Globalization and Manufacturing Decisions: The Role of Industrial Districts and Subsectors in the Textile Industry

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Abstract

This paper analyses the role of industrial districts and subsectors on the impact of globalization and draws recommendations for specialization and diversification manufacturing decisions. The sample includes 9,684 Spanish manufacturing textile firms and the analysis is both cross sectional and longitudinal. The results show the positive impact of specialization on productivity (district effect) and of diversification on business growth (subsector effect). They also show that globalization tends to diminish the district and subsector effects over time. Nevertheless, the paper indicates to managers that the production function in textile firms has viability in Europe under certain conditions of specialization and diversification.

KEY WORDS: globalization, subsector effect, district effect, manufacturing, globalization and manufacturing.

INTRODUCTION

The textile-apparel industry represents most of traditional manufacturing in the EU member countries (see European Commission at http://ec.europa.eu/index_en.htm). Recently, however, this industry is facing important challenges that question its ability to survive and perform at the corporate level particularly in its production function (Dangayach and Deshmukh, 2001; Nordas, 2004; Golf, et al. 2005; Guercini, 2005; Smith, et al. 2005; Abernathy et al., 2006; Abecassis-Moedas, 2007). The source of those challenges can be found in the fast and unstoppable advances in information technologies, market deregulation and large reductions in transport costs, which together constitute what is commonly called globalization. These aspects put together define a new and more intensely competitive scenario and, in this way, globalization has become one of the phenomena that better explains the recent slowdown in some traditional industrial sectors in the EU (Buckley and Ghauri 2004).

The response of many manufacturing firms to delocalization or to higher import intensity has been to relocate production or close plants in order to reduce costs in labour-intensive tasks (Staber, 1997; Paniccia, 2002; Dicken, 2003; Marques, 2005). According to Buckley and Ghauri (2004), globalization is leading to a relocation of some of the key functions of a firm. Whilst production activities are being transferred to firms located in countries with lower labour costs, other firms that operate within the high value added functions are being integrated. As a consequence, the impact of globalization on traditional manufacturing sectors can be observed at the managerial level through the existence of a higher number of commercial firms and at the social level through the high number of jobs lost. This process is particularly noticeable in those areas where the textile sector is more concentrated. This means that manufacturers will have to achieve world class specialisation to be globally competitive (Dangayach and Deshmukh, 2001). In addition, other factors such as the strong revaluation of the Euro, or a general increase in income levels, have also changed cost patterns and are contributing to accelerate this process (Denis et al., 2006).

Given this environment in the EU's traditional manufacturing sectors, in recent years the industrial districts have been highlighted as optimal location and the diversification towards high value-added product lines has been recommended as an optimal manufacturing decision. On one hand, a great deal of the economic miracle experienced by mature sectors, mostly in Italy, has been attributed to the industrial district production model (Pyke et al.1990; Paniccia, 2002; Nassimbeni, 2003; Dunford, 2006). This positive impact is generally referred to as the “district effect”. On the other hand, in the textile industry, the joint strategy of diversification and innovation (diversification towards high value-added subsectors) is considered crucial in facing the changes that have been occurring in the competitive environment (Jones and Hayes, 2004; Buxey, 2005; IFM, 2007b). A number of scholars have pointed out that differentiation in manufacturing strategy leads to better performance (see e.g. Gupta, 1984 and Kathuria and Porth, 2001). The impact of this manufacturing decision can be called “subsector effect” due to the differences in performance across subsectors in the textile industry (Puig, 2007).

The concept of “industrial district” differs from that of “cluster” in that the former combines important structural elements that are absent from the latter: community of people, system of relationships and the localized process of division of labour. This combination allows a way of organizing production in a territory that helps explaining its evolution and success by means of vertical disintegration and flexible specialization of production by each firm, as well as a network of relationships established among neighbouring firms (Lazerson and Lorenzoni, 1999; Hadjikhani and Ghauri, 2001; Dei Ottati, 2002; Pietrobelli and Olarte, 2002). More recently, the concepts of localization, diversification and innovation tend to be present in any public or private initiative aimed at preserving industrial sectors especially in the textile-apparel sector (Stenng, 2001; Golf et al. 2005; Zourech, 2007).

Whilst discussing the importance of industrial districts and the choice of main manufacturing activity, the previous literature has rarely discussed operations management (Nassimbeni, 2003) and has not formally tested the joint significance of the impact of location and product lines choice. This aspect is very important for the performance and competitiveness of the firm (Skinner, 1969; Hayes and Wheelwring, 1984; Devaraj et al. 2004, Urgal-González and García-Vázquez, 2007). Buckley and Ghauri (2004) emphasized the impact of economic geography and location of manufacturing as a crucial factor for global performance of firms. However, the literature has not tested how the significance and magnitude of the impact of location and product lines choice may have been changing over time. This information is very relevant for manufacturing decisions and without it managers risk making ill-informed choices. In this context, our work fills the gap currently existing in the literature by providing novel evidence: first, a cross-sectional analysis of the average district and subsector effects over the 2002-05 period; second, a longitudinal analysis of the evolution of those effects over that period.

Another contribution of our work is to show how the impact of globalization can change across subsectors within the same industry. In this way we are able to provide, for the case of the Spanish textile industry, some indication of which manufacturing decisions would improve the international competitiveness of the industry. It is important to obtain evidence on the Spanish case for a number of reasons. Firstly, the textile sector is particularly concentrated in Southern EU, in countries such as Italy, Spain and Portugal (Stengg, 2001; Dicken, 2003). For this reason, the study of the district effect is particularly important in these countries. Secondly, in the context of worldwide liberalization in the textile sector from 2005, Southern EU risks losing economic activity in its traditional sectors of comparative advantage (Marques, 2005). Hence it is important to look at the evolution of those sectors over time. Thirdly, Spain is the 5th largest producer of textiles in the EU and it represents 8% (Eurostat, 2007) of employment in this sector, having an asymmetrically distributed textile industry with strong regional concentration (Callejón and Costa, 1995). Moreover, although there is much evidence for Italy, little is known about the Spanish case. Hence Spanish evidence can help in better understanding the role of industrial districts and of the main textile activity (subsector) in an era of globalization and, at the same time, it justifies important manufacturing decisions in a country where the management of the textile sector is highly visible and relevant.

With the objective of testing the moderating role of production, location and specialization (district effect) and diversification (subsector effect) on the impact of globalization, this paper is structured around five sections. Section 2 establishes a conceptual benchmark to analyse the influence of a model of organizing production based on the industrial district. This then allows us to establish a number of hypotheses that relate the model and its main textile manufacturing activity to firm performance.

Section 3 describes the study design and section 4 tests our theoretical hypotheses and discusses the empirical results. Section 5 summarizes our main conclusions and managerial recommendations for a manufacturing strategy.

CONCEPTUAL BENCHMARK

The textile sector is a representative example of a traditional manufacturing sector in crisis as the adaptation to the changes introduced by the internationalization of markets and technological change has been difficult. In fact, Table 1 shows the negative change registered in some main indicators. Over a four year period (2002-05), 11.9% of jobs have been lost in the EU-25 and the figure is even higher (16.8%) in Spain.

Table 1: Percentual changes in the textile-apparel sector in 2002-05

	EU	Spain
Export/import ratio	-4.8	-14.6
Production	-10.0	-22.4
Employment	-11.9	-16.8
Number of firms	-20.0	-11.0

Source: Based on CITYC (2006), INE (2006) and Eurostat.

In addition to the crisis situation described above this industry has two important identifying characteristics. First, it has a tendency to locate in territorial production systems (Callejón and Costa, 1995; Stenng, 2001; Reimer, 2007). According to the Eurostat regional statistics, some clear examples of geographical concentration of the textile sector in EU regions are: Norte (Portugal); Véneto, Piemonte, Toscana and Emilia-Romagna (Italy); Nord-Westfalia, Bavaria and Baden-Württemberg (Germany); East Midlands and Lancashire (UK); Nord-Pas-de-Calais (France); and the Spanish regions of Cataluña and Comunidad Valenciana. Goglio (2002) reports that in Italy 35% of employment in the textile-clothing sector is geographically concentrated, whilst Boix and Galletto (2005) report a figure of 38% for Spain. Second, the various production tasks that integrate the textile value chain have a heterogeneous and interrelated character (Jódar et al. 1997; Jones, 2002; Buxey, 2005; Dunford, 2006). The heterogeneous character of the textile subsectors has been highlighted in various studies (Buxey, 2005; Golf et al. 2005; Taplin, 2006; Kilduff and Chi, 2006; IFM, 2007b; Puig 2007). All of them draw attention to significant differences in technological or labour intensity between the textiles and apparel industries, or between those activities in the initial stages of the value chain (yarn and finished products) and those pertaining to the final stages of production (clothing and distribution).

These elements put together suggest that the impact of globalization on the performance of textile firms will be influenced by the firm's main manufacturing activity (subsector effect) and by the firm's location (district effect).

Measurement of the industrial district and subsector effects

The interest in the study of industrial districts has boomed in the beginning of the 1970s as they were thought to be responsible, to a great extent, for the economic miracle experienced in certain industrial regions (for example, Oyonnax, in France; Jutland, in Denmark; Baden-Württemberg, in the former West Germany; Smäland, in Sweden; Vallès, in Spain; Silicon Valley and the Los Ángeles area, in the US; Cambridge in the UK; Sakaki in Japan, among others) and particularly in the center and north of Italy (Pyke and Sengenberger, 1990; Paniccia, 2002; Dunford, 2006). The district effect has, however, also been studied in other less developed areas outside Europe, allowing us to talk about a worldwide phenomenon, present in various economic sectors (some good examples are provided by Altenburg and Meyer-Stamer (1999) for Latin America, Das (1998) for India and McCormick (1999) for Africa).

The concept of industrial district has been developed as a model of industrial organization (Piore and Sabel, 1984), a type of enterprise network (Inkpen and Tsang, 2005) and also a way of organizing production (Lazerson and Lorenzoni, 1999, Nassimbeni, 2003). From the latter perspective it is a specific manufacturing system being formed by small, vertically disintegrated, manufacturing firms and a particular system of values, mixing competencies and cooperation, that makes them more efficient, flexible and innovative (Dei Ottati, 2002; Paniccia, 2002).

According to Becattini (1979), industrial districts are defined as a reality characterized by a geographically defined area and centred around a type of production mainly composed of a large number of SMEs, a flexible organization of production that allows satisfying a differentiated demand and strong linkages between economic and non-economic (sociological, cultural and ethical) factors.

The relative success of district firms, called "district effect" (Signorini, 1994ab), has been validated and measured quantitatively by means of the differences in performance between district and non-district firms in the same sector (Soler, 2000; Brasili and Ricci, 2001; Molina-Morales, 2001; Becchetti, et al. 2007). This is done using a "district dummy", a variable that indicates whether a firm belongs to the geographical area considered to be a district, in this way showing the advantages of belonging to a district using various measures of efficiency and profitability.

Similarly, a "subsector dummy" can be used, as is done in this paper, to compare the performance of firms in different subsectors. If significant differences are found, we can confirm the existence of a "subsector effect".

Research hypotheses

There is a consensus among a great deal of the literature related to industrial districts that, within a particular industrial sector, those manufacturing firms located in a district are more competitive than those located outside (Porter, 1998; Paniccia, 2002; Bell, 2005). The reasons for the competitive advantage conferred by the district location are related to the reduction in delivery times and logistic costs, as well as the avoidance of cultural differences and communication problems (Bolisani and Scarso, 1996). In spite of a few critiques to the limitations of the methodology (Paniccia, 1998; Tattara, 2001; Staber, 2007), there is a large number of studies that have shown empirical evidence with respect to the configuration of industry (Steinle and Schiele, 2002), the specific social and organizational characteristics of the territory (Dei Ottati, 2002) or the superior competitiveness of the firms in a district (Pietrobelli, 2000). Traditionally these variables have been quantified through economic and financial indicators of the firm such as productivity or profitability (Signorini, 1994b; Soler, 2000) and more recently the rate of growth of sales or of value added (Molina-Morales, 2001; Becchetti, et al. 2007), or international performance (Maccarini et al., 2003, Belso-Martínez, 2006; Becchetti et al., 2007).

Some evidence of the district effect in the Spanish textile-apparel industry is presented by Costa and Viladecans (1999), Soler (2000) and Pla-Barber and Puig (2007). The first study finds a positive district effect on export intensity. The second work provides some empirical evidence for that effect on firms' efficiency and vertical disintegration. The third validates the superior international performance of textile firms located in the district of Alcoi-Ontinyent.

One of the objectives of this paper is to test the effects of globalization on the performance of manufacturing firms operating in different product lines (subsectors) within the textile industry. Using productivity as an indicator of performance, and geographical location as a criterion to measure such effects, the following hypothesis is formulated:

Hypothesis 1: textile manufacturing firms located in an industrial district are expected to have higher productivity than those outside the district.

Although the district location is expected to be a necessary condition to achieve a better performance, it may not be a sufficient one. In addition to location, the economics and business literature has identified other factors that impact on profitability or market performance (Devinney et al., 2005). These can be either resources and capabilities inherent to the firm (Wernerfelt, 1984) or industry-level factors such as barriers to entry and exit and the degree of product differentiation (Porter, 1981). Although the existing empirical evidence seems to point to a more important role of firm-level effects, there is also some consensus around their dynamic nature (McGahan and Porter, 1997; Chang and Sing, 2000; Bou and Satorra, 2007).

Moreover, as argued before, the impact of environmental changes and the managerial strategic response of textile firms have created new competitive scenarios. The textile industry district is organised as a value added structure where competitiveness is derived from external economies of scale and scope, which allow district firms to benefit from cost savings (Enright, 1998; Becattini, 2002). For the Spanish textile-apparel industry in particular, the impact of the worldwide trade liberalization in the textile sector, implemented from 2005, is expected to be asymmetric, not only due to geographical concentration, but also due to heterogeneity across the different subsectors in this industry, particularly in terms of value added (Puig, 2007). Other studies (Buxey, 2005; Golf et al., 2005; Kilduff and Chi, 2006; Taplin, 2006; IFM, 2007a) that analyze the various competitive stages of the textile-apparel sector suggest that firms in manufacturing activities with different value-added levels face significant differences in demand conditions and competencies. These differences can thus create what we have called “subsector effect”. Based on this concept we formulate the following hypothesis:

Hypothesis 2: textile manufacturing firms in higher value added subsectors are expected to have higher growth of sales than those in lower value added subsectors.

At this stage, it remains to be established whether, among those manufacturing firms in higher value added subsectors, those that are located in an industrial district have a higher profitability than those located outside the district (Giuli, 1997; Smith et al., 2005; IFM, 2007ab). There is a strand of research that estimates the impact of industry-level and firm-level factors on the creation of value added (Hawawini et al. 2003) and of networks of firms and industrial districts on innovation and diversification processes (Baptista and Swann, 1998; Bell, 2005). Since the pioneering studies of Skinner (1969) and Hayes and Wheelwring (1984) a large literature has developed on the importance of an adequate match between the production function and the competitive strategy for the firm’s competitiveness (Joshi et al., 2003). However, the applications of that literature in the context of industrial districts are still scarce (Nassimbeni, 2003). For that reason, new research on the impact of product diversification towards higher value-added product lines in the context of manufacturing in industrial districts is crucial to derive strategic choices that allow textile firms to face the challenges brought by globalization (Young et.al., 1992; Buxey, 2005).

In line with authors such as Cairncross (1997), Dangayach and Deshmukh (2001), DeMartino et al (2006), Urgal-Gonzalez and Garcia-Vázquez, (2007), Dana et al. (2007) and Ward et al. (2007), in this paper we argue that there is a strong link between globalization, understood as a dynamic environment, and manufacturing decisions. The industrial district and the main manufacturing activity are expected to play a moderating role on the impact of globalization. That role, being based on a particular model of organization of production (Lazerson and Lorenzoni, 1999, Paniccia, 2002; Steinle and Schiele, 2002; Nassimbeni, 2003), should serve to guide manufacturing decisions and, as a consequence, to verify the reach and foreseeable effects of globalization on the textile industry and in this way fill the gap currently existing in the literature.

In attempting to fill that gap and as a consequence of the first two hypotheses, we now ask whether the manufacturing decision based on diversification towards less labour-intensive and more R&D-intensive manufacturing activities is of equal interest for district and non-district firms (Amin, 1993; Buckley and Ghauri, 2004). Given the special characteristics of the competitive environment and of the firms that they contain, it could be the case that industrial districts have a higher positive impact on the profitability of firms within high value added subsectors (Toni and Nassimbeni, 2003). This idea is summarized in the following hypothesis:

Hypothesis 3: textile manufacturing firms located in a district and simultaneously active in higher value-added subsectors are expected to obtain higher profits with respect to those that do not locate in a district and/or are active in lower value-added subsectors.

STUDY DESIGN

The population of the study is composed of the Spanish manufacturing firms in the textile-apparel sector (codes 17 and 18.2 of CNAE 93 and NACE Rev.1). Hence those textile firms whose main activity is related to the chemical or the commercial sectors are excluded. We cannot capture data for every single firm, even with the use of primary data obtained by surveys, as it is well known that not all firms respond. We can, however, attempt to have a sample that is as large as possible. The most comprehensive database existing for Spanish firms is the SABI database ("Sistema de Análisis de Balances Ibérico" – Iberian System of Balance Sheet Analysis), which is compiled jointly by Bureau Van Dijk and Informa using data collected from the "Registro Mercantil" – Public Company Registry. In fact, the Amadeus database compiled by Bureau Van Dijk for European firms replicates the information contained in the SABI database for Spain and Portugal. The SABI database contains information on over 550,000 Spanish firms and 65,000 Portuguese firms of various sizes (small to large), whilst others such as the Cabsa database contains data for the 5,000 largest Spanish firms. The use of SABI brings additional advantages, such as the level of disaggregation at both the geographical and sectoral levels. Finally, the SABI database has been widely used in research on Spanish and Portuguese firms (Iglesias et al. 2007; Jiménez and Palacín, 2007).

From this population we extract a sample based on a number of criteria. First, we define the time period as 2002-05. Our sample starts in 2002 because this year corresponds to the beginning of the implementation of the third phase of the WTO Agreement on Textiles and Clothing (ATC). The last year used in the analysis is 2005 for two reasons. Firstly, because it was the last year for which data was fully available in the SABI database and it was the first year of full implementation of the ATC. Secondly, we based our sampling on the declaration of main activity by the manufacturing firm, so that we considered only those firms returned under the primary code of "textiles" (subsectors 17.1 to 17.7) and "apparel" (subsector 18.2). In this way, we have excluded those firms that, although present in those subsectors, have declared another to be their main activity (for example, sales, machinery, chemicals or leather). According to the data extraction done in January 2008, the number of firms registered with main activity in the subsectors 17 and 18.2 in the textile-apparel sector added up to 11,022. Finally, from this initial number of firms we excluded those that expired or closed down (819), were in liquidation (377) or under non-capitalist legal forms (171). This is important because in this way we make sure that the lack of data is not due to attrition in our sample and also because the non-capitalist firms have other motivations beyond economic performance that might bias our results. After this process we were left with a total number of 9,684 manufacturing firms that we used as our sample.

Classification of productive activities (subsectors)

The literature dealing with the textile-apparel sector has been grouping its subsectors differently, depending upon the purpose of the study (Toyne et al., 1980; Jódar et al., 1997; Cluster Competitividad, 1999; Jones, 2002; Buxey, 2005; Kilduff and Chi, 2006; Taplin, 2006). In line with the more general proposal of Dalziel (2007) we believe that it is necessary to establish a clear framework and consequent classification of the activities that compose the textile-apparel sector so that the data can be comparable across different subsectors.

As suggested by Jódar et al. (1997), the textile-apparel industry can be classified according to the following three criteria: 1) inputs used; 2) type of productive activity; 3) integrating the two previous criteria. Following the third route we can create a classification that takes into account both the nature of the inputs and the classification of CNAE-93. Hence, we distinguish five main activities (subsectors): (1) Yarn (codes

17.1 and 17.2), (2) Finished products (17.3), (3) Home-technical (17.4 and 17.5), (4) Knitted textiles (17.6 and 17.7) and (5) Clothing (18.2). This classification has the agreement of one of the most influential associations of the textile sector in Spain (ATEVAL) and has the advantage of being more operational compared to other classifications commonly used (for example, the WTO classification of yarns, fabrics, made-up textile products and clothing).

Definition of the industrial district

Having defined the set of productive activities within the textile sector, we now need to account for the locations that will be the object of our empirical analysis. The methodology employed has been structured around two main stages.

The first stage is the identification of the main concentration areas at the municipality level using Coefficients of Specialization (CE). The Coefficient of Specialization (CE) is a statistical tool that measures the presence of an activity in a territory with respect to the presence of that sector in the whole reference sample. It is defined as: $CE_{ij} = \frac{E_{ij} / E_j}{E_i / E_n}$, where E_{ij} is employment in sector i in location j, E_j is total employment in location j, E_i is total employment in sector i, E_n is total employment in the country (in this case Spain). Given that in all previous work in this area the thresholds have been arbitrary and that the textile industry in developed countries shows a strong tendency towards concentration (O'Donoghue and Gleave, 2004), we have established a threshold of 10 points (high dependency).

The second stage is the grouping of those concentration areas in a well-known industrial district located in Alcoi-Ontinyent (Ybarra, 1991; Cluster Competitividad, 1999; Pla-Barber and Puig, 2007). This district is located west of the Alicante and Valencia provinces and employs over 15,000 people (8% of total employment in the Spanish textile-apparel sector). Its borders are defined by 8 centres of textile activity: Agullent, Albaida, Alcoi, Banyeres, Bocairent, Cocentaina, Muro and Ontinyent. Using this methodology, out of the total number of 9,684 firms in our sample, 749 (around 8%) are inside the district and the remaining 8,937 firms are outside the district.

Constructs

Table 2 briefly defines the three dependent variables used in our analysis: Productivity, Growth of Sales and ROA (Return On Assets). These variables have been chosen in accordance to our hypotheses and have also been used in a large number of previous studies of the "district effect" (Signorini, 1994b; Soler, 2000; Brasili and Ricci, 2001; Becchetti et al 2007) and in studies of Operations Management (Kotha and Swamidass, 2000; Kathuria and Porth, 2003). Other variables such as ROI (Return On Investment) or growth of value added, that have also been included in studies of the "district effect" or studies which used the SABI database, were not considered in this study after having found a strong correlation with the three dependent variables in Table 2.

Table 2: Description of dependent variables

Name	Code	Description	Formula
Productivity	**PR**	This activity ratio is defined as the contribution of employees towards the final account results.	$\frac{\text{Sales - Costs of Goods Sold - Other Operating Expenses}}{\text{Cost of Employees}}$
Growth of Sales	**GOS**	This activity ratio indicates the change in the volume of sales, this is, the increase or decrease of the business level with respect to the previous year.	$\frac{\text{Sales}_{n} - \text{Sales}_{n-1}}{\text{Sales}_{n-1}}$
Return On Assets	**ROA**	This profitability ratio indicates the average revenue obtained by a firm as a consequence of investing in assets.	$\frac{\text{Operational Profit}}{\text{Total Assets}}$

Source: Based on SABI (2008).

The independent variables of interest, also represented in our hypotheses, are three dummies: industrial district, subsector (CNAE) and their interaction. The industrial district dummy takes the value 1 if a firm is located in the industrial district and 0 otherwise. The dummies for each subsector (from 1 to 5) are defined as taking the value 1 if a firm belongs to that given subsector and 0 otherwise. This formulation allows us to distinguish also five types of firms located within the industrial district, which makes for the interaction dummies (five subsector dummies for district firms).

DeMartino et al (2006) find that firm-specific characteristics, such as size and age, are important influences in a cluster's response to globalization. In an attempt to account for firm-specific characteristics we consider size and age as two alternative control variables. These are used as alternatives due to the high correlation found between them. Firm size is proxied by the number of employees and firm age is given by the number of years the firm has been active in each year of interest. The period averages are computed as the mean number of employees in the sample period in the case of size and as the number of active years in the last sample year (2005) in the case of age. As the regression results obtained were identical for the two controls, we only report the results for the size control.

Analytical approach

In order to test the three hypotheses explained previously a regression analysis is carried out for each of the three dependent variables (productivity, sales growth and ROA). This is done first for cross-sectional period averages (2002-05) and then with a panel structure for the years 2002, 2003, 2004 and 2005 in order to test the different effect of globalization for district and non-district firms and across subsectors. Whilst the cross-sectional regressions provide average coefficients in the sample period (2002-05), the panel regressions add important insights, as they allow a view of how the district effect and the subsector effect have evolved in that period. This is even more important if considering that the sample period has brought the worldwide liberalization of trade in textiles and clothing due to the phasing-out and, in 2005, the end of the WTO Agreement on Textiles and Clothing (WTO, 2008). Hence the panel regressions provide a picture of how globalization may be impacting on the Spanish textile manufacturing firms and suggest some future trends.

The models built for the first two dependent variables have the same structure, although according to Hypotheses 1 and 2 the district effect is expected to be significant for productivity but not for sales growth. Following Hypothesis 3, the model built for the third dependent variable puts together the district effect and the subsector effect.

The cross-sectional regressions for each of the three dependent variables used are described by, respectively, equations (1), (2) and (3) as follows:

(1) $$lpr_i = \alpha + \beta_1 D_i + \beta_2 S_{ki} + \beta_3 lsize_i + \varepsilon_i$$

(2) $$gos_i = \alpha + \beta_1 D_i + \beta_2 S_{ki} + \beta_3 lsize_i + \varepsilon_i$$

(3) $$roa_i = \alpha + \beta_1 \left(D_i * S_{ki} \right) + \beta_2 lsize_i + \varepsilon_i$$

where *i* represents each firm in the sample, *D* is the district dummy (1 if firm *i* is in a district, 0 otherwise), S_k (k=1,…,5) is the set of five subsector dummies (1 if firm i is in subsector k, 0 otherwise), $lsize_i$ is the firm size included as a control variable specific to each firm, α is a constant term and ε is the error term. The numeric variables that only take positive values – productivity (*lpr*) and size (*lsize*) – have been logged to guarantee the log-normality of their distribution and to reduce the effect of very high values in the sample. This is common practice in empirical studies (see for example Gujarati, 2003).

Two sets of panel regressions have been carried out. In the first one, time effects are assumed to have an autonomous impact on the dependent variables, that is, they are included as intercepts. The resulting equations (4), (5) and (6) are given by:

(4) $$lpr_{it} = \alpha + Y_t + \beta_1 D_i + \beta_2 S_{ki} + \beta_3 lsize_{it} + \varepsilon_{it}$$

(5) $$gos_{it} = \alpha + Y_t + \beta_1 D_i + \beta_2 S_{ki} + \beta_3 lsize_{it} + \varepsilon_{it}$$

(6) $$roa_{it} = \alpha + Y_t + \beta_1 \left(D_i * S_{ki} \right) + \beta_2 lsize_{it} + \varepsilon_{it}$$

where *i* and *t* represent, respectively, each firm and each year in the sample, *D* and S_k are defined as before, Y_t is a year dummy, α is a constant term and ε is the error term. The control variable $lsize_{it}$ is now specific to each firm and each year, as both size and age of firms change over time.

Finally, time effects are allowed to influence the dependent variables through changes in the district effect and the subsector effect over time. The resulting equations (7), (8) and (9) representing this model are written as:

(7) $$lpr_{it} = \alpha + \beta_1 \left(D_i * Y_t \right) + \beta_2 \left(S_{ki} * Y_t \right) + \beta_3 lsize_{it} + \varepsilon_{it}$$

(8) $$gos_{it} = \alpha + \beta_1 \left(D_i * Y_t \right) + \beta_2 \left(S_{ki} * Y_t \right) + \beta_3 lsize_{it} + \varepsilon_{it}$$

(9) $$roa_{it} = \alpha + \beta_1 \left(D_i * S_{ki} * Y_t \right) + \beta_2 lsize_{it} + \varepsilon_{it}$$

where i and t represent, respectively, each firm and each year in the sample, $lsize_{it}$ is defined as before, α is a constant term and ε is the error term. The dummy variables D and S_k are now interacted with the year dummies Y_t so that their coefficients are allowed to change over time.

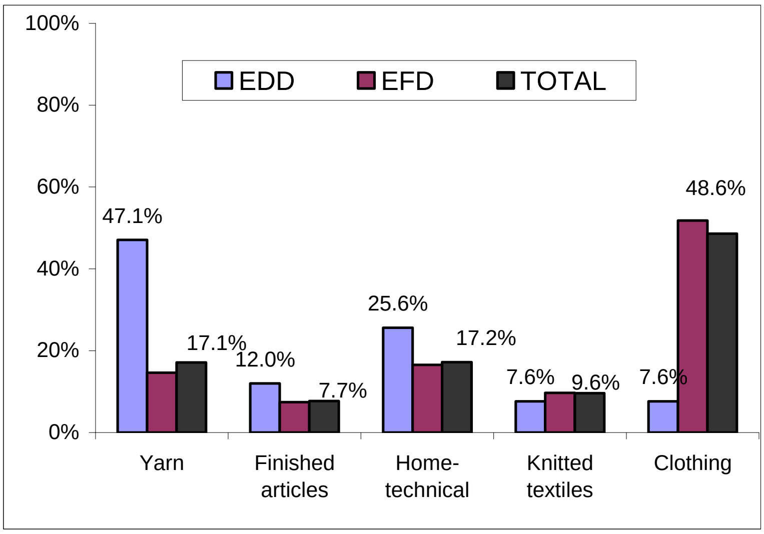
The regressions were run in STATA software with robust standard errors to account for heteroscedasticity in the sample. Compared to other softwares (for example, SPSS), STATA has the advantage of allowing an option for computing robust standard errors when running the regressions. The regression methods are Ordinary Least Squares (OLS) for the cross-section regressions and Generalized Least Squares (GLS) with random effects for the panel regressions. The Breusch-Pagan test validates the use of random effects for our sample. As Baltagi (2005) and Wooldridge (2002) provide good overviews of random effects models we omit their detailed discussion and instead focus on the interpretation of the results.

RESULTS AND DISCUSSION

A limitation of studies of industrial districts that has been highlighted in the literature relates to the design established for hypothesis testing (Paniccia, 1998; Tattara, 2001; Staber, 2007). One has to be careful in drawing conclusions as it could be assumed that certain differences in performance are due to the district effect when in reality they could be due to the subsector effect, or vice-versa. Hence, the first step of hypothesis testing is to analyze the specialization pattern of the industrial district of Alcoi-Ontinyent so that the performance of the district firms can be more clearly compared to that of non-district firms within the same production segments (subsectors).

Figure 1 shows the productive specialization of district firms (EDD) and non-district firms (EFD). The bulk of it falls on the Yarn (47.1%), Finished articles (12.0%) and Home-technical (25.6%) subsectors. The residuals of these three subsectors are positive and significant, so that the industrial district contains relatively more firms in these subsectors than would be expected given the distribution of the whole sample. Hence it could be the case that industrial districts are seen to perform better due to their subsectoral specialization rather than because of the district organization in itself. As a consequence, it is crucial to disentangle the district effect from the subsector effect, as is done in this paper. Only after accounting for the role of subsectoral specialization one can really measure the district effect.

Figure 1: Specialization pattern of the industrial district in 2006



Source: Based on SABI (2008).

The main descriptive statistics and correlations of the numerical variables are shown in Table 3. None of the correlation coefficients is higher than 0.5, however the measures of size and age (our regression controls) are positively correlated to a visible extent and, as mentioned before, for this reason they are included separately in the regressions. They are both positively correlated with productivity and ROA and negatively correlated with the growth of sales, which suggests that the changes occurring in the competitive environment have had a different impact on the various performance measures. For example, whilst larger and older firms have better financial results, they are worse-off than smaller and younger ones in revenue and sales terms.

Table 3: Descriptive statistics and correlation coefficients

		Mean	St. dev.	1	2	3	4
1	Size (employees)	18,19	58,43	--			
2	Age	12,96	10.32	0.436**	--		
3	Productivity	1,26	5,88	0.028*	0.078**	--	
4	Growth of Sales	12,59	70,51	-0.113**	-0.346**	0.058**	--
5	ROA	-6,23	38,49	0.102**	0.113**	0.325**	0.011

Note: (**) significant at 5%; (*) significant at 10%.

Table 4 shows the means (and standard deviations) of the numerical variables included in the regressions for the period 2002-05. These indicators disaggregated by subsector and district should be taken as simple indicators, as among non-district firms there is also a high percentage of geographically concentrated firms (Goglio, 2002; Boix and Galletto, 2005) and in some cases firms have very different sizes. These aspects put together lead to a higher standard deviation for non-district firms. As expected, on average district firms, with 17.5 employees, are smaller than non-district firms (Soler, 2000). Besides, the former are on average more productive than the latter. On the other hand, the growth of sales of non-district firms (13.12%) is higher than that of district firms. Finally, although ROA is negative, which shows the difficulties faced by the sector in the sample period, district firms have done better than non-district firms. With this data in mind, we can now test our initial hypotheses.

Table 4: Means (and standard deviations) of the numerical variables in the period 2002-05

		(1) Yarn	(2) Finished products	(3) Home-technical	(4) Knitted textiles	(5) Clothing	Mean
EFD	Size (employees)	25.6(63.0)	17.5(28.4)	17.4(58.3)	17.5(38.5)	16.7(66.8)	19.0(51.0)
	Productivity	1.35(2.8)	1.12(2.0)	1.34(3.4)	1.31(1.6)	1.23(8.2)	1.27(3.6)
	Growth of Sales	9.98(80.3)	16.32(74.8)	21.80(76.9)	5.37(51.0)	12.11(69.0)	13.12(70.4)
	ROA	-4.60(35.5)	-9.94(41.4)	-2.83(26.9)	-3.13(21.0)	-8.34(45.5)	-5.77(34.1)
EDD	Size (employees)	14.6(20.3)	31.4(60.6)	16.3(30.6)	13.8(25.5)	11.4(10.2)	17.5(29.4)
	Productivity	1.17(2.7)	1.48(1.2)	1.33(0.8)	1.29(0.8)	1.30(0.8)	1.32(1.2)
	Growth of Sales	4.08(63.7)	-0.56(36.8)	15.00(74.0)	-1.02(33.4)	17.70(60.1)	7.04(53.6)
	ROA	-4.03(30.9)	-5.38(33.6)	-2.13(15.8)	-6.08(29.2)	-4.94(41.3)	-4.51(30.2)

Hypotheses testing

Hypothesis 1 established a relationship between the location of a manufacturing textile firm in a district and higher productivity. The results in Table 5 clearly show that, even after accounting for differences in subsectoral specialization and in firm size (number of employees), the productivity of those manufacturers that are located in the industrial district is about 12% higher than that of the ones outside the district (following common practice, the marginal effect (ME) of a dummy variable when the dependent variable is given in logs is calculated using the expression ME=exp (coefficient)-1). It should also be noted that the role of the main manufacturing activity is on the whole significant (see F-test 2), hence ignoring it would lead to biased results, as has been the case in much of the previous literature.

Table 5: Cross-section regression results for H1 and H2

	Lpr	gos
District	0.114*** (0.022)	-4.126(2.886)
(1) Yarn	0.061*** (0.019)	-2.019(2.491)
(2) Finished articles	-0.013(0.022)	3.314(3.261)
(3) Home-technical	0.046**(0.018)	7.986*** (2.356)
(4) Knitted textiles	0.096*** (0.024)	-8.310*** (2.076)
Lsize	0.012* (0.006)	-6.384*** (0.721)
Constant	0.103*** (0.019)	25.359*** (2.226)
Observations	6938	6934
R-squared	0.010	0.017
F-test (1)	11.56***	20.75***
F-test (2)	7.00***	10.37***

*Note: Regressions run using the OLS estimator. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. F-test (1) tests H0: whole model insignificant. F-test (2) tests H0: subsectors effect jointly insignificant.*

Hypothesis 2 stated that those manufacturing firms that specialize in more R&D-intensive subsectors should have a higher growth of sales. These are the sectors where competition from low labour cost emerging markets would be less intense, hence where there would be higher scope for growth in high labour cost developed countries (Buxey, 2005). The results in Table 5 confirm this hypothesis, even after accounting for the impact of being in a district and for differences in firm size. As expected, there is no district effect for sales growth and firm size actually has a negative impact on sales growth. This result can be explained by the fact that larger firms are less flexible and it supports the idea that productive specialization, decentralization and cooperation bring a competitive advantage (Ward et al., 2007).

Taking subsector 5 (Clothing) as the benchmark, the only subsector that performs significantly better than the benchmark is subsector 3 (Home-technical), which is also the more R&D-intensive subsector (Buxey, 2005). The growth of sales in the Home-technical subsector is around 8% higher than in the benchmark Clothing subsector and thus the former outperforms all other subsectors. Effectively, Table 5 shows that the growth of sales is highest in the Home-technical subsector, even for firms outside the district. It should be noted that, once again, the choice of subsector is overall significant in determining firm performance (see F-test 2). From this point of view, it seems that the manufacturing decision activity is at least as important as the location strategy. In order to study this point in more detail, we now look at Hypothesis 3.

Hypothesis 3 postulated that textile firms would achieve highest ROA if simultaneously located in a district and specialized in an R&D-intensive subsector. The results in Table 6 validate this hypothesis. After accounting for differences in firm size, only two subsectors perform significantly better within the district: subsectors 1 (Yarn) and 3 (Home-technical). District firms in the Yarn subsector have a ROA 3.28% higher than non-district firms and are only surpassed by district firms in the Home-technical subsector, with a ROA 4.68% higher than non-district firms. The result for the Yarn subsector is somewhat surprising. As Table 5 shows, its productivity is higher than average (significant coefficient), but the growth of sales is not (coefficient not significant), making the subsector effect weaker for Yarn than for Home-technical (for which both coefficients are significant). In our view, there are two possible explanations for this difference. One is that the district effect may be in favour of the Yarn subsector, as it is significantly influencing productivity and this group is quite overrepresented in the district (see Figure 1). Another factor that may be driving the results is the different evolution of the subsectors, which may be linked to the response to worldwide liberalization in the textile sector.

Table 6: Cross-section regression results for H3

	roa
district*(1) Yarn	3.282*** (1.173)
district*(2) Finished articles	-1.350(3.844)
district*(3) Home-technical	4.684*** (1.128)
district*(4) Knitted textiles	0.137(4.463)
district*(5) Clothing	0.704(5.952)
Lsize	3.128*** (0.367)
Constant	-12.357*** (1.057)
Observations	7215
R-squared	0.011
F-test (1)	13.73***
F-test (2)	4.48***

*Note: Regressions run using the OLS estimator. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. F-test (1) tests H0: whole model insignificant. F-test (2) tests H0: joint district-subsectors effect jointly insignificant.*

From Table 6 it can be seen that, on the contrary, district firms in subsectors 2 (Finished articles), 4 (Knitted textiles) and 5 (Clothing) do not have a significantly higher ROA. Also looking at F-test (2) it can be seen that the subsector effect is once again significant on the whole. We have thus shown, through rigorous analysis, that the district effect can be subsector-specific and that the measurement of the district effect may be biased when specialization patterns are not taken into account.

The results in Tables 5 and 6 translate an average behaviour over the sample period (2002-05). However, they do not tell us how the district and subsector effects have evolved over time. Given the worldwide liberalization process in the textile sector during the sample years, changes in manufacturing firm performance are expected over time as adjustments to globalization take place (Nassimbeni, 2003; Buxey, 2005; Ward et al. 2007). In order to analyze the impact of globalization on manufacturing firm performance and distinguish that impact on district and non-district manufacturing firms, as well as across subsectors, we conduct a panel analysis. First we look at whether a significant time trend can be detected (Table 7) and verify whether that general time trend has a dissimilar impact on the district and subsector effects (Table 8).

The coefficients of the average time effects as explained in equations (4)-(6) are shown in Table 7 (all other coefficients remain as in Tables 5 and 6 and so are omitted). They are all (but one) significantly negative and also increasingly more so (see Chi-squared test 2). It is clear from the results that, independently of location, specialization and size, other forces were at work during the sample period that progressively worsened the performance of manufacturing Spanish textile firms. We call that bundle of forces "globalization".

Table 7: Panel regression results (average time effects)

	lpr	**gos**	**roa**
2003	-0.038*** (0.006)	-3.055*** (1.033)	-0.839 (0.525)
2004	-0.074*** (0.006)	-9.377*** (1.050)	-1.935*** (0.536)
2005	-0.108*** (0.007)	-13.122*** (1.072)	-3.432*** (0.551)
Chi-squared (1)	289.59***	184.54***	42.97***
Chi-squared (2)	113.45***	95.43***	23.00***

*Note: Regressions run using the GLS random effects estimator. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Only the year dummy coefficients are reported here. All other coefficients follow those of Tables 7 and 8. A Breusch-Pagan test validated the random effects model. Chi-squared (1) tests H0: year effects jointly insignificant. Chi-squared (2) tests H0: equal year effects.*

Finally, we ask whether the impact of globalization has been moderated by location decisions (district effect) and manufacturing decisions (subsector effect). Table 8 summarizes those results, with the full results provided in the Appendix. It can be seen that the district effect on productivity shows a diminishing trend over time, although it remains significant in the sample period. On the contrary, but as expected, the impact of the subsector effect does not survive the 2005 worldwide liberalization of trade in textiles, except for subsector 3 (home-technical), where it falls to half between 2002 and 2005, but still remains significant. The two subsectors with a significant joint district-subsector effect (Yarn and Home-technical) follow different trends, although the effect loses significance in both cases. The joint effect in the yarn subsector seems to be declining much faster than in the home-technical subsector. If we were to extend the analysis up to the current year (for which the data is still not available) we would likely see a negative joint effect for the yarn subsector but still a positive joint effect for the home-technical subsector. In this way, the latter proves to be the most resilient to globalization forces.

Table 8: Panel regression results (evolution of the district and subsector effects over time)

	lpr (district effect)	**gos (subsector effect)**					**roa (joint district-subsector effect)**				
		1	2	3	4	5	1	2	3	4	5
2002	0.120***	13.414***	19.188***	26.286***	10.385**	18.090***	7.349***	2.489	7.452**	3.280	6.337
2003	0.106***	9.628**	19.151***	22.556***	10.876**	14.320***	4.080	0.311	4.015	-0.967	6.940
2004	0.114***	8.442**	12.607***	14.843***	-1.476	8.133**	4.503	2.123	4.884	-0.425	-10.645
2005	0.103***	3.131	ND	14.068***	-3.702	4.084	-0.236	1.238	3.485	-0.338	2.969

*Note: Extracted from Tables A1 and A2. * significant at 10%; ** significant at 5%; *** significant at 1%.*

Discussion

The objective of this paper was to analyse the role of industrial districts and subsectors on the impact of globalization and to test whether specialization and diversification of manufacturing can be the best instruments to handle these evolving environments.

Our contribution, using both a cross-sectional and a longitudinal analysis, highlights three main findings. First, it shows the joint importance of the location in a district and of the manufacturing specialization chosen within the district. Second, it shows that despite globalization the textile production function is viable and competitive under certain conditions. Finally, it shows that the importance of those conditions can change over time through the action of external forces.

As a consequence, manufacturing firms that are located in industrial districts or adopt an organizational model similar to it respond differently to globalization according to their manufacturing specialization, that is, those that specialize in resilient subsectors will be able to better survive the forces of globalization. We show that, for Spanish textile manufacturing firms, the most resilient subsectors are those with higher value-added as suggested by Buckley and Ghauri (2004). We have reasons to believe that this result may be carried over to textile firms in other countries (Jones and Hayes, 2004; Guercini, 2004; Buxey, 2005). Globalization may in fact accentuate the importance of location in the case of industries that use intensively knowledge-based inputs (Porter, 1998; De Toni and Nassimbeni, 2003). This is certainly the case for subsector 3 (home-technical), where knowledge-based inputs are very important. Some case study evidence shows that manufacturing firms in the textile-clothing industry have survived globalization by focusing on a low-volume, niche market, competing in quality and strong design branding, and becoming more capital-intensive to overcome the shortage of highly-skilled workers (Buxey, 2005). For this reason, adequate manufacturing decisions relatively to the degree and type of manufacturing specialization are vital for the survival of firms in this industry. This confirms the discussion in the literature on the relationship between manufacturing and performance (Kotha and Orne, 1989; Kathuria and Porth, 2003).

Another important contribution of this paper is related to the trajectory followed by the district effect. Our conclusions are similar to those of previous literature on traditional manufacturing (Staber, 1997; Paniccia, 2001). Specifically about the erosion of the influence of district location, Pla-Barber and Puig (2007) test the impact of globalization on the internationalization of district firms, whilst Nassimbeni (2003) analyses the influence of strategies adopted by large producers in the eyewear industrial district and provides evidence that the district has lost most of its traditional features and inter-organizational relations have significantly changed. These conclusions raise important questions relating to the conditions under which the district production model should evolve, namely with respect to the value chain.

CONCLUSIONS AND RECOMMENDATIONS

The main objective of this work has been the study of the role of industrial districts and subsectors on the impact of globalization, which allows us to draw recommendations for specialization and diversification manufacturing decisions in a traditional manufacturing industry (textiles-apparel) in a country (Spain) where this type of manufacturing has had great importance from the economic, social and political point of view. We measure, in a period of intense liberalization in the textile sector (2002-05), two different but related effects – district (specialization) and subsector (diversification) – using cross-sectional and longitudinal analyses. Whilst the former gives us an average view of subsectoral differences, the latter allows us to discuss the evolution of those differences over time. Moreover, our results also act as moderators of the industry-level and firm-level effects (Devinney, et al. 2005). This is a novel contribution of the paper that had been absent from previous literature.

The cross-sectional results show that there is a clear district effect with respect to firm productivity, that is, those firms that locate in a district are more productive than those locating outside. These results are supported by other studies that also find a relationship between these variables (Signorini, 1994b; Soler, 2000; Molina-Morales, 2001). We also find a clear subsector effect with respect to sales growth, and a negative relationship between the latter and size. Hence, firms that focus on high value-added activities achieve a higher growth of sales. This is consistent with the Buckley and Ghauri (2004) discussion on the emergence of specialized global factories as a consequence of globalization. The finding supports the recommendation for a manufacturing strategy of specialization and diversification towards more capital-intensive subsectors (Giulli, 1997; Stenng, 2001; Abertany et al., 2007).

The longitudinal analysis also shows, as suggested in the work of Becattini (2002), Dunford (2006) and Pla-Barber and Puig (2007), that the district advantage is dynamic. These results are also found in recent studies about industry-level and firm-level effects (Bou and Satorra, 2007). Hence, globalization can either strengthen or, as is found here, weaken the advantages of locating in a district, or of other key determinants of a firm's performance. All in all, firms should not adopt a passive attitude in the presence of globalization. On the contrary, they can be more resilient to globalization if adopting the appropriate manufacturing strategy.

In particular, as a result of our analysis, a number of manufacturing decisions can be recommended. At the product level, managers should adopt a strategy of diversification towards higher value-added subsectors, expanding the available product variety by means of complementary lines that focus on niche markets and can have technological applications. These manufacturing decisions correspond to adopting a defender (niche-based) or a prospector (innovation-based) business strategy (Ward et al., 2007). At the firm and organizational levels, managers should adopt the model of the industrial district with vertical disintegration and flexible productive specialization. These decisions, which link the manufacturing function to competitive strategy, imply the specialization in core competencies, in order to gain flexibility, and the cooperation between enterprises and a range of other institutions (Technological Institutes, Associations of Entrepreneurs, Universities, etc). Our recommendations are compatible with other actions such as a greater commitment to international markets, international subcontracting and others described in detail in IFM (2007b). As globalization increases the dynamic character of the business environment, firms need to broaden the range of factors of competitive advantage by competing not only in price, but also in quality, design, customer support and image (Ward et. al, 2007).

The results in this paper are naturally subject to a number of limitations concerning the data and the geographical definition of the industrial district. Firstly, our conclusions were derived from a sample of Spanish manufacturing firms in the textile sector. We do not know if the results can be generalized to other countries and traditional manufacturing sectors, although some evidence points in that direction. A future step will be to test the robustness of our results in other traditional sectors (for example, footwear) and other countries (for example, Italy or Portugal). This can also be done for more recent years as data becomes available. Secondly, the data do not offer information about other key competitiveness factors in the value chain activities of the textile sector, such as innovation, that should be considered in future research. Other information, such as detailed data on costs and revenues, which would allow us to disentangle the causes of the differentiated evolution of the district and subsector effects over time, is not available either. Finally, the delimitation of the main manufacturing activity (subsectors) and especially of the industrial district remains to some extent arbitrary, although there is no guidance in the literature as to what is the threshold of specialization for a geographical unit to be considered to be inside a district, or whether those thresholds should be weighted with respect to population or type of industry. These questions remain for future research.

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APPENDIX

Table A1: Panel regression results with year-specific district and subsector effects for H1 and H2

	lpr	gos
district*2002	0.120*** (0.025)	-3.999(3.643)
district*2003	0.106*** (0.025)	-4.700(3.593)
district*2004	0.114*** (0.026)	-5.731(3.625)
district*2005	0.103*** (0.026)	-0.985(3.641)
(1) Yarn*2002	0.230*** (0.030)	13.414*** (4.260)
(1) Yarn*2003	0.156*** (0.030)	9.628**(4.251)
(1) Yarn*2004	0.124*** (0.030)	8.442**(4.264)
(1) Yarn*2005	0.062**(0.030)	3.131(4.214)
(2) Finished articles*2002	0.095*** (0.024)	19.188*** (3.848)
(2) Finished articles*2003	0.065*** (0.023)	19.151*** (3.747)
(2) Finished articles*2004	0.040*(0.023)	12.607*** (3.697)
(2) Finished articles*2005	ND	ND
(3) Home-technical*2002	0.174*** (0.030)	26.286*** (4.285)
(3) Home-technical*2003	0.149*** (0.030)	22.556*** (4.241)
(3) Home-technical*2004	0.101*** (0.030)	14.843*** (4.227)
(3) Home-technical*2005	0.107*** (0.029)	14.068*** (4.199)
(4) Knitted textiles*2002	0.244*** (0.033)	10.385**(4.669)
(4) Knitted textiles*2003	0.213*** (0.033)	10.876**(4.649)
(4) Knitted textiles*2004	0.157*** (0.033)	-1.476(4.688)
(4) Knitted textiles*2005	0.107*** (0.033)	-3.702(4.720)
(5) Clothing*2002	0.119*** (0.027)	18.090*** (3.835)
(5) Clothing*2003	0.089*** (0.027)	14.320*** (3.824)
(5) Clothing*2004	0.059**(0.027)	8.133**(3.829)
(5) Clothing*2005	0.026(0.027)	4.084(3.834)
lsize	-0.001(0.004)	-3.006*** (0.579)
Constant	0.058**(0.026)	7.118*(3.773)
Observations	23380	22537
Number of firms	7516	7315
R-squared (within)	0.0257	0.0183
R-squared (between)	0.0031	0.0005
R-squared (overall)	0.0128	0.0076
Wald Chi-squared	421.47***	256.59***
Breusch-Pagan test for random effects	4277.54***	26.54***
Chi-squared (1)	28.68***	3.65***
Chi-squared (2)	334.77***	225.32***
Chi-squared (3) - 2002	58.09***	22.19***
Chi-squared (3) – 2003	41.52***	19.61***
Chi-squared (3) – 2004	27.10***	19.38***
Chi-squared (3) - 2005	23.46***	24.07***

*Note: Regressions run using the GLS random effects estimator. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Wald Chi-squared tests H0: whole model insignificant. Chi-squared test (1) tests H0: no district effect over time. Chi-squared test (2) tests H0: no subsectors effect over time. Chi-squared test (3) tests H0: equal subsectors effect.*

Table A2: Panel regression results with year-specific district and subsector effects for H3

	roa
district*(1) Yarn*2002	7.349*** (2.718)
district*(1) Yarn*2003	4.080(2.748)
district*(1) Yarn*2004	4.503(2.760)
district*(1) Yarn*2005	-0.236(2.750)
district*(2) Finished articles*2002	2.489(5.023)
district*(2) Finished articles*2003	0.311(5.015)
district*(2) Finished articles*2004	2.123(5.079)
district*(2) Finished articles*2005	1.238(5.117)
district*(3) Home-technical*2002	7.452**(3.799)
district*(3) Home-technical*2003	4.015(3.724)
district*(3) Home-technical*2004	4.884(3.709)
district*(3) Home-technical*2005	3.485(3.735)
district*(4) Knitted textiles*2002	3.280(6.515)
district*(4) Knitted textiles*2003	-0.967(6.626)
district*(4) Knitted textiles*2004	-0.425(6.886)
district*(4) Knitted textiles*2005	-0.338(6.936)
district*(5) Clothing*2002	6.337(6.580)
district*(5) Clothing*2003	6.940(6.499)
district*(5) Clothing*2004	-10.645(6.601)
district*(5) Clothing*2005	2.969(6.593)
lsize	2.948*** (0.313)
Constant	-11.702*** (0.781)
Observations	24116
Number of firms	7651
R-squared (within)	0.0023
R-squared (between)	0.0112
R-squared (overall)	0.0068
Wald Chi-squared	116.26***
Breusch-Pagan test for random effects	931.96***
Chi-squared (1)	25.74
Chi-squared (3) – 2002	1.04
Chi-squared (3) – 2003	1.21
Chi-squared (3) – 2004	5.12
Chi-squared (3) – 2005	0.78

*Note: Regressions run using the GLS random effects estimator. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Chi-squared test (1) tests H0: no joint district-subsector effect over time. Chi-squared test (2) tests H0: equal joint district-subsector effect across subsectors.*