1973. Second, the overall number of firms in the industry is virtually the same in 2006 as at the start of the period of analysis[75]. However, this general stability masks an inverted u-shaped trend in the number of furniture firms. Third, and as a direct consequence of the preceding two features of the industry, average firm size as measured by employment has increased over the period. Specifically, there was a 27% increase in average firm size as measured by employees per firm. This general growth masks a u-shaped trajectory in this measure of average firm size over the period. As shown in Table 4.1, average firm size virtually halved in the period 1973-1987 and then more than doubled from 1987 to 2006. If we use this variable as a proxy for economies of scale it suggests that these have increased in furniture manufacturing firms over the past two decades.

The distribution of furniture manufacturing activity

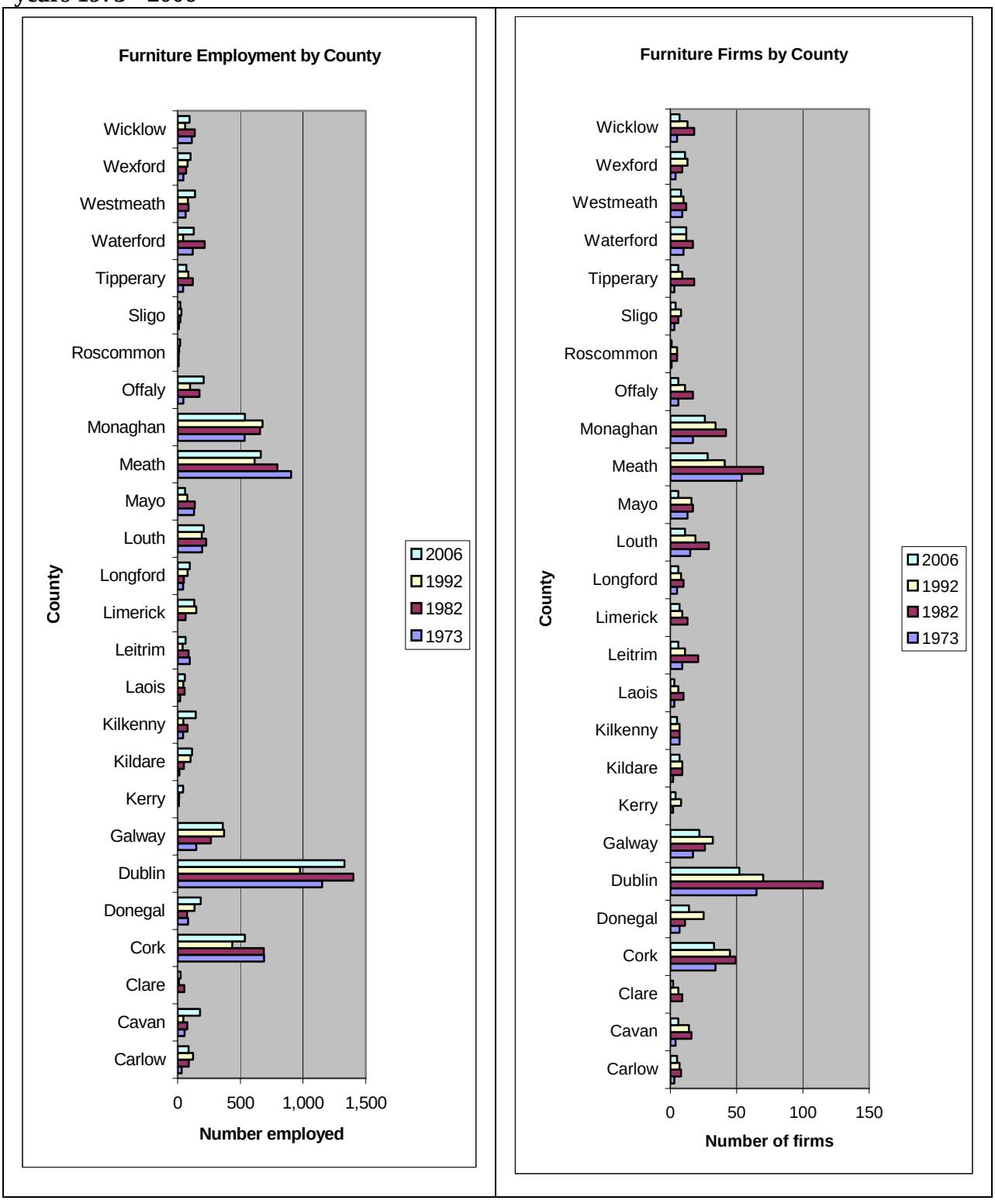
Alongside the relatively good performance of the furniture industry between 1973 and 2006, critically, from a regional and rural development perspective, furniture manufacturing appears to be relatively dispersed. As shown in Figure 4.1, each of the twenty-six counties in Ireland contained furniture manufacturers in 2006. Moreover, the data shows that this is the case for the entire period under consideration except for Counties Clare, Limerick and Kerry, which, according to this dataset, had no furniture activity in 1973. Although county Roscommon appears to have no furniture employment in 1973, it did actually have one firm employing 7 persons but this does not show up clearly in the Figure 4.1. Apparent concentrations

[75] Compared to the general economy-wide trends in employment (69% increase) and firm numbers (115% increase) over the period, the evolution of the furniture industry does not appear as impressive. However, the growth pattern of the furniture industry does compare favourably to the trends in other low and medium tech sectors such as clothing over the period.

of furniture industry activity over the period are clear from the figure in counties Monaghan, Meath, Dublin and Cork. In the first sub period (1973-1982), counties Dublin and Meath consistently contained the first and second highest level of employment and number of furniture firms respectively. County Cork filled third place and county Monaghan fourth position over this period. In the second sub period (1992-2006) counties Dublin and Cork contained the highest number of firms and employment levels, except for 1992 when county Monaghan contained more furniture employment than county Meath. Average firm size has increased in Dublin and Meath over the entire period, whereas in Cork and Monaghan it has decreased[76].

[76] The actual data is, in Dublin from 18 to 26 employees: in Meath from 17 to 24 employees: in Cork from 20 to 16 employees: in Monaghan from 31 to 21 employees.

Figure 4.1: Furniture manufacturing employment and firms by county, selected years 1973 - 2006



Looking at this data more formally, Table 4.2, which reports descriptive statistics at county level for the industry confirms that the mean level of furniture employment on a county basis has increased while the mean number of firms is the same at the

end as at the beginning of the period. The relatively small standard error compared to the mean both for employment and the number of firms suggests that the sample of furniture firms is a reasonably accurate reflection of the population. The positive values for skewness and kurtosis statistics indicate that the distributions are not normal and are more likely positively skewed and leptokurtic.

Table 4.2: Furniture Industry County Level Descriptive Statistics, Selected Years 1973-2006

	1973		1987		2006	
	Employment	Firms	Employment	Firms	Employment	Firms
Mean	176.38	11.38	168.12	21.31	215.46	11.46
Standard Error	58.59	3.14	43.17	3.59	55.43	2.30
Median	51.00	5.50	81.50	14.00	122.00	6.50
Mode	0.00	3.00	91.00	10.00	536.00	6.00
Standard Deviation	298.75	16.02	220.11	18.33	282.66	11.71
Kurtosis	4.75	5.81	4.48	3.77	9.41	4.97
Skewness	2.34	2.46	2.21	1.98	2.85	2.16
Range	1151.00	65.00	898.00	77.00	1309.00	51.00
Minimum	0.00	0.00	7.00	4.00	20.00	1.00
Maximum	1151.00	65.00	905.00	81.00	1329.00	52.00

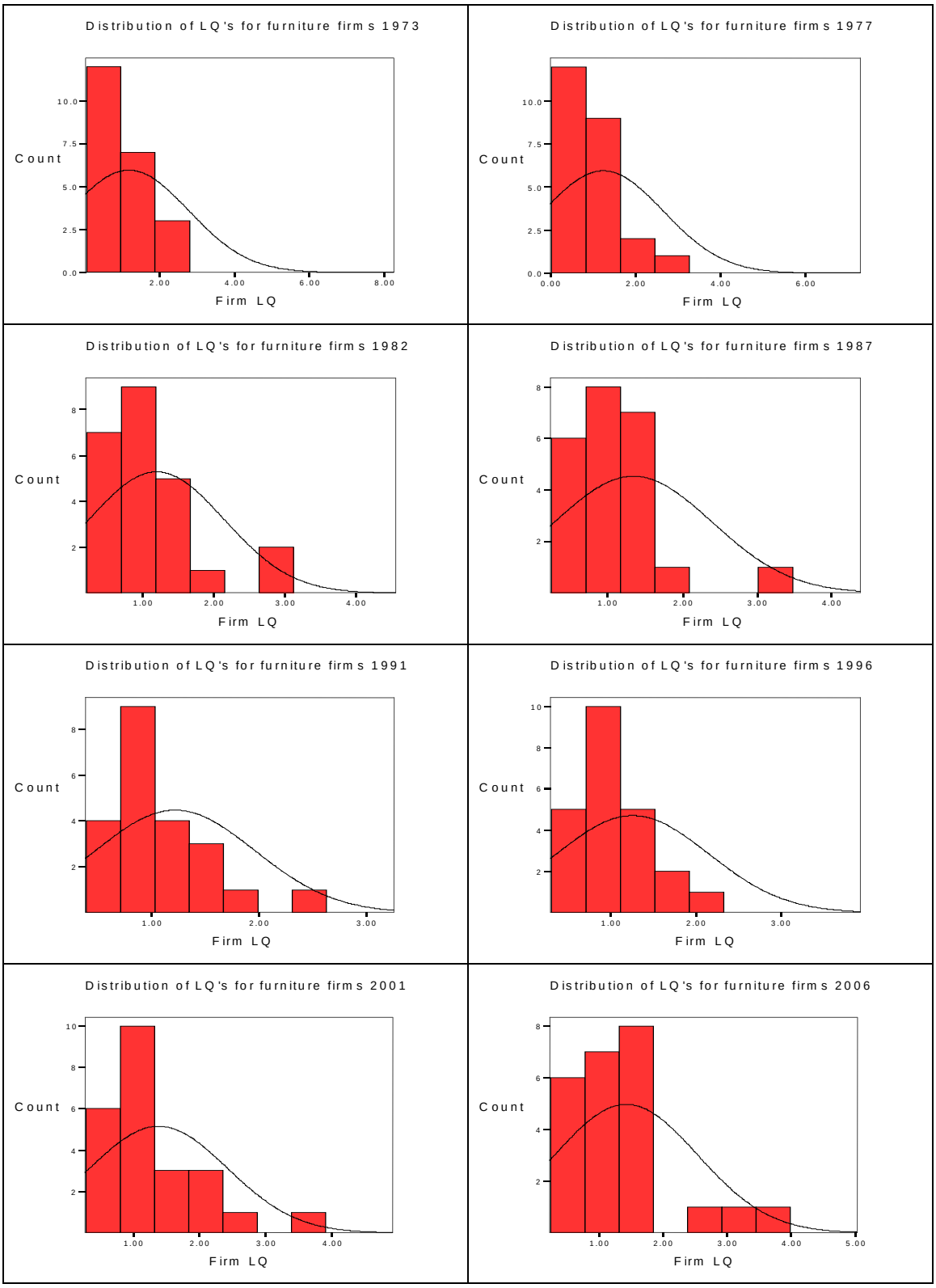
SLQ analysis of the Irish furniture industry

The period of analysis is from 1973 to 2006[77]. The first step in the SLQ analysis is to test if the 'raw' LQ values are normally distributed[78]. There are two ways to do this. The first method is the inspection of graphic representations of the data such as histograms and probability plots. The second way is to use a more formal goodness of fit test. Figure 4.2 displays histograms of the furniture firm LQ distributions at five-year intervals from 1973 to 2006. The distributions do not appear symmetrical and in fact suggest positive skewness for each of the years considered. Positive skewness is to be expected in a distribution if there is a floor or ceiling value (Miles and Shevlin, 2007). For LQs there is a floor value because it is not possible to have a value less than zero. Moreover, if 1 is considered the national average, it is possible to have values greater than 2.

[77] Due to a revision of the NACE classification in 1991, industrial data before and after this date is not directly comparable without recalculation. Plastic and metal furniture was not included in the furniture category prior to 1991 (see Jacobson *et al*, 2002 for more detail of the impact on the furniture sector.) However, we are interested in the longer-term trend rather than comparing data around the 1991 date.

[78] The 'raw' LQs are presented in Appendix A. These LQs indicate that in 2006, fourteen counties exhibited industrial agglomerations using the conventional cut-off point of 1. However, counties Monaghan and Meath stand out as having LQs of 5.03 and 3.90 respectively.

Figure 4.2: Histogram of furniture firms' location quotients 1973 to 2006

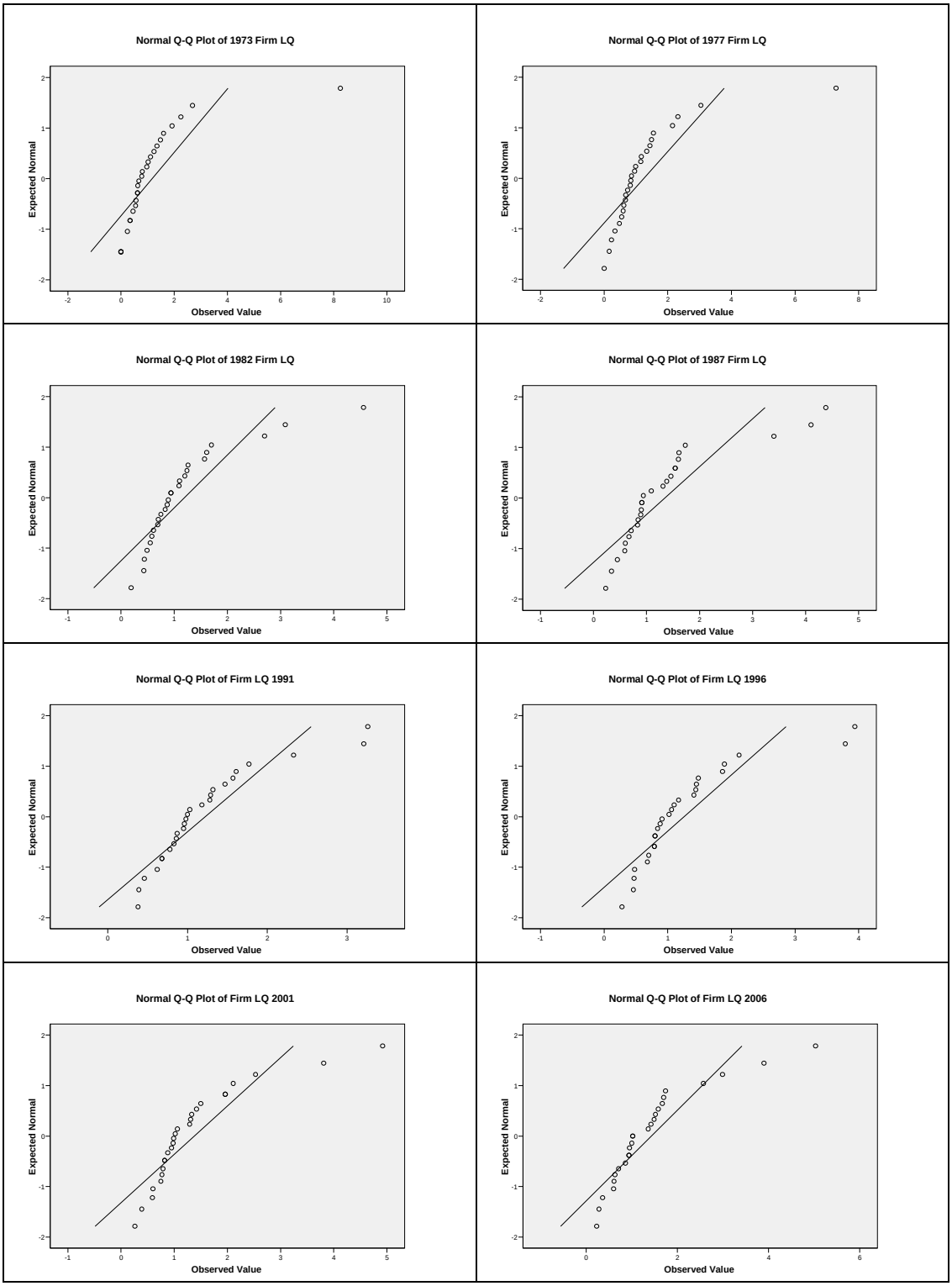


Of note from the histograms is that for the majority of them, the tails are heavy and the distributions do not have the characteristic bell shape. Interestingly, the mode seems to have increased over the time period. In 1982, 1987, 1991, 2001 and 2006

there are outliers that suggest a non normal distribution. Although histograms can indicate that the distribution deviates from normal they cannot identify whether the deviation is large enough to be important. That assessment must be done by more formal goodness-of-fit tests.

The second preliminary way to inspect for normality is to examine a probability plot. This mathematical method compares the dataset with an imaginary dataset that would be found in an ‘ideal’ normal distribution with the same mean and standard deviation (Miles and Shevlin, 2007). Graphically, if the datasets approximate a normal distribution, the points of the probability plot that are generated lie in a straight line along the diagonal from bottom left to top right. If the distributions differ from normality then the points lie further from the diagonal. An s-shaped curve indicates symmetry, but if it does not lie along the diagonal line, then it is unlikely to be normally distributed.

Figure 4.3: Probability plots of furniture firms' location quotients 1973 to 2006



As shown in Figure 4.3, in all of the plots, the curve deviates from the straight line (indicating skewness) and also the curves appear non-symmetrical. Both of these features suggest non-normal distributions.

To formally test the normality of these distributions O'Donoghue and Gleave (2004) suggest that the Kolmogorov-Smirnov (K-S) test be used. This test is based on the maximum difference between an empirical and a hypothetical cumulative distribution (Massey, 1951). However, Field (2006, 545) argues that the Shapiro-Wilk (S-W) test, although less widely reported, is actually more accurate and Mahibbur Rahman and Govindarajulu (1997) and Yazici and Yolacan, (2007) report that the Shapiro-Wilk statistic provides a superior omnibus indicator of nonnormality in comparison with other normality tests. The Shapiro-Wilk test statistic is obtained by dividing the square of an appropriate linear combination of the sample order statistics by the usual symmetric estimate of variance. This ratio is both scale and origin invariant and hence the statistic is appropriate for a test of the composite hypothesis of normality (Shapiro and Wilk, 1965; 591). In particular, when using SPSS software to carry out the tests (as was used for this paper), Field (2006, 527) argues that although the S-W statistic yields exact significance values, the K-S test sometimes gives an approximation for the significance (e.g. see Table 4.3 below). As a result, the S-W test is the preferred goodness of fit test used here although the K-S test is also reported. Both of the tests use the same hypotheses:

> H_O: there is no difference between the distribution of the dataset and a normal distribution
> H_A: there is a difference between the distribution of the data set and a normal distribution

The decision criterion for both tests is the same. If the test is non-significant ($p > .05$) then the distribution of the sample is not significantly different from a normal distribution (i.e. it is probably normal) and we accept the null hypothesis H_O. However, if the test is significant ($p < .05$) then the distribution in question is significantly different from a normal distribution (i.e. it is non-normal) and we accept the alternative hypothesis H_A. As displayed in Table 3, the furniture firm LQs distribution for each of the years under consideration are significant according to the S-W test (and the K-S test) and therefore cannot be considered normally distributed.

Table 4.3: Tests of Normality for Firm LQs

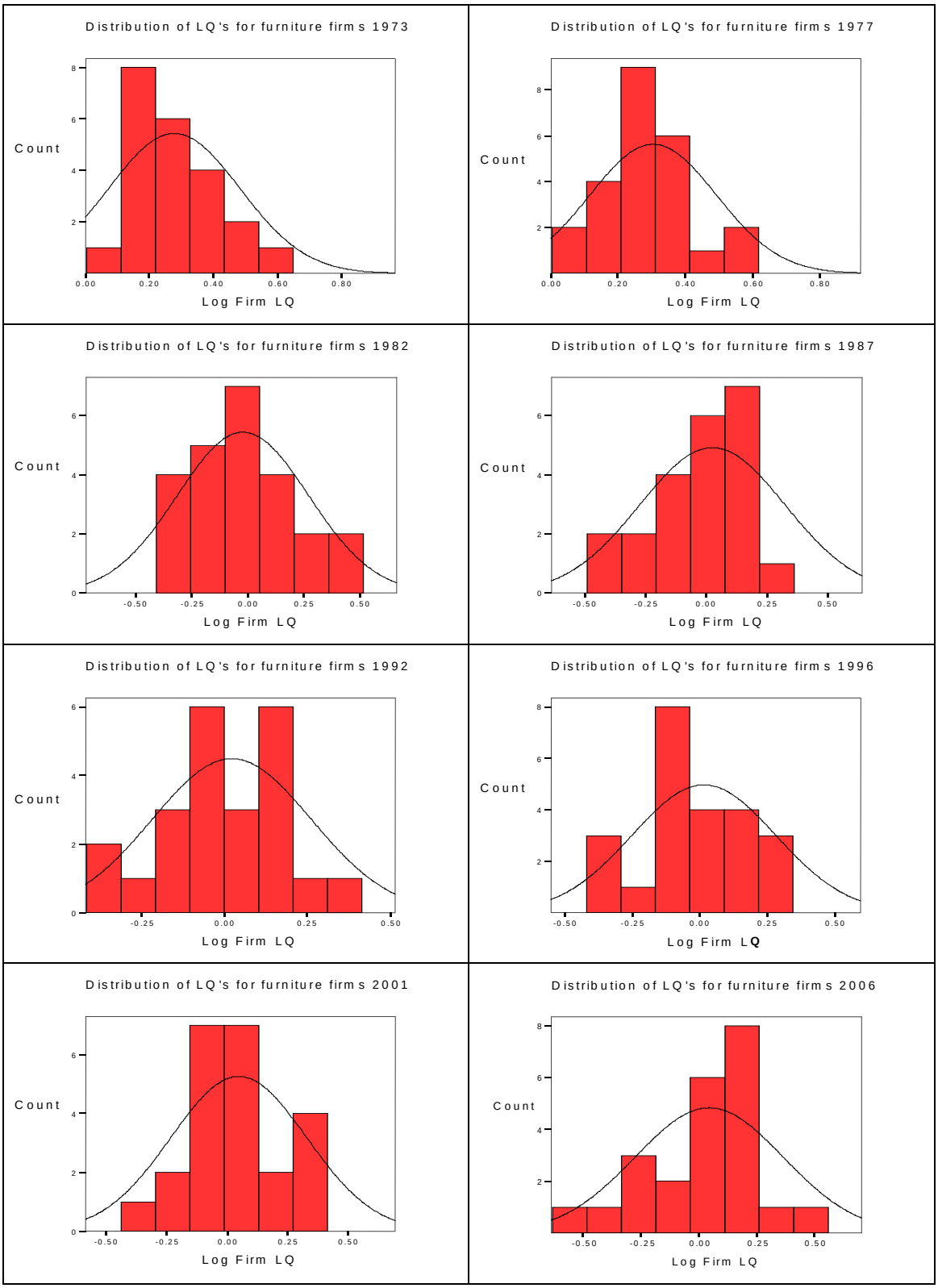
	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Firm LQ 1973	.240	26	.000	.579	26	.000
Firm LQ 1977	.262	26	.000	.632	26	.000
Firm LQ 1982	.241	26	.000	.755	26	.000
Firm LQ 1987	.247	26	.000	.756	26	.000
Firm LQ 1992	.179	26	.032	.829	26	.001
Firm LQ 1996	.208	26	.005	.772	26	.000
Firm LQ 2001	.222	26	.002	.768	26	.000
Firm LQ 2006	.236	26	.001	.807	26	.000

[a] Lilliefors Significance Correction[79]

As normality cannot be assumed, the next step is to logarithmically transform the LQ distributions in an attempt to reduce the positive skew of the distribution. The graphical assessment of the normality of the transformed variables is presented in Figures 4.4 and 4.5.

[79] The Kolmogorov-Smirnov one-sample test for normality is based on the maximum difference between the sample cumulative distribution and the hypothesized cumulative distribution. If the D statistic is significant, then the hypothesis that the respective distribution is normal should be rejected. For many software programs, the probability values that are reported are based on those tabulated by Massey (1951); those probability values are valid when the mean and standard deviation of the normal distribution are known a-priori and not estimated from the data. However, usually those parameters are computed from the actual data. In that case, the test for normality involves a complex conditional hypothesis (i.e how likely is it to obtain a D statistic of this magnitude or greater, contingent upon the mean and standard deviation computed from the data), and the Lilliefors probabilities should be interpreted (Lilliefors, 1967).

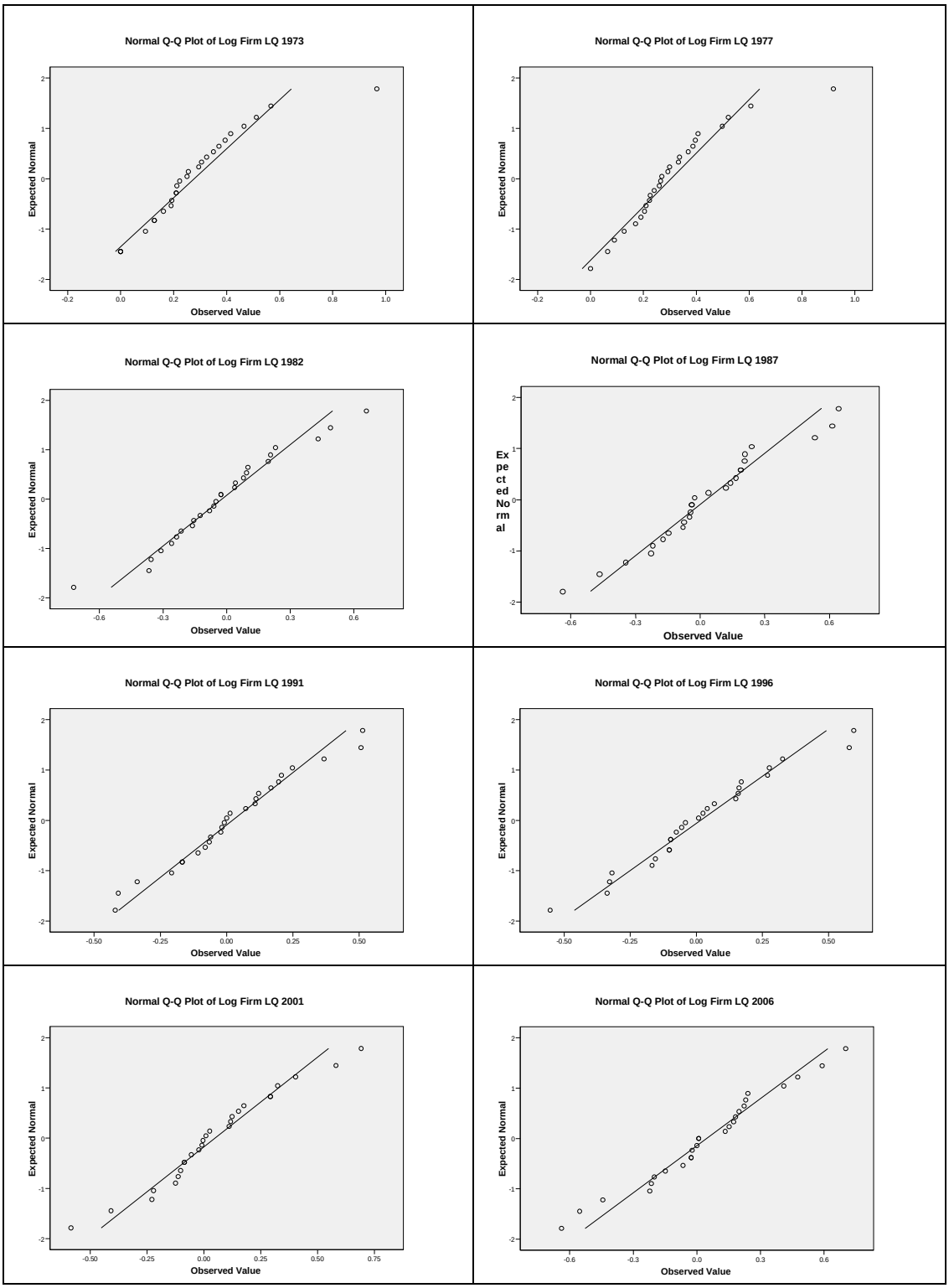
Figure 4.4: Histograms for transformed furniture firm location quotients 1973-2006



From Figure 4.4, 1973 does not appear to approximate a normal distribution. For other years, the normality of the distributions is not as clear from a visual inspection of the histograms. However, the probability plots in Figure 4.5 reflect less positive

skew in the data as indicated by the closer adherence of the observed values to the expected values as represented by the straight line. The plots also appear more symmetrical. Both of these features suggest normality.

Figure 4.5: Probability plots for transformed furniture firm location quotients 1973-2006



The transformed distributions are formally checked for normality using the S-W and K-S procedures. The results in Table 4.5 show that, this time, the S-W and K-S tests return slightly conflicting results.

Table 4.5: Tests of normality for logarithmically transformed firm location quotients

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Log Firm LQ 1973	.120	26	.200(*)	.893	26	.011
Log Firm LQ 1977	.139	26	.200(*)	.908	26	.024
Log Firm LQ 1982	.106	26	.200(*)	.977	26	.811
Log Firm LQ 1987	.124	26	.200(*)	.964	26	.481
Log Firm LQ 1992	.091	26	.200(*)	.972	26	.677
Log Firm LQ 1996	.099	26	.200(*)	.971	26	.643
Log Firm LQ 2001	.114	26	.200(*)	.974	26	.741
Log Firm LQ 2006	.117	26	.200(*)	.975	26	.766

* This is a lower bound of the true significance.

[a] Lilliefors Significance Correction

The S-W test statistic indicates that the transformed data for 1973 and 1977 cannot be assumed to approximate a normal distribution. However, the K-S test statistic suggests that all the transformed distributions are normal. Therefore, the results in Table 4.5 outline the limitations of using the K-S test as it only provides an approximation of the significance as opposed to the exact value reported by the S-W test. As the S-W procedure is our preferred goodness of fit measure, the years 1973 and 1977 are excluded from the remaining analysis. The final stage in the process is to convert the logarithmically transformed LQs for the remaining years, 1982, 1987, 1992, 1996, 2001 and 2006 into z-values. The results, which are the SLQs described by O'Donoghue and Gleave (2004), are shown in Table 4.5.

Table 4.6: SLQ and Irish Furniture Industry 1982 – 2006

	SLQ 1982	SLQ 1987	SLQ 1991	SLQ 1996	SLQ 2001	SLQ 2006
Carlow	-0.01	0.38	0.36	0.2	0.25	0.34
Cavan	0.40	0.30	0.61	0.5	0.87	0.56
Clare	-1.14	-1.24	-1.84	-2.13	-2.26	-2.13
Cork	-0.13	-0.22	-0.09	-0.34	-0.37	-0.11
Donegal	-0.47	-0.26	-0.36	-0.44	-0.62	-0.6
Dublin	-0.45	-0.85	-0.79	-0.64	-0.96	-0.83
Galway	0.21	-0.22	-0.16	0.04	-0.14	-0.34
Kerry	-2.39	-2.22	-1.79	-1.29	-1.63	-1.87
Kildare	-0.66	-0.34	-0.54	-0.42	-0.08	-0.11
Kilkenny	-0.98	-0.58	-0.79	-0.27	-0.54	-0.21
Laois	0.35	0.46	0.21	0.55	0.22	0.4
Leitrim	1.55	1.69	1.44	0.98	1.27	1.35
Limerick	-0.81	-1.65	-1.49	-1.32	-0.99	-0.81
Longford	0.75	0.71	0.77	0.95	0.99	1.14
Louth	0.78	0.59	0.37	0.54	0.37	0.48
Mayo	0.22	0.04	-0.13	-0.21	-0.48	-0.77
Meath	2.33	1.96	2.05	2.11	1.90	1.71
Monaghan	1.75	2.05	2.02	2.17	2.30	2.05
Offaly	0.87	0.60	0.73	0.1	0.46	0.43
Roscommon	-1.18	-0.67	-0.43	-1.25	-0.58	-1.53
Sligo	-0.35	0.54	0.41	-0.03	-0.2	-0.14
Tipperary	-0.20	-0.83	-0.95	-0.69	-0.48	-0.22
Waterford	-0.10	-0.36	-0.34	-0.44	-0.25	0.28
Westmeath	0.42	0.54	0.94	1.17	0.87	0.58
Wexford	-0.73	-0.24	-0.04	0.58	0.27	0.61
Wicklow	-0.01	-0.18	-0.18	-0.42	-0.19	-0.22

From Table 4.6, our primary interest is in values that lie beyond 1.96 (positive) standard deviations from the mean. As outlined previously, this cut-off represents the 5% level of statistical significance. There are only two sets of SLQs that fulfil this criterion for any time period - that is counties Meath and Monaghan. For county Monaghan, the result is valid for the period from 1987 to 2006. By contrast, for county Meath, although the result is valid from 1982 to 1996, it cannot be classed as an industrial agglomeration since 1996. Therefore, based on this methodology only county Monaghan is deemed to exhibit an exceptional concentration or agglomeration of furniture firms for the most recent time period.

It is also useful to note the minus SLQ results. These data may be interpreted as identifying those counties where furniture manufacturing is underrepresented relative to the mean level of activity. Unsurprisingly, fourteen out of the twenty-six counties

show minus SLQs. However, there is only one statistically significant negative SLQ and that is for county Clare since 1996.

As outlined in a previous section, the identification of industrial agglomeration by itself is no indicator of future success as it is possible that agglomeration diseconomies may emerge to frustrate the positive local dynamic in a concentration of firms. In order to gain some insight (albeit through use of a very imperfect measure) into the dynamics of agglomerative tendencies within the Irish furniture industry, it is informative to examine the actual changes in the SLQs. The results of this exercise are outlined in Table 4.7.

Table 4.7: Actual change in SLQ 1982 – 2006

	SLQ 1982	SLQ 2006	Change in SLQ 1982 – 2006
Carlow	-0.01	0.34	0.35
Cavan	0.40	0.56	0.16
Clare	-1.14	-2.13	-0.99
Cork	-0.13	-0.11	0.02
Donegal	-0.47	-0.60	-0.13
Dublin	-0.45	-0.83	-0.38
Galway	0.21	-0.34	-0.55
Kerry	-2.39	-1.87	0.52
Kildare	-0.66	-0.11	0.55
Kilkenny	-0.98	-0.21	0.77
Laois	0.35	0.40	0.05
Leitrim	1.55	1.35	-0.20
Limerick	-0.81	-0.81	0.00
Longford	0.75	1.14	0.39
Louth	0.78	0.48	-0.30
Mayo	0.22	-0.77	-0.99
Meath	2.33	1.71	-0.62
Monaghan	1.75	2.05	0.30
Offaly	0.87	0.43	-0.44
Roscommon	-1.18	-1.53	-0.35
Sligo	-0.35	-0.14	0.21
Tipperary	-0.20	-0.22	-0.02
Waterford	-0.10	0.28	0.38
Westmeath	0.42	0.58	0.16
Wexford	-0.73	0.61	1.34
Wicklow	-0.01	-0.22	-0.21

How should these changes be interpreted? Counties Meath and Monaghan are the only counties with significant SLQs for some or all of the period. The SLQ for county Meath has declined consistently over the period from 1982 to 2006, whereas the SLQ for county Monaghan has increased over the period. However, going back to Table 4.6 for a moment, it is clear that there is little overall change in the SLQ for county Monaghan in the twenty-year period that the SLQ is actually significant from 1987 to 2006. *In fact, the SLQ increased until 2001 and then declined back to its 1987 level by 2006.* For county Meath, the negative change in SLQ reported in Table 4.7 indicates a reduction in agglomerative forces, or more specifically, localisation economies. For county Monaghan, although the change in SLQ is positive, the trend over the critical period of 1987 – 2006 is static. Only an examination of data post 2006 will be able to confirm or refute the trends in these two counties.

As shown by the changes in SLQs in Table 4.7, there are other counties that although not characterised as agglomerations according to the methodology used here, appear to be accounting for a relatively greater concentration of furniture manufacturing over the period. There may be nascent agglomerations developing here. By contrast, other counties seem to be losing their share of furniture manufacturing. For ease of exposition, counties are grouped in Table 4.8 into categories in terms of whether they display large or small SLQs (defined as less than 1) and whether these are increasing, decreasing or remaining static, whether or not the SLQs are significant.

Table 4.8: Summary of SLQ changes 1982-2006

Large SLQ (decreasing)	**Small SLQ (decreasing)**
Meath, Leitrim	Louth, Offaly, Cork, Kildare, Sligo, Kilkenny, Galway, Donegal, Mayo, Dublin, Roscommon, Clare, Limerick*
Large SLQ (**static**)	**Small SLQ(increasing)**
Monaghan	Wexford, Westmeath, Cavan, Laois, Carlow, Waterford, Tipperary, Wicklow, Kerry, Longford
* Limerick SLQ is static	

Those firms with small but increasing SLQs are displayed in the bottom right hand corner of Table 7. Counties in the top right hand corner of Table 7 are those showing a decline in the relative concentration of furniture firms. If we interpret both of these findings as a respective increase and decrease in the attractiveness of the various counties as locations for furniture production, it directs attention towards using more in-depth firm and county level analysis to try to gain an understanding of the dynamic surrounding furniture manufacturing in these respective groups of counties.

Discussion

The application of the SLQ methodology to the Irish furniture industry clarifies the extent of industrial agglomeration in the industry. For the time period when statistically significant agglomerations can be identified (i.e. from 1982-2006), the furniture industry may be characterised as going from a relatively dispersed to a more localised and back to dispersed locational pattern, mirroring that found by Strobl (2004) for Irish industry generally over the longer time period ranging from the 1920s to the 1990s There are only two counties where industrial agglomeration for the furniture sector can be statistically identified. For county Meath, an industrial

agglomeration was present in the period from 1982 to 1996, but the relative concentration of furniture firms in the county has declined since then. For county Monaghan, an industrial agglomeration is evident in the period from 1987 to 2006. However, this relative concentration is the same at the end as at the beginning of the period, and has in fact declined in the period 2001-2006, raising questions about the local dynamism in that particular place. By contrast, there are other Irish counties such as Wexford, Westmeath, Cavan, Laois, Carlow, Waterford, Tipperary, Wicklow and Kerry, where the relative importance of furniture manufacturing appears to be growing, although the findings here do not carry any statistical significance. Little is known about the furniture industry in these counties and the features that are responsible for the patterns that are identified here. The remainder of this section reviews the contribution of the analysis under four headings.

Theoretical and conceptual understanding of industrial agglomeration

The analysis contained in this paper is a statistical analysis and cannot shed any light on the economics of what might be happening to the furniture industry in various counties. For example, it can say nothing about the existence or relative importance of pecuniary or technological externalities in the Irish furniture industry. However, as outlined above we know that an industrial district was identified among furniture firms in county Monaghan (Jacobson and Mottiar, 1999). The professional milieu associated with that industrial district may indicate that there are some dimensions of technological externalities in that place that are contributing to the industrial agglomeration there. On the other hand, it may be the case that technological externalities are no longer as confined by geography, and that similar type benefits can be obtained on a national or even international basis through firm linkages and networking (see Heanue and Jacobson, 2008 for evidence for a firm in county Monaghan). The trend towards dispersion within the industry may indicate that pecuniary advantages, which operate over a wider geographic scale, are increasingly important for such a supplier-dominated price sensitive industry (Caniëls and Romijn, 2005). If that is the case, then the trend towards less agglomerative forces in the industry may continue.

On the basis of the evidence presented here, the impact of localisation economies is at best static, or at worst declining, in the two industrial agglomerations identified. Although urbanisation economies were not tested for in any way, it is interesting that none of the counties that have significant urban settlements (Cork, Galway, Limerick, Waterford or Dublin) exhibit a statistically significant SLQ. Nevertheless, it was argued that market effects from the large cities of Dublin and Belfast may be important for furniture producers in county Meath.

The trajectories of the SLQs for counties Meath and Monaghan highlight the evolutionary structure of the furniture industry. It hints at the possible changing balance between economies and diseconomies of agglomeration in those two particular locations. By comparison, the other counties displaying emerging (although not significant) local dynamism demand explanation that might rely on factors such as the youth of the firm, the sectoral specialisation, institutional and policy support or economies of scale.

Methodology of identifying industrial agglomerations

The methodology of SLQ as proposed by (O'Donoghue and Gleave, 2004) was extended in two particular ways. The use of the S-W as opposed to the K-S goodness of fit test proved to be more stringent. By focusing on number of firms as the key variable for the SLQ, rather than employment as in O'Donoghue and Gleave (2004), the analysis specifically focused on identifying industrial agglomeration as conventionally understood in the literature, i.e. conceptualised as localisation economies.

Of course, the SLQ analysis carried out here, similar to location quotient analysis overall, is subject to criticisms, especially in relation to the assumption of identical production functions. The labour intensive production systems involved in upholstered furniture in county Meath are very different from the capital intensive systems used in county Monaghan (see below). Moreover, there are obvious production system differences in other furniture sub sectors that occur throughout each county (e.g. kitchen manufacturing, office and shop furniture, occasional furniture etc.) but which could not be analysed separately here due to data constraints. The assumption of identical production functions, particularly when focusing on

number of firms as the key variable as was done in this paper, may underestimate agglomeration in those counties where the minimum scale of furniture production is large (possibly leading to fewer firms) and overestimate agglomeration in those counties where minimum scale is low (leading to more firms). Also, of course, as outlined above, it suggests that the labour productivity in a labour intensive county (such as Meath) is the same as that in a capital-intensive county (such as Monaghan) on a firm-by-firm basis.

With the type of analysis presented here, there is often the fear that the artificial geographical limit of county boundaries may restrict the identification of industrial agglomerations that cross over county boundaries. However, there is no statistically supported evidence of a more regional agglomerative pattern among contiguous counties. Nevertheless, there does appear to be a general dynamics in the region of Wexford, Waterford, Laois, Carlow in the South East/Midlands and Cavan Monaghan, Leitrim in the Border region. Conversely, the Western/Northwestern counties of Galway, Mayo, Sligo, Donegal and Roscommon exhibit a decline in dynamism according to the metric used here.

A high concentration of an industry in a particular place as measured by LQs may measure geographic specialisation and not dynamic localisation economies (Feldman, 1999). It has been implicitly assumed here, following the assumptions in other similar research (e.g. O'Donoghue and Gleave, 2004) that the identification of an industrial agglomeration through the use of a location quotients methodology means that agglomeration economies are present (by definition). It is fortunate that there is other research on the furniture industry in counties Monaghan and Meath (see immediately below) that can contextualise the findings here, but it is still insufficient to either confirm or refute whether or not agglomeration economies are in fact present in those two counties.

Knowledge of the Irish furniture industry

Other evidence on the industry tends to support the general thrust of the findings from this paper. Heanue and Jacobson (2008) report that innovative furniture firms in counties Monaghan and Meath are increasingly forging global linkages, with local embeddedness becoming less critical as a source of competitive advantage; a pattern

confirmed by Jordan and O'Leary (2005) for high-tech Irish companies. In relation to county Monaghan, there has been a concentration of woodworking in the county for hundreds of years and the furniture industry in that county is described as an industrial district (Mottiar 1997; Jacobson *et al* 2001). Close proximity, competition as well as formal and informal co-operation, close inter-firm relationships - both horizontal and vertical - and people having been trained in one firm then establishing their own firms, are all characteristics of the group of furniture firms in county Monaghan. Jacobson and Mottiar (1999) have shown that while some of the normal characteristics of industrial districts are absent from the County Monaghan furniture industry, the elements described above together with the existence of a professional milieu and an awareness of mutuality of interest, are sufficient to designate this agglomeration of firms as an industrial district. However, the direction of change in the county Monaghan SLQ identified in this paper lends support to the scepticism about the dynamism inherent in the industrial district in county Monaghan expressed in Heanue and Jacobson (2002), although more research is needed to support or refute this assertion.

Less is known about the furniture firms in county Meath although the Committee on Industrial Progress, (1973) and O'Donnellan, (1994) highlighted that there was an apparent localised concentration there, particularly around the town of Navan. County Meath has traditionally been the location for a large number of upholstery firms, partly because of its proximity to the Republic's capital city of Dublin, and also its closeness to Belfast, the main urban centre in Northern Ireland. There is some evidence that although there is a local sub-supply sector of sorts in the locality it is very weak (Heanue and Jacobson, 2004b). The sub-supply industry includes foam supply, timber supply, frame supply and a pool of labour. This pool of labour consists of skilled people - sewers, machinists, frame makers and upholsterers; a pool of labour, however, that is increasingly shrinking (Heanue and Jacobson, 2004b). The other main benefits of Navan as a location include the fact that it is close to the main urban centres (and markets) of Dublin and Belfast cities. In addition, because of its reputation and the relatively large number of furniture firms in close proximity, retailers come to Navan to source products, and because of proximity to Dublin, the firms in Navan can respond to retailer's orders quicker than many of their competitors. Therefore, there still appears to be some benefits to being located in

Navan, although many of these could not be classed as agglomeration economies. The direction of change in the county Meath SLQ identified in this paper lends support to the probable lack of localisation economies among furniture firms in this county.

The changing fortunes of the agglomerations in counties Monaghan and Meath may be strongly influenced by the sectoral concentration in the respective areas. County Meath has traditionally been a location for upholstery and soft furnishing manufacturers. This sector is, out of all the furniture manufacturing sectors, probably the least capital intensive, least mechanised, least automated and relatively most labour intensive sector (Heanue and Jacobson, 2004b) and has been subject to fierce import competition particularly from South East Asia. The labour intensive nature of this sector is reflected by the increase in average firm size in county Meath from 17 to 24 employees over the period. An inability to reduce reliance on increasingly expensive labour together with a local supply sector that no longer confers the same pecuniary and technological advantages as heretofore, has probably reduced the dynamism of firms in this area[80].

By contrast, county Monaghan mostly contains firms that make living room, dining room and occasional furniture from solid wood and composite board material. The county has traditionally been the location for some of the largest, most successful, and export oriented Irish furniture companies (Heanue and Jacobson, 2004a). Many of these firms use state of the art CNC machinery and have developed a particular expertise in the machining and finishing of composite panel boards. The capital intensity of the production system of firms in county Monaghan has undoubtedly influenced the decline in average firm size from 31 to 21 employees over the period.

More generally, product features of the industry also undoubtedly influence its distribution. For example, some sub-sectors such as kitchen and fitted furniture manufacturing often service a relatively localised market and correspond closely

[80] It is noted for the upholstered furniture manufacturing sector in the US that there are low substitution elasticities among inputs implying that when the price of an input rises, there is little opportunity for input substitution and therefore profits can only be maintained by increasing prices for the final products (Seldon and Bullard, 1992).

with joinery and carpentry activity in some cases. However, there is relatively little published information on these sub-sectors.

Policy implications

For industrial/enterprise policy, the findings at least raise important questions about the possible role of agglomerations for the competitiveness and/or innovativeness of this particular sector. The absence of strong evidence for industrial agglomeration in the industry should raise questions as to why the local economic, institutional and structural features of the sector do not appear to have as positive an impact on Irish furniture firms as is reported elsewhere. However, the findings do find more general support from the evidence that for many spatial concentrations of firms, there is relatively little local interaction (McCann, 1995). It may well be the case that whatever agglomeration is occurring in the Irish furniture industry is a result of natural advantage or factor endowment in particular places, rather than any localisation dynamic. There is a clear need for research to help identify the specific economic and institutional linkages that contribute to the success of the most competitive and innovative Irish furniture firms, whether those linkages are local, regional or global, and from an enterprise support perspective, how such linkages may be promoted. From a regional and rural development policy perspective, the relatively dispersed nature of the industry, albeit on a small-scale in many counties, means that it is likely to remain an important source of employment for rural areas. The fact that whatever agglomeration does occur, takes place in rural as opposed to urban locations, challenges the dominant 'urbanisation economies' discourse prevalent within much Irish industrial and spatial analysis (e.g. O'Leary, 2007). Although not directly tested, the location pattern of the industry tends to support the dispersal impact on industry of regional industrial policy in the later decades of the 20th century as outlined by Boylan (1996) and Meyler and Strobl 2000), a role that appears more recently to be dismissed in favour of an 'urbanisation' imperative.

Shortcomings and direction for future research

The formal identification of an industrial agglomeration as was carried out in this paper is no guarantee that agglomeration economies are actually present in that place, although we implicitly assume that that is the case. The SLQ as constructed here measures the relative concentration of furniture firms in a particular geographic area.

It may be the case that the concentration is just that; a spatial concentration of firms. Other analysis is needed to conclusively confirm or refute the existence of agglomeration economies. Such research could take the form of econometric analysis such as that of Caballero *et. al.* (1990) or Feser, (2001) that would seek to identify whether internal or external economies exist in the furniture industry.

In addition, case study and qualitative research could reveal the interactions and reasons for such behaviour of both successful and not so successful furniture firms. Moreover, the analysis presented in this paper could be repeated in the future in order to extend the agglomerative trajectories uncovered here. Of course, the linkages and interactions of Irish furniture firms could be explored through the lens of a less spatially focused theoretical framework than that of industrial agglomeration. Increasingly, the notion of proximity implicit in industrial agglomeration has been extended along various dimensions (see for example, Boschma, 2005), each of which imply different things for the competitiveness of firms.

One of the main contributions of the paper is, from a statistically based foundation, to raise further research questions that if answered will help provide a better understanding of the Irish furniture industry at county level. There is already some evidence, which supports the general thrust of this paper, that it is extremely difficult to generalise about the relationship between Irish furniture firms and their location, however, most of that literature relates to counties Monaghan and Meath. This paper identified what appear to be several other nascent dynamic county level groupings of furniture firms that deserve research attention.

Data permitting, it would be useful to compare the results from a variety of measures of industrial agglomeration including plant-based indices. Similarities of results from different measures could boost confidence in the robustness of the patterns identified.

Concluding comments

This paper found that there is some evidence of industrial agglomeration in the Irish furniture industry (as suggested by Committee on Industrial Progress, 1973; O'Donnellan, 1994; Jacobson and Mottiar, 1999 and Jacobson *et al*, 2001), but the scepticism about the strength of such dynamism (raised by Heanue and Jacobson, 2002; 2005; 2008) is also supported. These finding raise important questions about the organisational, economic and institutional structure of this relatively robust industry that are not fully understood. For example, just because agglomerative tendencies in the industry appear to be declining does not necessarily mean that the firms in certain locations are becoming less competitive or innovative. This analysis could not shed any light on those relationships[81].

Methodologically, the paper extended the technique of SLQs, in an incremental fashion. The overall technique is, however, subject to the criticisms of location quotient analysis generally, especially the shortcomings of the assumption of homogenous production functions and the fact that economies of agglomeration are implicitly assumed in the results, not explicitly tested for.

From an industrial policy perspective, the results of this analysis raise questions about the promotion of clustering[82], or relying on notions of agglomeration, in relation to explaining the dynamics of the Irish furniture industry, at least in the recent past. From a rural and regional development perspective, policy in that area (along with the features of the sector itself) can probably claim some credit for influencing the location pattern of the industry in the latter part of the 20th century. It is also clear that, in contrast to much conventional wisdom, agglomeration economies are possible in rural locations.

[81] An insight into the innovation strategy of a firm in the County Monaghan industrial agglomeration forms part of Paper 3

[82] This point is also made in Papers 1, 2 and 3.

Conclusion

This dissertation set out to explore the industrial economic issues of firm behaviour, industrial organisation and industrial structure in Irish furniture manufacturing, an industry that was focused upon due to the lack of research on such LMT sectors, its resilience over a long period of time and its geographic dispersion within Ireland. Specifically, the dissertation examines various aspects of networking, industrial organisation, innovation, and industrial agglomeration in the Irish furniture manufacturing industry. In doing so, it also explores dimensions of institutional learning, organisational proximity, industrial policy and embeddedness. In drawing together the results of this dissertation, it is useful to discuss them at three levels – the substantive research findings, broader reflections from the dissertation and suggestions for future research.

The substantive research findings

Drawing on the philosophical approach of pragmatic realism, this dissertation uses case study methodology in Papers 1, 2 and 3 to address the specific "why" and "how" research questions posed in each paper. These questions centred on contemporary phenomena such as the formation and nature of trust among competitor firms in a network; the relationship between the innovation processes of firms and geographic location, and the interaction between industrial policy and different types of industrial organisation. These were situations where the boundaries between phenomenon and context were not clearly evident, where contextual information was clearly going to be important and multiple sources of evidence would be useful. In these circumstances, a case study approach best suited the research questions. Paper 1 is a single-case complete study, based on the unique case of a publicly stimulated formal network of three furniture firms. Paper 2 is an embedded single case study. The case study is industrial organisation in the furniture industry, with two subunits, industrial networks and industrial districts within the case. Paper 3 uses a multiple case design focusing on four firms in two sectors, furniture manufacturing and fabricated metal products.

By contrast, Paper 4 sought to answer a "what" question in relation to the spatial distribution of furniture firms. Statistical analysis of the number of firms in particular

locations, which facilitated the testing of hypotheses about the distribution of the data, was the appropriate method to address this research question. Based on this methodology, the dissertation contributes new theoretical, policy, empirical and methodological knowledge about an under-researched Irish LMT sector and in doing so contributes to the appropriate focal literatures in several respects. What are these contributions?

First, in a contribution to the theoretical understanding of network formation, it is shown that organisational proximity, fostered by the frequent interaction of firms in a geographically *diffuse* institutional framework, can lead to the development of ascribed trust among geographically dispersed competing firms, similar to that which may 'naturally' occur in a geographically *concentrated* group of enterprises. This contribution is contained in Paper 1. Related questions concerning the spatial limits of agglomeration economies are also addressed in Paper 2 in terms of comparing two forms of industrial organisation – industrial districts and industrial networks. In addition, the case study-based findings in Papers 1 and 2 about the type and spatial extent of benefits or economies among different forms of industrial organisation in the furniture industry help illustrate the patterns of agglomeration identified by statistical methods in Paper 4. This contribution supports those of others (for example, Cooke, 1996 and Foss, 1996) who argue that qualitative features of inter-organisational linkages such as trust, can exist in the absence of the spatial proximity of firms. By revealing the indirect role of an enterprise support agency in mediating the development of such trust even before the firms began networking, this dissertation also makes a contribution to the literature. By looking at the pre-interaction stage of networking, Paper 1 complements the work of Cooke and Wills (1999), for example, who show how trust can be encouraged among firms by public networking programmes once the firms begin to interact.

Second, in the context of policy changes, an examination of two different types of industrial organisation in the furniture industry – industrial districts and networks – raises questions about whether support for individual companies within industrial agglomerations is a strategically correct policy. Policy support for networking in general and not just among spatially proximate firms emerges as a desirable policy. This contribution is contained in Paper 2. The importance of addressing such a policy

issue, and the complexities involved in trying to do so, are also underlined by the data presented in Paper 4 which identifies some counties that either presently or in the recent past justify the label of industrial agglomeration but now appear to exhibit a lack of local dynamism, and other counties that do not yet satisfy the criterion to be labelled an industrial agglomeration, yet exhibit a growing local dynamism. Papers 1, 2 and 3, drawing on a variety of arguments, all indicate that policy should be positively disposed towards promoting networking as a possible alternative (or addition) to the support for existing agglomerations and in particular the successful firms within those agglomerations. The central findings emanating from Paper 2 thus confirm the arguments of Roper (2001) about the desirability of network and linkage promotion in Ireland while disagreeing with his assertion that there is no evidence of the benefits from the spatial proximity of firms in Ireland. (The existence of a furniture industrial district in Monaghan, by definition, suggests benefits from spatial proximity). However, as outlined below, support for and improved understanding of the issues surrounding the sustaining of networks, in addition to encouraging their start up, is warranted.

Paper 2 raised many important questions such as whether there are limits to growth in the Monaghan industrial district, and what if any the relationship is between these limits and industrial agglomeration. In addition, are there opportunities for growth for the Irish furniture industry outside the Monaghan industrial district? The updated information on the demise of the key firm, John E. Coyle, in the Monaghan industrial district, compared to the continued viability of the TORC firms and FURN 2 (from Paper 3) who are all outside County Monaghan, bears out the concern expressed in Paper 1 with excessive policy focus on individual firms within industrial agglomerations. That FURN 1, (from Paper 3) also in County Monaghan, continues to survive, also as a recipient of public support (though to a lesser extent), suggests that a deeper understanding of the respective strategies of the firms and how these strategies were decided upon, may provide an insight into their life cycles. This issue is explored in more detail below.

Third, from an empirical standpoint, the research in this dissertation shows that a wide variety of relationships between embeddedness and innovation is possible, and the form that this takes is influenced by the heterogeneous array of firm responses to

the challenges faced by globalisation, building on their existing and possible future business strategies. Successful firms in different industries – or sub-sectors of industries – can network in different ways; the same firm can even change the nature of its networking and linkages over time, as the industry, market and technology evolve. This variety and complexity is evident in relation to various dimensions of innovative processes. This contribution is contained in Paper 3. This paper explicitly deals with the relationship between location and innovation and suggests that location is becoming a less important driver of the innovation processes of the furniture cases reported in that paper. In addition, Paper 3 contributes to the still under-researched area of innovation processes in LMT sectors, a deficit others have also sought to address (see for example, Hirsch-Kreinsen *et al.* (2006) and a recent FP5 project with the acronym PILOT, www.pilot-project.org). Paper 1 and part of Paper 2, in a discussion of the TORC furniture network, examine a specific form of innovation in the furniture industry, organisational innovation. The inverse relationship between location and innovation processes identified in Paper 3 is confirmed in relation to location and organisational innovation in Papers 1 and 2. By contrast, however, the fabricated metal product cases in Paper 3 reveal that location is important for the innovation processes of those firms. The empirical research emanating from Paper 3 thus supports, in a general way, those theorists like Uzzi (1997), Boschma (2005) and Maskell *et al*. (2006) who are critical of simplistic arguments about the advantages of clustering.

Fourth, a particular methodology for identifying industrial agglomerations – standardised location quotients – is applied in a new empirical setting, the Irish furniture industry. In addition, the methodology itself is expanded in two ways compared to its previous use (see O'Donoghue and Gleave, 2004). First, a different goodness of fit test is used. Second, rather than using employment data, the number of firms is used in the calculation of the standardised location quotient. This contribution is contained in Paper 4. This paper provides a sound empirical context for the questions raised around the issues of location, proximity, networking, innovation, agglomeration and appropriate policy responses, which are dealt with in more detail in Papers 1, 2 and 3. Moreover, linking the statistically based industrial agglomeration profile of the industry in Paper 4 with the case study based data related to location, proximity, networking, innovation and agglomeration in Papers 1,

2 and 3 exemplifies the benefits of being able to generate data from more than one research method and then utilise such data sources to enrich any analysis. For example, the case study data in Paper 3 provide exemplars of how the strategies followed by these innovative firms, lead to a reduction in their linkages with the immediate locality, and increase their non-local connections. This and the analysis of organisational innovation in Paper 1 and of different forms of industrial organisation in Paper 2, enrich our understanding of some of the factors that are influencing the changing patterns of agglomeration identified in Paper 4.

Broader reflections from the dissertation

Several years have passed since some of the analysis in this dissertation (especially Papers 1 and 2) was undertaken. Therefore, it is informative to update, within the constraints of this dissertation, what is known about the present status of the furniture companies that formed the empirical core of this dissertation. This has been done in Paper 1, where in a footnote to the conclusion, the story of the TORC network is updated to 2009. In Paper 2, the story of the furniture firm John E. Coyle is updated to 2009 in a footnote to the discussion section. The usefulness of this exercise is that it provides an even fuller background against which to consider the implications of this research and future research suggestions based on the dissertation's findings.

The dissipation of the TORC network is consistent with the experience of formal networks formed under the auspices of the Danish Networking Programme in the 1990s. For the TORC network, we cannot yet say with certainty whether its cessation reflects the culmination of its 'natural' life cycle, the breakdown of trust among the firm members, or some other reason. The emphasis within Irish network policy has up until now been, and will most likely continue to be, concerned with encouraging not sustaining networks. Present suggestions for evaluating Ireland's latest Industry-Led Networks initiative focuses on issues of traditional measures of net additionality for the network (Lynch *et al*., 2009) and will not directly address issues of network sustainability, through an incorporation of issues such as trust, competitive pressures and rent-seeking. In addition, the proposed evaluation framework only considers activities for 24 months: the TORC network life cycle was about seven years. Increasing such knowledge of the dynamics of network sustainability is equally as

important as additionality issues given the importance still attached to networking within Irish enterprise policy.

It was outlined in Paper 2 that the firm John E. Coyle had been important in the development of the furniture industry in County Monaghan. People who had served apprenticeships in Coyles ran 75 percent of the furniture firms in or near Monaghan town. In addition, Enterprise Ireland had provided substantial grant aid to John E. Coyle; it was a significant exporter and flagship for the industry. As noted in Paper 2, John E. Coyle ceased trading in 2008, possibly a victim of a high volume output production strategy that made it susceptible to competition from low cost imports. The case study firms mentioned in this dissertation, that are still trading in 2009 – Castlebrook, O'Donnells and FURN1 (in Monaghan) and FURN2 (in Navan) – have remained in business by following two generic strategies. First, they operate in niche sectors rather than high volume segments of the industry. Second, innovation in terms of products, processes, organisational forms, new markets and new sources of supply (outsourcing) has been central to their development. Both as a cause and effect of such strategic positioning and flexibility, the firms have become more globalised and less reliant on their immediate locality.

What can the findings of this dissertation contribute to the formulation of Irish enterprise/industrial policy, in the context of Irish economic development? In seeking to address this question it is useful to identify three (not mutually exclusive) themes, which to a greater or lesser extent, have been woven through all reviews of enterprise/industrial policy from the Telesis report in the 1980s to Enterprise Strategy Review Group in 2004. The themes are:

1) The possible role of indigenous (predominantly SME) enterprises as opposed to foreign-owned multinationals in Ireland's economic development.
2) The potential contributions of high-tech and LMT sectors. This often translates into a discussion of the need to support knowledge-intensive, innovative, value-added and export intensive enterprises.
3) The challenges facing rural-based enterprises in the context of achieving the policy objective of balanced regional development.

The empirical findings of this dissertation confirm, first and foremost, that small Irish-owned enterprises are able to thrive in competitive global environments. Indigenous industry still employs over half of the manufacturing workforce in Ireland, although its contribution to national value added and productivity is lower. As indigenous enterprises are likely to continue to be important providers of employment for the foreseeable future, and it is a policy objective to build on their broader economic contribution through helping them to 'move up the value chain', it is vital to understand as much as possible about their industrial dynamics. This can only be done on a sector by sector basis taking a pragmatic approach to research design.

The policy obsession with high-tech industry both at national and international level has led to a skewed view of what constitutes knowledge-intensive, value-added and export intensive enterprises (von Tunzelmann and Acha, 2003; Hirsch-Kriensen *et al.*, 2005). As shown in this dissertation, and confirmed by Europe-wide research such as that in the PILOT project mentioned above, some firms in so-called LMT sectors also have these attributes. In fact, one of the case study firms in Paper 3 explicitly compared the way they organise their activities to that of any high-tech firm. This is not a semantic or academic point. The failure of such LMT firms to be considered as knowledge, value-added and export intensive by virtue of sectoral identity alone (instead of through empirical verification), excludes them from consideration as contributors to the 'knowledge-economy' or 'smart-economy'[83], and therefore, from policy and funding support.

The Irish government is committed to the idea of balanced regional development, a necessary part of which entails understanding the reasons why firms locate in rural areas, are successful in those localities, and how they can be encouraged to stay in

[83] The most recent Irish policy statement on economic development, Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal (2008), sets out a framework to address the current economic challenges and to build a 'Smart Economy' with a thriving enterprise sector, high-quality employment, secure energy supplies, an attractive environment, and first-class infrastructure. As outlined in the document, the notion of a 'Smart Economy' combines the successful elements of the enterprise economy and the innovation or 'ideas' economy while promoting a high-quality environment, improving energy security and promoting social cohesion. A key feature of this approach is building the innovation or 'ideas' component of the economy through the utilisation of human capital – the knowledge, skills and creativity of people – and its ability and effectiveness in translating ideas into valuable processes, products and services (p.7).

those locations. The Irish furniture industry is a predominantly rural-based industry. Although the case study firms in this dissertation are all rural-based, it is clear that the embeddedness of these innovative, export-intensive in their respective localities is diminishing. Nevertheless, the firms are not relocating elsewhere. On the other hand, it is also clear from the analysis presented here that other rural areas in Ireland, outside the traditional furniture manufacturing strongholds of counties Monaghan and Meath, are experiencing positive change in terms of furniture manufacturing. There is no clear explanation yet of why that is occurring. From another perspective, some elements of the furniture industry will always serve a very local market (e.g. fitted kitchens and bedrooms) and therefore will always be dispersed around the country. The decision to encourage either of the two broad types of furniture firms – the export focused or the local market focused – will undoubtedly have different implications for balanced rural development objectives. The dynamic in predominantly rural-based sectors other than furniture manufacturing may be different and we need to understand those also.

To summarise, what are the overall implications of the dissertation's findings for the industrial economics issues of firm behaviour, industrial organisation and industrial structure? In terms of firm behaviour, contributions are made on the issues of innovation, network formation and institutional learning. For industrial organisation, knowledge is added to the literatures on industrial networks and industrial districts and the role of policy in such industrial organisations. In addition, the literature on organisational proximity and embeddedness is contributed to. On the subject of industrial structure, the dissertation tests an amended methodology for identifying industrial agglomerations.

Suggestions for future research

In relation to the issues of organisational proximity, trust and networking, the extent of research on organisational proximity where the associated firms are not located close to one another is still limited. This is not to say that everything that can be said about trust in spatially proximate firms has been said. However, it does follow from the study of just one network of only three firms presented in this dissertation that much less is known about how trust evolves in the absence of agglomeration than where it is present. Thus, additional dispersed networks, both sectorally

homogeneous and heterogeneous, both national and international, both small and large, need to be studied so as to develop and apply more widely the ideas examined in Paper 1. A particularly useful piece of research would be to test the hypothesis from Paper 1 against the experience of firms that became involved in Enterprise Ireland's Industry-led Networks Initiative that was launched in 2006. Another useful follow-on research project would be to comprehensively revisit the TORC network and fully explore its trajectory since the case study presented here was completed. Gaining a full insight into the conditions that led to the winding up of the TORC network, particularly in terms of the trajectory of the trust element of the relationships, would complement the analysis in Paper 1 which explored the beginning of the TORC network from a trust perspective. Combining such a piece of work with that in Paper 1, would provide a holistic picture of the life-cycle of an industrial network from a trust perspective that could usefully inform networking policy. Alternatively, or in addition, the TORC networks could be revisited from the perspective of the rent-seeking literature[84].

The research findings on different forms of industrial organisation in the furniture industry need to be updated – particularly in relation to the ongoing dynamic for those locations such as Counties Monaghan and Meath where furniture manufacturing has traditionally been strong. Apart from the headline story about the demise of John E. Coyle, we need to increase our understanding about how the industrial organisation of the furniture industry has been changing in these locations. In addition, taking on board the results from Paper 4 which identified some locations in Ireland that exhibit nascent local dynamism in relation to furniture manufacturing, very little is known about the industrial organisation of the industry in these locations. What is the role of agglomerative tendencies and of networks in these locations? Should network linkages, rather than cluster development *per se*, be encouraged? If so, should we also direct effort toward sustaining as well as encouraging new networks? How should such policies be formulated for these emerging, dynamic, furniture-manufacturing localities? These are all important research issues.

[84] As indicated in Paper 1, rent-seeking (along with export development and increasing scale) was one of the key reasons that the TORC members advanced for forming the network

The research on innovation processes within furniture manufacturing and fabricated metal products was undertaken against a theoretical background that broadly recognises that innovation occurs in increasingly geographically distributed networks, and through the integration of disciplinarily diverse knowledge areas. Both of the furniture firms tend to support the Uzzi (1997) and Boschma *et al.* (2002) inverted U-shaped hypothesis about embeddedness and innovation, but in different ways. Overall, the two fabricated metal product firms illustrate a traditional view of embeddedness and therefore contradict the hypothesis of Uzzi (1997) and Boschma *et al.* (2002). However, these two firms illustrate the traditional view in different ways. One of the key findings from this research is the heterogeneity of the relationship between locality and innovation both within and among LMT sectors. Another result is that that the stage in the firm and industry life cycles and heterogeneous reactions to globalisation pressures may be factors in whether successful firms have deep, shallow or stretched embeddedness. The need to explore these issues with other firms in the furniture and fabricated metal product sectors, and in other LMT sectors, opens up a rich research agenda.

In terms of the methodology for identifying industrial agglomerations four specific suggestions for further research emerge. First, utilising different data sets, it would be useful to compare the results from a variety of measures of industrial agglomeration, including plant-based indices, to those of the SLQ. Similarities of results from different measures could boost confidence in the robustness of the patterns identified in this dissertation. Second, the formal identification of an industrial agglomeration as was carried out in Paper 4 is no guarantee that agglomeration economies are actually present in that place, although it is implicitly assumed that that is the case. The SLQ as used in this dissertation measures the relative concentration of furniture firms in a particular geographic area. It may be the case that the concentration is just that: a spatial concentration or co-location of firms. Other analysis is needed to conclusively confirm or refute the existence of agglomeration economies. Such research could take the form of econometric analysis similar to that of Caballero *et al.* (1990) or Feser (2001) to seek to identify whether internal or external economies exist in the furniture industry. Third, the analysis presented in Paper 4 could be repeated in the future in order to extend the description of the agglomerative trajectories uncovered here. Fourth, alternative goodness of fit

measures, spatial boundaries (other than county level) and economic indicators (other than employment or number of firms) could form the basis for further SLQ analysis of the furniture or other industries.

This dissertation used a variety of methods to address several research questions. In that sense, the dissertation has set the groundwork for a possible mixed-methods triangulation study of the industry. For example, the statistical analysis in Paper 4 could be augmented with case studies in selected counties and qualitative interviews in selected firms in those counties to tease out whether and in what ways local dynamism is increasing or decreasing and why or why not. More generally, a pragmatic approach to the future research projects identified here seems appropriate.

One of the over-arching themes to emerge from the dissertation is that both establishing global linkages and relying less on local connections on one hand and deepening the embeddedness and local linkages on the other, appear to be equally valid, for different firms, in different industries, at different stages in their development. Our theoretical, conceptual and empirical knowledge of such relationships needs to be expanded. If LMT sectors such as furniture manufacturing are to continue to make a contribution to Irish economic development, it is clear from this dissertation that what is required is to build on these findings with new theoretical and empirical knowledge about, for example, the development path of such industries, the innovation strategies firms use to maintain resilience, the alternative types of industrial organisation that underpin firm activities, and the changing spatial features of such industries.

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Appendix A: Empirical Instruments for Papers 1& 2

1. Expert Inteview Guideline

2. Enteprise Ireland Network Personnel Guide

3. Network Company Interview Guide

Industry Expert Interview Guideline

Topic 1: The Irish Engineering/Furniture industry

- S.W.O.T.
- How does EI categorise the industry?
- Main movers: subsectors, firms, products, locations (in Ireland), origin-imports, destination-exports
- Potential case study firms?
- Skill levels

Topic 2: Policy towards the industry/individual firms

- Objectives
- Instruments
- Networking
- Innovation
- Policy gaps/opportunities

Topic 3: National Reference Group

- Contribute a critical evaluation of the results of the empirical case studies, including an analysis of the generalisability of the outcomes.
- Participants should be business, policy and related sectors.

Interview Guide - The Pilot Furniture Network – Enterprise Ireland Personnel

- Why were these three firms picked for the Pilot Network Programme? What criteria used? What did the different firms bring to the Network?

- Were the firms previously involved in either formal or informal cooperation arrangements?

- What happened to the fourth firm – Joe Manning, Co. Carlow?

- How long have the firms been in business? How many employees?

- How does the network work – production wise?

- Main problems – i.e. communications, invitations to quote etc.

- What is the status of the network now? Scale of business done as a result of the network; main advantages/disadvantages/the future.

Other networks. What is the relevance/involvement of the furniture sector?

⇒ Technology Transfer and Partnership Programme
⇒ National Linkage Programme
⇒ FASNET
⇒ PLATO
⇒ The Enterprise Trust

- A number of programmes on behalf of the Office of Science and Technology i.e.

⇒ Measure 1 grants for R&D in firms
⇒ 3 Strategic Networks among the Technology Centres it funds in the Colleges of Technology/RTCs.

Personnel

- Who are Enterprise Ireland people responsible for the furniture sector now?

- Who was the Danish Network Consultant who worked closely with the DTI – and trained the Irish network facilitators?

- Contact details for key Pilot Network Personnel

Themes for Structured Discussion with Furniture Firms in the Pilot Inter-Firm Network Programme

BACKGROUND

Name:	Date of Establishment:	Today's date:

Total number of people employed:
Craftspeople:
Technical
Managerial
Contract
Designer

Where are you main markets in Ireland?

What percentage of your sales are in Ireland?

JOINING THE NETWORK

1. How did you actually become involved with the Pilot Network Programme?

2. At the time, why did you decide to join the Pilot Network Programme?

3. What were the main benefits to you/your company from the **facilitation** phase of the Pilot Network Programme?

4. What was it about the other companies that were going to be involved in the Pilot Network Programme that convinced you to proceed with the facilitation phase of the programme?

THE NETWORK EXPERIENCE

5. What have been the main benefits for you/your company from the network since the facilitation phase ended?

6. In what longer-term ways do you expect you/your company to gain from having participated in this network?

7. What do you foresee as the potential disadvantages/problems from participating in the Network?

8. What particular strengths do you/your company bring to the network?

9. What are the particular strengths that the other two companies brought to the network?

10. What was your prior knowledge of, and contact with, the other companies or owners in the network?

11. What was your prior knowledge of, and contact with, other individuals in the network? E.g. network manager etc.

12. What were the initial problems in establishing the network?

SECTOR INITIATIVES

13. Have you/your company taken part in previous sectoral initiatives? When? Who was your contact? Where are they based?
    - *National Linkage Programme*
    - *The Technology Transfer and Partnership Programme*
    - *Furniture Technology Centre Activities*
    - *(Forbairt) Enterprise Ireland Furniture Certificate Programme*
    - *Company Development Programme*
    - *DIT ADAPT Project – Innovation and Re-engineering in Furniture SMEs*

14. Do you participate in any other networks (e.g. training or otherwise)?
    - *FASNET* (only Dublin West and Kildare)
    - *PLATO* (business training networks)
    - *Enterprise Trust* (employers organisation/employers input in support of local development)

15. Are you, or have you been, a member of the National Furniture Manufacturers Association?

16. Are you, or have you been, involved in Advisory Groups e.g. DIT, FC Letterfracek, UL, EI?

NETWORK CONTACT

17. How often do you personally meet with the other network companies?

18. How often do you have telephone, email, fax contact with the other network companies?

19. How often do you meet with John Lennon/Joe Manning?

20. How often do you have telephone, email, fax contact with John Lennon/Joe Manning?

21. Do you exchange information, other than about TORC with the other two companies, i.e. other products, processes, markets, competitors, other technical information etc?

NETWORK STATUS

22. What is the status of the network now? Have there been any sales?

23. Do you have, or are you discussing, any other projects with the other network members? What are they?

24. Before you joined the network, would you have considered the other two companies to be direct competitors of yours? Why/why not? Was it important that the target market was outside Ireland?

25. What have you learned from the networking process that has been useful to you for other areas of your business?

26. What percentage of your business do your foresee coming from the network over the next five years?

COOPERATION IN THE INDUSTRY

27. Has your company been (or is currently) involved either formally or informally with other furniture firms? When? With whom?
    - Subcontracting
    - Sub-supply
    - Joint ventures – production, product development, marketing

28. Are there other companies in your sector you would consider cooperating with? Who are they? Why/why not?

29. Are there other companies in your locality you would consider cooperating with? Who are they? Why/why not?

30. What are the main competitive issues facing your company in the future?

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Appendix B: Empirical Instruments for Paper 3

1. Integrated Interview Guideline

2. Standardised Questionnaire

Integrated Interview Guideline

I. *Is there a specific LTI knowledge base?*

1. Where is the relevant production-process knowledge mainly "localised"? (machinery, manuals, engineering department, skilled workers ...)

2. Does the firm regularly use external competence and/or knowledge resources? If so, which and for what? How do they absorb it?

3. How important is the supply of new technological or engineering knowledge generated outside compared to the experience and knowledge of own personnel?

4. Which types of knowledge are relevant for processes, e.g. experiences of specific employees, specific engineering knowledge?

5. Is there a specific tradition concerning production and/or design methods and practices?

II. *Are there LTI-specific ways to generate and use knowledge resources?*

1. From where and how does the firm obtain information and knowledge they need (on markets, technology, trends)?

2. How does the firm introduce new process technologies: purchase standardised components (ramp-up!) or develop the technologies themselves? Who is involved in each case?

3. How does the firm assure that relevant process knowledge accumulated through experience does not get lost? How do they protect relevant knowledge?

4. Does the firm use any formal systems or instruments of knowledge management, quality assurance etc.? How significant are IT-technologies for storing and handling of knowledge in the company? (access to database etc.)

5. Does the firm identify specific problems and barriers that keep them from being innovative? Possibilities to improve the situation?

III. *Are there LTI-specific patterns of innovation?*

1. As for product innovation, how does the firm know in which direction to go? In the case of recent far-reaching process innovation: background and reasons for it?

2. Are there any innovation *projects* or does it "just happen"? (actors involved etc.)

3. Do the firm use any formal methods to stimulate (e.g. incentive schemes) and organise innovation?

4. Who (inside and outside the plant) is typically involved in the innovation process?

5. How does the firm incorporate new scientific knowledge? With which personnel? Are there sufficient training programmes etc. adapted to an LTI environment?

IV. *Collaboration and interchange between low-tech firms and high-tech firms (vertical; value chain)*

1. Does the company merely deliver components according to well-defined demands or is it involved in the definition?

2. Who in the company talks to whom on the side of the partner and about what?

3. In case of a component supplier: Is there a pre-defined clear-cut interface between their product and the high-tech environment in which it will work?

4. Or are they involved in e.g. design specifications of the customer product? How?

5. What and how do they learn in such an interchange?

V. *Other co-operation in innovation (horizontal; networks/innovation system)*

1. Does the firm consider more co-operation (or any) as economically useful? In what respect? With whom and how?

2. Are there any lasting interchanges between them and other actors that are important for the way they do business?

3. With whom? (universities; other companies: customer/supplier, low/high tech; others)

4. Where are the partners located (in the region/elsewhere)? What kind and content of interchange?

5. Have there been any projects jointly developed with customers and/or suppliers?

VI. *In which way do market conditions shape/influence innovative behaviour?*

1. Why do they innovate at all?

2. How receptive are their major customers to product innovation?

3. How turbulent are the relevant product markets?

4. Degree of competitive pressure?

5. Situation on the relevant labour market?

VII. *Organisational innovation*

1. Prevailing forms of work organisation on the shop floor? How permeable is the hierarchy in terms of knowledge flows? Is there a need for change?

2. Changes in work organisation in the last five years? (background, reasons)

3. Are capital-intensive or labour-intensive modes of production predominant? Is automation considered a means to improve productivity and competitiveness?

4. Plans to change working conditions (working time, wages etc.)?

5. How do they improve the internal qualification level? (e.g. systems of vocational training, further education, changes in work organisation)

VIII. Workforce policy; industrial relations

1. Prevailing modes of personnel recruitment? Role of works councils, trade unions etc. in personnel policy?

2. Workforce qualification? Recent changes; current plans; future perspectives?

3. Does the company participate in staff training programmes with other companies or organisations? (e.g. associations)

4. Do they employ specialised personnel for R&D and/or design? (number? qualification? tasks?)

5. If so, how do they interact with other departments etc.?

IX. Policy

1. Role of political institutions and legislation on regional, national and European level? Who are the policy decision-makers? Is the firm able to influence policy makers? How should policy be formulated for this industry?

2. Are there specific policies in the region/locality that give the company a competitive advantage compared to competitors? How do these policies affect the firm's behaviour/ability to innovate/be competitive? What changes, if any, should be made to these policies?

3. What policies (industrial, innovation, employment, training, gender/equality, environmental sustainability, regional, immigration, other) impact positively/ negatively on the company? In what ways? How do these policies affect firms behaviour/ability to innovate/be competitive? What changes, if any, should be made to these policies?

4. Do they receive financial or other assistance (advice) from any organisation/ institution towards, R&D: Non-R&D activities (e.g. Product design, Trial production and tooling up, Marketing/market analysis, Patents and licences), Investment in plant, machinery and equipment: How do these policies affect the firms behaviour/ability to innovate/be competitive? What changes, if any, should be made to these policies?

5. Are there policies to enhance/encourage interaction/cooperation with other firms/ organisations/institutions? What are these policies? Who operates them? Where are the firms/organisations/institutions based? Are these initiatives successful? How do these policies affect the firms behaviour /ability to innovate/be competitive? What changes, if any, should be made to these policies?

Standardised Questionnaire

Basic data of the company

Q01. The company is a

- ❑ single plant
- ❑ headquarters with *several* plants
  Number of other plants (nationally) □□□
  Number of other plants (internationally) □□□

  In which countries?
  □□□ .....□□□ .....
  □□□ .....□□□ .....
- ❑ part of an alliance or group of companies,
  as a:
  - ❑ department
  - ❑ legal independent subsidiary
- ❑ Other .....

Q02. To which industrial sector does the company belong?
.....

NACE-Code (if known): .....

Q03. What year was the company established?

Q04. How is your company structured?

- ❑ By function: .....
  .....
- ❑ By division/branches: .....
  - ❑ according to products
  - ❑ according to regions
  - ❑ according to customers
- ❑ Matrix, according to .....

Q05. **What was the company´s *turnover* in 1997 and 2002?**
In the next two years, do you expect turnover to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future
Turnover total (Mio. €)			+ 0 -
What percentage of turnover is due to			
- *national sales*			+ 0 -
- *international sales*			+ 0 -

Q06. **What were the total *investments* by the company in 1997 and 2002?**
In the next two years, do you expect investments to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future
Total investments (M€)			+ 0 -
Investments in:			
R&D			+ 0 -
Patents & licences			+ 0 -
Product design			+ 0 -
Trial production & tooling up			+ 0 -
Marketing			+ 0 -
Plant/Machinery/capital equipment			+ 0 -
Training			+ 0 -
Logistics			+ 0 -
Other			+ 0 -

Q07. **How many *employees* did the company have nationally and internationally in 1997 and 2002?**
In the next two years, do you expect employment to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future
Total number of employees			+ 0 -
Percentage of which:			
- *national*			+ 0 -
- *international*			+ 0 -

Q08. **How many employees are there in each *department* of the company (national)?**
In the next two years, do you expect employment in each department to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future
Research & Development			+ 0 -
Production planning			+ 0 -
Manufacturing/Production			+ 0 -
Quality control			+ 0 -
Purchase, material administration, logistics			+ 0 -
Sales			+ 0 -
Commercial management			+ 0 -
Other			+ 0 -

3. The Production Process

Product families

	I	II	III
Q09. **What 3 main product ranges are produced by the company?**	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
	.....	.....	.....
Q10. What are the respective shares of turnover?	ca.	ca.	ca.

Q11. Are your company's products?

Custom-made products	☐	☐	☐
Products with variations	☐	☐	☐
Products without variations	☐	☐	☐

Q12. *How many individual components* are needed to make up the final product?

	☐	☐	☐

Q13. How would you describe your production process?

Single or low volume production (< 20 pieces)	☐	☐	☐
Medium volume production (20 - 1.000 pieces)	☐	☐	☐
Mass production (> 1.000 pieces)	☐	☐	☐
Continuous process-production	☐	☐	☐

Q14. How is your production process organised?

Line production	☐	☐	☐
Workshop production	☐	☐	☐
Cellular manufacturing, islands, parallel flow production	☐	☐	☐

Q15. **What is the company's general competitive *strategy?***
(Please record in order of importance 1, 2, 3, etc)

Price-/Cost-leadership	☐	Diversification	☐
Quality-leadership	☐	Innovation-leadership	☐
Custom-orientation	☐	Other	☐
Concentration on core competences	☐	.....	

Q16. What programmes/initiatives/training did the company undertake last year in order to improve performance?
(Please record in order of importance to the company´s competitiveness, i.e. most important first)

Title	*Targets*
.....	.....
.....	.....
.....	.....

4. The Value-Chain

Q17. **How many suppliers and customers did the company have in 1997 and 2002?**
In the next two years, do you expect these to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future		
Suppliers			+	0	-
Customers			+	0	-

Q18. **How important is it for your suppliers and customers to be geographically close?**

	Not important at all				*Very important*
Suppliers	❑	❑	❑	❑	❑
Customers	❑	❑	❑	❑	❑

Reasons: .....

.....

3.1. The supply chain

Q19. **What was the overall value of inputs of goods and services?**
In the next two years, do you expect these values to increase (+), stay the same (0) or decrease (-)?

1997	2002	Future		
€	€	+	0	-

Q20. **Where are your suppliers based?**
In the next two years, do you expect these shares to increase (+), stay the same (0) or decrease (-)?

	1997	2002	Future		
Region			+	0	-
Other part of the country			+	0	-
EU countries			+	0	-
Countries exterior to the EU			+	0	-
Total	100	100	+	0	-

3.2. Interconnection with customers

Q21. **Where are your customers located? Approximately what percentage of your turnover arises from each group of customers?**

In the next two years, do you expect these shares to increase (+), stay the same (0) or decrease (-) ?

	1997	2002	Future
Region			+ 0 -
Other part of the country			+ 0 -
EU countries			+ 0 -
Countries exterior to the EU			+ 0 -
Total	100	100	+ 0 -

Q22. **What proportion of the company's turnover do the top three customers account for?**

In the next two years, do you expect that these shares will increase (+), stay the same (0) or decrease (-) ?

	1997	2002	Future
Main customer			+ 0 -
Second customer			+ 0 -
Third customer			+ 0 -

5. Links with external organisations/institutions

Q23. **What external organisations/institutions do you have active links with? What are these links?**

Organisation/institution	Type of link
University	.....
Research institute	.....
Industrial development agency	.....
Other	.....

Q24. **Where are these organisations/institutions located?**

In the next two years, do you expect these cooperations to increase (+), stay the same (0) or decrease (-) ?

	1997	2002	Future
Locally	❑	❑	+ 0 -
Region	❑	❑	+ 0 -
Other parts of the country	❑	❑	+ 0 -
Other EU countries	❑	❑	+ 0 -

Q25. **How important is it for these organisations/institutions to be geographically close?**

	Not important at all				*Very important*
University	❑	❑	❑	❑	❑
Research organisation	❑	❑	❑	❑	❑
Industrial development agency	❑	❑	❑	❑	❑
Other	❑	❑	❑	❑	❑

Reasons: .....

.....

Q26. **In which sectors is or has this cooperation been pursued?**
We also ask you to specify the geographical range in which your collaboration has taken/is taking place. More than one item can be checked off.

	Regional	**National**	**Global**
Technology/Research and Development	❑	❑	❑
Stocks/Purchasing	❑	❑	❑
Organisation/Administration	❑	❑	❑
Production	❑	❑	❑
Personnel/Qualifications	❑	❑	❑
Logistics	❑	❑	❑
Marketing	❑	❑	❑
Sales	❑	❑	❑
Post-sales services	❑	❑	❑
Management of plant and constructions	❑	❑	❑
Quality management	❑	❑	❑

Appendix C: 'Raw' furniture industry location quotients, 1973-2006

	1973	1977	1982	1987	1992	1996	2001	2006
Carlow	0.56	0.99	0.94	1.38	1.28	1.17	1.31	1.42
Cavan	0.62	0.68	1.24	1.31	1.47	1.41	1.96	1.67
Clare	0.00	0.23	0.44	0.45	0.38	0.28	0.26	0.23
Cork	1.02	0.84	0.87	0.91	1.00	0.84	0.88	1.02
Donegal	0.67	0.74	0.69	0.89	0.86	0.79	0.75	0.71
Dublin	0.63	0.62	0.70	0.59	0.68	0.70	0.60	0.60
Galway	1.11	1.34	1.09	0.91	0.96	1.06	1.02	0.86
Kerry	0.00	0.16	0.19	0.23	0.39	0.47	0.39	0.28
Kildare	0.34	0.48	0.61	0.84	0.78	0.80	1.06	1.02
Kilkenny	0.78	0.67	0.49	0.71	0.68	0.88	0.79	0.95
Laois	0.55	0.86	1.20	1.46	1.18	1.45	1.29	1.49
Leitrim	2.25	2.32	2.70	3.40	2.33	1.89	2.53	2.99
Limerick	0.00	0.34	0.55	0.34	0.46	0.46	0.59	0.61
Longford	1.48	1.44	1.57	1.73	1.61	1.86	2.11	2.57
Louth	1.60	2.15	1.61	1.60	1.29	1.44	1.42	1.58
Mayo	1.35	1.17	1.10	1.09	0.98	0.91	0.82	0.63
Meath	8.25	7.29	4.56	4.10	3.26	3.79	3.81	3.90
Monaghan	2.69	3.04	3.09	4.38	3.21	3.94	4.92	5.03
Offaly	1.24	1.55	1.70	1.61	1.57	1.10	1.50	1.52
Roscommon	0.24	0.00	0.43	0.67	0.83	0.48	0.77	0.36
Sligo	0.80	0.82	0.75	1.54	1.32	1.02	0.98	1.00
Tipperary	0.34	0.55	0.83	0.60	0.62	0.68	0.82	0.94
Waterford	0.97	1.15	0.89	0.83	0.87	0.79	0.95	1.36
Westmeath	1.92	1.49	1.26	1.54	1.77	2.12	1.96	1.70
Wexford	0.45	0.60	0.58	0.90	1.03	1.48	1.33	1.74
Wicklow	0.62	0.96	0.94	0.94	0.95	0.80	0.99	0.94