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# Efficiency of the Textile and Clothing Industry in Poland and Spain

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**Abstract**
*The purpose of this paper is to compare the levels of efficiency of Polish and Spanish textile and clothing firms. The analyses were based on firm-level accounting data for the time period 1998-2001. Interestingly, for the period analysed we did not find any statistically significant differences between the efficiency of Polish and Spanish textile/clothing firms. The general result of this study shows that firms in both countries are, on average, relatively highly efficient in their production processes. The efficiency score reaches a level of 86% .*

**Key words:** *textiles, clothing, efficiency.*

## Introduction

The textile and clothing industry has traditionally played a very significant role in the economy of the European Union (*EU*). According to the latest statistics of the European Apparel and Textile Organization *EURATEX*, in 2005 there were roughly 154,000 textile and clothing enterprises producing a turnover of approximately 198 billion euros and employing more than 2 million people [1]. Over the last ten years there has been great concern regarding the competitiveness of this industry. The reason for this is that the textile and clothing sector has experienced the most turbulent chapter in its history with respect to the competition from low wage countries, the advance in technology, the development of new production plants,the rapid progress in information technology, and the increasing demand for variety (Owen, 2001) [2].

The particular cases of the Polish and Spanish textile and clothing sectors are no exception. The volatility of the environment, the development of a new competitive landscape and constant restructurisation can best summarise the textile-clothing situation in these countries. In both regions the textile and clothing sector has traditionally been an important part of the national industries as well as a large source of employment in the manufacturing sector. The Spanish textile and clothing industry is the fifth largest among the old EU member states, while Poland is the largest textile and clothing producer among the Central and Eastern European Countries. It is worth highlighting that the value added and employment figures of the textile and clothing industry are comparable for both countries, reaching approximately 5,000 million euros and 250,000 employees in 2002, respectively [3].

The problem of measuring efficiency and productivity across different industrial sectors is important to both firm managers and policy makers for a number of reasons. Firstly, efficiency and productivity are performance measures used to evaluate firms, which can be described as success indicators. Efficiency and productivity assessment derives useful information which may help both the worst and best performing firms to make improvements, and company managers to support their decisions. Finally, the measurement of efficiency and productivity is essential to policy making, designed to the improve performance of all industries; however, it is particularly crucial in the textile and clothing sector.

Motivated by the observations describe above, in this paper we compare the productivity and efficiency levels of textile and clothing firms operating in Spain and Poland. The period analysed consists of 4 years, between 1998 and 2001, the analyses being based on firm-level accounting data. The rest of the paper is organized as follows: the next section presents background literature on productivity and efficiency; section 3 describes the data used and the empirical procedure; section 4 analyses the results; while the final section summarises the conclusions.

## Productivity and efficiency

### Labour productivity

Every production process of a firm involves the use of a set of resources referred to as Inputs, which are then transformed into a set of outcomes called Outputs. The labour productivity ratio belongs to the family of partial productivity ratios defined by the general formula of a total Output to a particular Input. This is easy to compute and, consequently, widely used; however, it is conceptually unsatisfactory as it does not incorporate many other important factors, such as the firm's technology. Interpreting the labour productivity ratio, we might mistakenly attribute a gain in Output resulting from an increase in capital to labour, even though the performance of the labour worsened during the period considered. Therefore, comparing the productivity of countries, we can obtain an unfair image in favour of one country. To illustrate this, let us analyse a simple example. We sketch a graph on whose vertical axis we put the reciprocal of the labour productivity ratio, computed as, for example, Labour to Revenues, and on the horizontal - the reciprocal of the capital productivity ratio, that is Capital to Revenues (***Figure 1***).

The ratio L/Revenues can be interpreted as the labour requirement (how much work we need to produce revenues of one monetary unit), while C/Revenues are a capital requirement (how much capital is necessary to produce revenues of one monetary unit). For example, in the case of firm A, we can see that it requires a big quantity of labour but a small quantity of capital, which is contrary to firm B, which needs a lot of capital but very little labour. Therefore, if we only analyse the firm with respect to labour pro-

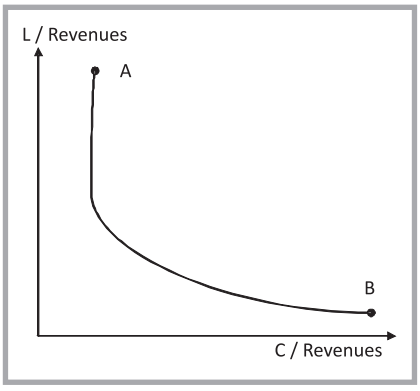


***Figure 1.*** *Labour and capital requirement.*

ductivity, we can conclude that the labour productivity of firm A is low compared to firm B. But if we take both dimensions into consideration, we see the situation slightly differently – firm A is less technological and requires more labour, while firm B substitutes labour with technology. That is why we need to consider more dimensions of a firm's production process by including the total factor productivity ratio, which is the Output index divided by the total Input usage index. There are many possible methods within this framework: one being the efficiency, which in addition to considering the multidimensionality of a production process, allows for comparison between firms.

**Efficiency**

Firm efficiency equals the maximisation of the ratio of Output to Input of the production process. In other words, the firm is efficient when it is at its best. According to the OECD definition, efficiency refers to the degree to which a production process reflects the best practice. Consequently, efficiency has a relative aspect because we are comparing firms with the best practice benchmark (frontier). The intuitive measure of efficiency is the result of comparing the observed with optimal values of the Input and Output within the firm's production process - it is the distance between the quantities of Outputs and Inputs observed and the quantities defining the best practice benchmark. Farrell (1957) [4] formally distinguished between Input and Output oriented efficiency measurement. He defined efficiency as one (100% efficiency) minus the maximum equi-proportional reduction in Inputs while maintaining the production of originally specified Output levels (Input orientation), or one (100% efficiency) plus the maximum augmentation of Outputs while still utilising the originally specified Input levels (Output orientation). According to such a definition, a score of unity would indicate efficiency, while a score less than unity (Input orientation) or more than unity (Output orientation) implies inefficiency. The measurement in terms of production possibilities described here results in the technical notion of efficiency; however, the comparison may also be conducted in terms of values (cost, revenue, profit), i.e. economic efficiency.

Let us consider a simple example to understand the technical efficiency concept and measurement. Suppose we have 4 firm: A, B, C and D, each of which uses one Input to produce one Output. Firms A, B and C are efficient and create an efficient frontier, while firm D is inefficient (***Figure 2***).

Let D´ and D´´ be a horizontal and a vertical projection of firm D on the frontier. Geometrically, the technical efficiency is the distance measured between firm D and its horizontal projection (Input orientation) or vertical projection (Output orientation) onto the production frontier. Hence, the technical efficiency of firm D in the Input reducing orientation is equal to:

$$TE_{input} = OD'/OD;$$

while in the Output orientation, it is the following ratio:

$$TE_{output} = ID''/ID.$$

One of the possible methods to estimate the efficiency described above is the Data Envelopment Analysis (*DEA*) approach. *DEA* applies linear programming techniques to observed Inputs consumed and Outputs produced by firms to obtain efficiency measures. Therefore, to compute the *DEA* efficiency, one needs information on the Inputs and Outputs to the production process. Next the *DEA* constructs an efficient production frontier based on the best practices. Each firm's efficiency is then measured relative to this frontier either in the Input reducing or Output augmenting orientation. This relative efficiency is calculated by obtaining the ratio of the weighted sum of all Outputs and the weighted sum of all Inputs. Because of the space limitation of this paper, we do not provide here a detailed description of the method. We would like to refer readers to the *DEA* seminal papers of Charnes et al. (1978) [5] and Banker et al. (1984) [6] as well as the monograph of Thanassoulis (2003) [7].

## Data and empirical methodology

Empirical analyses were carried out on samples of Polish and Spanish firms for the time-period 1998-2001, representing two *NACE Rev. 1.1* codes: 17 – Manufacture of textiles and textile products; and 182 – Manufacture of other clothing and accessories. In total we have 436 Polish and 565 Spanish observations for the entire period. We possess accounting data in the form of individual firm balance sheets and profit and loss accounts. These

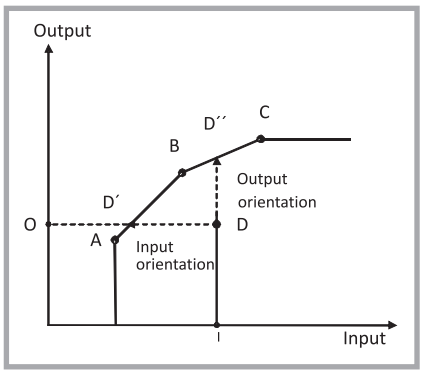


***Figure 2.*** *Efficiency example.*

data were collected from multiple sources that we linked together. In the Polish case, firm-level data were derived from two sources: the *AMADEUS* database and the "*MONITOR POLSKI B"*. *AMADEUS* is a data set containing financial information on over 7 million public and private companies in 38 European countries, including Eastern Europe, while *"MONITOR POLSKI B"* is a Judicial and Business Journal which publishes the financial statements of public and private companies in Poland. In the Spanish case, individual firm information was derived from the *SABI* database. *SABI* (Sistema de Análisis de Balances Ibéricos) contains financial accounts for over 650,000 Spanish and 80,000 Portuguese companies. Although we combine three different sources, the homogeneity of data is guaranteed because of the following: (1) we use public information regulated by harmonised accounting rules, (2) for most of the firms the information is audited and (3) *SABI* and *AMADEUS* are databases provided by the same firm, and the defintion of variables is exactly the same; at the same time the information on Polish firms contained in *AMADEUS* is derived from *"MONITOR POLSKI B"*. The data extracted from *AMADEUS* and *SABI* databases was expressed in thousands of US dollars at current international prices. Constant price measures were obtained using price index deflators, based on information from Spanish and Polish Statistical Offices. In addition, because the data taken from *"MONITOR POLSKI B"* was expressed in Polish currency (Polish zloty - PLN), it was calculated into US dollars using an exchange rate between USD and PLN for the 31st of December of each year, provided by the National Bank of Poland. The initial database was modified to check for outliers and extreme observations following the iterative procedure of Prior and Surroca (2004) [8]. ***Table 1*** presents the final

structure of the database, indicating the outliers as well.

Our empirical methodology follows two steps: first we compute the labour productivity ratio for Polish and Spanish textile and clothing firms. The labour productivity is measured as a ratio of firm revenues to the number of full-time employees. Then we compare the results with efficiency measures for both samples. To compute the efficiency, we use a linear programming technique called Data Envelopment Analysis (*DEA*), described briefly in the section above. We apply *DEA* in the Input orientation and use the following accounting Input-Output measures: Revenues (Output), Fixed assets, Costs of goods sold and the Number of full-time employees (Inputs). Finally, we run the Kruskal-Wallis nonparametric test in order to statistically compare the average efficiencies of both samples.

## Results

### Comparison of labour productivity

***Table 2*** reports the results of labour productivity in the textile and clothing industry in Poland and Spain for the time period 1998-2001.

The analysis shows that for 1998-2001 the labour productivity of Polish textile and clothing firms in the sample was almost 6 times lower than that of Spanish companies. At the same time, however, we can observe a convergence of the countries with respect to labour productivity – the results indicate that in 1998 the labour productivity in Poland was more than 7 times smaller, while in 2001 this gap was only 5 times. These results are similar to those reported by Wysokińska (2003) [9], who indicated that in the period 1996-1998 the labour productivity in the Polish textile and clothing industry was much lower than the average for old members of the EU. However, as we pointed out previously, partial productivity ratios such as labour productivity have some limitations. Although the results obtained are correct, we need a better procedure to measure firm performance, such as total factor productivity and, even better, efficiency.

### Comparison of efficiency

Let us now look at the efficiency results computed with *DEA* methodology. When we analyze the efficiency from multiple Input-Output perspective, we find different results (***Table 3***).

**Table 1**. *Final structure of the database – outliers indicated in parentheses.*

| NACE Rev. 1.1 Code | 1998 | 1999 | 2000 | 2001 | 1998-2001 |
|---|---|---|---|---|---|
| **POLAND** | | | | | |
| 17-Manufacture of textiles and textile products | 64 (4) | 67 (1) | 66 (2) | 67 (1) | 264 (8) |
| 182- Manufacture of other clothing and accessories | 43 (3) | 43 (3) | 45 (1) | 41 (5) | 172 (12) |
| **TOTAL** | **107 (7)** | **110 (4)** | **111 (3)** | **108 (6)** | **436 (20)** |
| **SPAIN** | | | | | |
| 17-Manufacture of textiles and textile products | 93 (6) | 94 (5) | 96 (3) | 94 (5) | 377 (19) |
| 182- Manufacture of other clothing and accessories | 46 (8) | 49 (5) | 47 (7) | 46 (8) | 188 (28) |
| **TOTAL** | **139 (14)** | **143 (10)** | **143 (10)** | **140 (13)** | **565 (47)** |

***Table 2.*** *Comparison of labour productivity for textile and clothing firms operating in Poland and Spain, 1998-2001 (in thousand USD).*

| Labour productivity | 1998 | 1999 | 2000 | 2001 | 1998-2001 |
|---|---|---|---|---|---|
| **POLAND** | 22.48 | 22.37 | 29.96 | 28.62 | 25.88 |
| **SPAIN** | 162.04 | 146.65 | 151.67 | 144.38 | 151.15 |

***Table 3.*** *Efficiency results in Polish and Spanish textile and clothing firms, 1998-2001, * values of standard deviation are indicated in parentheses.*

| | 1998 | 1999 | 2000 | 2001 | 1998-2001 |
|---|---|---|---|---|---|
| **POLAND** | 0.86 (0.12) | 0.83 (0.12) | 0.87 (0.09) | 0.88 (0.10) | 0.86 (0.11) |
| **SPAIN** | 0.86 (0.11) | 0.85 (0.12) | 0.85 (0.12) | 0.86 (0.12) | 0.86 (0.12) |
| **Significance levels** | 0.99 | 0.11 | 0.17 | 0.74 | 0.95 |

Interestingly, we can observe that for the time period 1998-2001 there is no statistically significant difference between the efficiency of Polish and Spanish textile and clothing firms in our samples, neither if we analyse year by year nor when we take the aggregate measure for the whole period (we can not reject the hypothesis that there are no significant differences in the efficiency between Polish and Spanish firms as the significance levels obtained are always higher than 0.1). The average efficiency found is pretty high, reaching the level of 0.86 (86%), which indicates only the 0.14 (14%) inefficiency. But there is still scope for efficiency improvement, and companies can reduce the Input to 0.14 (14%). Also, standard deviations of efficiency are reasonably low, which suggest that the analysis yielded reliable efficiency scores. Therefore, in relative terms the distance between textile and clothing firms in Poland in Spain is non-existent, as it was in the case of labour productivity.

## Discussion and conclusions

This study has investigated the efficiency levels of samples of Polish and Spanish textile and clothing firms for the time period 1998-2001. For the total period analyzed, we have 436 observations in Poland and 565 observations in Spain. As a starting point, we began with a comparison of the basic partial productivity ratio i.e. the labour productivity, computed as the firm revenues to the number of full-time employees. We have concluded that Spanish firms are about 6 times more labour-productive than Polish ones; however, this gap is becoming smaller, indicating the occurrence of a convergence process between the countries. This result is in agreement with Wysokińska (2003) [9]. However, focusing on labour productivity, although we get correct results, we obtain only a small part of the real situation as such a ratio does not take into account, for example the technology the firm uses. Consequently, the ratio works pretty well for doing the analysis inside one country where the technological conditions are similar but might give unfair results when comparing more countries. The answer to this problem is the total factor productivity ratio and efficiency which allow for the multidimensionality of the firm's production process. One of the possible methods within this framework is the linear programming method of Data Envelopment Analysis (*DEA*), which we used to extend the la-

bour productivity results. Interestingly, the efficiency results obtained with this approach indicate that Polish and Spanish textile and clothing firms are equally efficient, reaching an efficiency level of 86%. That is firms in both countries do equally well, when taking the technology they posses into consideration. In view of these results, we can further conclude that we need to complement traditional labour productivity ratio analysis with another method of performance assessment, such as *DEA,* in order to obtain a wider picture of the situation in industrial sectors across different countries. This makes labour productivity only a starting point when analysing firm performance. Such results also highlight a certain similarity between the Polish and Spanish textile and clothing industries, as indicated by the introductory statistics.

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