Quality certification and performance of Brazilian firms: An empirical study

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Abstract

The paper studies the relationship between quality certification, as indicated by the ISO 9001 and 9002 certificates, and the performance of Brazilian firms since 1992. The comparison between the group of certified firms and an especially constructed control group indicated that, as a rule, one cannot discern differential levels of performance across the two groups for different indicators. \textcopyright 2000 Elsevier Science B.V. All rights reserved.

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1. Introduction

The increasing degree of competition in several markets following, for example, trade liberalization processes, has underscored the importance of non-price competition in a global market. In this sense, the growing significance of global best practices is emblematic, including the total quality management (TQM) schemes in the modern corporation, and accordingly one can observe a large literature on the topic within the management field. Representative contributions include Garvin [1] and Deurtouzos et al. [2].

The importance of the quality dimension of productive processes, however, has received less attention in the context of economic analysis. Leibenstein [3] advanced the possibility of non-allocative forms of inefficiency in a typical firm. This form of technical inefficiency, the so-called “x-inefficiency”, consists of intrinsic characteristics derived from organizational complexities. An example might be given by sub-optimal effort levels within a principal–agent relationship.

In addition to this generic contribution, one should emphasize the work of Barron and Gjerde [4] which constructed a model on the adoption of TQM programs. The theoretical framework addressed the trade-offs involved in the referred issue by means of a modified cost function which incorporated the effects of TQM programs. The relevant trade-offs of the adoption of TQM can then be examined by confronting benefits of adoption with the related cost (e.g. training costs). Testable implications of the model included explanatory factors which favoured TQM adoption such as the...
number of employees, rate of turnover and access to internal funding. The empirical results largely support the theoretical formulation for a sample of US firms.

Having considered the issue of the adoption of TQM programs, it is relevant to assess whether the related firms have experimented superior levels of performance in comparison with their counterparts which have not adopted those programs. Easton and Jarrel [5] follow this line of investigation. In fact, the aforementioned paper conceives the construction of control groups that allows comparison with firms which have not adopted TQM. The evidence indicates that performance in terms of accounting measures and stock returns is improved for the firms adopting TQM.

Withers et al. [6] investigate the impact of TQM and/or just-in-time (JIT) systems as precursors to ISO 9000 certification. The work, based on attitude questionnaires, indicated that within the group of firms adopting either of those management systems, there was a better understanding by managers of the importance of factors pertaining to quality training and top management commitment, for example. There is, nonetheless, a gap in the empirical literature on quality certification. The present paper aims at investigating the possibility of differential performance levels among firms which have received ISO 9001 and 9002 quality certificates and those which have not. The paper is organized as follows: Section 2 briefly outlines the empirical framework to be considered in the sequence and describes the data. Section 3 presents the empirical results. Section 4 summarises the conclusions and considers possible directions for future research.

2. Quality certification and performance: An empirical framework

The contribution of Easton and Jarrel [5] indicated that firms adopting TQM tend to have superior performance levels. In principle, one could consider the quality certification process, as represented by the ISO 9000 series, as the outcome of previous efforts involving programs such as TQM, for example. This interpretation further motivates the development of a performance-comparison study in the context of quality certification. In particular, one will be interested in verifying whether the firms which received the ISO 9001 or 9002 certificates display superior performance levels. A crucial issue in this type of study is to define a control group carefully. For that purpose, we can follow the lead of the previously mentioned authors and consider a criterion suggested by Barber and Lyon [7], namely by constructing a control group with firms of the same two-digit sector and with similar (10% above or below) performance on the basis of operating income to total assets, in the year previous to certification. Specifically, we make use of two basic data sources. First, the Brazilian technical norms entity (Associação Brasileira de Normas Técnicas-ABNT), by means of its CB-25 division, provided a nominal list of the firms receiving ISO certificates within the 1992–1998 period. Second, we considered the most extensive firm-level data source on accounting data for Brazil. We relied on the Getulio Vargas Foundation databank on the 1000 largest firms in Brazil, which was available for the 1986–1996 period.

Having access to the aforementioned sources, the construction of the control group was considered. Following the criterion mentioned before, we were able to generate a control group with two firms for each certified firm. The similarity criterion was considered in terms of five different return indicators: operating income to total assets (OITA), net income to total assets (NITA), sales to total assets (SATA), operating income to sales (OISA) and net income to sales (NISA). The criterion used here for construction of the control group requires the availability of the relevant accounting figures (operating income and total assets) for the year before certification. In addition, we disregarded ISO 9003 certifications because of their reduced number and thus concentrated on 9001 and 9002 certification. Taking these caveats as reference, we were able to work with a sample of 129 firms, 48 referring to the ISO 9001 certificate and the remainder to the ISO 9002 certificate. The sectoral distribution of the certificates appears in Table 1.

Inspection of the table shows that capital-intensive sectors (e.g. Chemicals, Machinery, Metals, Steel and Transport Materials) display a relatively
3. Empirical results

In this section we undertake the sign test and the Wilcoxon signed-rank test to assess statistically whether there is any discernible difference between the performances of the two relevant groups. The former test takes medians as reference, whereas the latter considers differences in the means of the group of certified firms and the control group in terms of the five selected performance indicators. The Wilcoxon signed-rank test is reputed to have more power than the popular sign test because the former only uses the sign of pairwise differences. The set of tables presented below shows the value of the test statistics together with the 2-tailed exact p-values.

We first consider ISO 9000 certificates in general. The results are displayed in Table 2 below.

The results indicate that, except for the SATA indicator, there is no significant difference between the two groups for the two tests. When we consider sub-groups by certification age, as shown in Tables 3 and 4, similar evidence is obtained. In fact, only for the SATA indicator can one detect a strong result in terms of a superior performance by certified firms, as indicated in Table 4, whereas one can observe some evidence of differential performance in terms of the NISA indicator for the Wilcoxon test in the same table.

Next, we consider the tests by ISO 9000 sub-type. The general results for the ISO 9001 are presented in Table 5. Once more the evidence does not favour differential levels of performance and only in the case of SATA can we reject the null hypothesis of the test. If we consider the evidence by certification age, as shown in Tables 6 and 7, the same type of result emerges with the addition of a close rejection of the null hypothesis for the NISA and OISA indicators.

Finally, we present the results concerning the ISO 9002 certificate. Table 8 considers the group as a whole and the results are similar to the previous ones. There is strong evidence favouring the null

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Table 1
ISO 9000 certification

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number of certified firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary services for Econ. activity</td>
<td>2</td>
</tr>
<tr>
<td>Cellulose and paper</td>
<td>7</td>
</tr>
<tr>
<td>Chemicals</td>
<td>24</td>
</tr>
<tr>
<td>Communication and electrical material</td>
<td>15</td>
</tr>
<tr>
<td>Construction</td>
<td>1</td>
</tr>
<tr>
<td>Food processing</td>
<td>1</td>
</tr>
<tr>
<td>Machinery</td>
<td>16</td>
</tr>
<tr>
<td>Metals</td>
<td>16</td>
</tr>
<tr>
<td>Metallic minerals extraction</td>
<td>5</td>
</tr>
<tr>
<td>Non-metallic minerals transformation</td>
<td>4</td>
</tr>
<tr>
<td>Pharmaceutical and veterinary products</td>
<td>1</td>
</tr>
<tr>
<td>Plastic material products</td>
<td>4</td>
</tr>
<tr>
<td>Retail trade</td>
<td>1</td>
</tr>
<tr>
<td>Steel</td>
<td>10</td>
</tr>
<tr>
<td>Textiles</td>
<td>1</td>
</tr>
<tr>
<td>Transport material</td>
<td>14</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>4</td>
</tr>
<tr>
<td>Wood</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
</tr>
</tbody>
</table>

*Source: ABNT and authors’ construct*

large number of certifications. Moreover, one observes a larger number of certificates in technically advanced sectors in contrast with the remaining sectors in which the number of ISO certificates is very small.

The rest of the paper considers the comparison of the group in which firms received ISO 9000 certificates with a control group. As mentioned earlier, given the available data, one can generate two control firms for each certified firm. It is possible to compute the average on these control firms and then generate a control group with the same size as the group of certified firms. These groups can then be compared in terms of a two-related-samples nonparametric test. The results obtained from these statistical tests are presented in the next section.

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1 Since the samples were not randomly chosen, the related-sample procedure will be more appropriate. In fact, Easton and Jarrel (1998) raise this point in the similar context of their paper.

2 Authorative expositions of these widely used tests appear in [9] and [8].
hypothesis except for the SATA and NISA indicators.

When we consider sub-groups by certification age the results are basically sustained. In the case of firms with less than 2 years of certification the evidence is even stronger, as indicated in Table 9, where we cannot reject the null hypothesis for any of the selected indicators (only marginally for NISA in the case of the sign test).

When one considers the sub-group of firms certified for at least 2 years the results are very similar, as displayed in Table 10. In this case, only for the SATA indicator is there some evidence against the null.

The overall evidence of this section indicates that there are no differential levels of performance when one compares certified firms with ISO 9001 and 9002 with a control group of uncertified firms.
4. Final comments

The paper conducted an empirical study comparing the performance of firms which have received ISO 9000 certificates with a control group of firms which have not been certified. For that purpose, five different indicators were considered and non-parametric tests were computed. As a rule, the evidence indicates that no differential levels of performance can be detected across the two groups. This result is sustained even if we study sub-groups by certificate type (9001 or 9002) or by certification age. Despite the strong evidence, it is possible to question the use of accounting indicators. In fact, ideally one would be interested in comparing the productive efficiency of firms in the different groups. This line of research is problematic as data availability may pose a serious restriction, especially concerning data on input quantities.

Finally, it is worth mentioning another research topic that deserves further investigation. The connection between quality programs such as TQM or just-in-time schemes (JIT) and ISO certification requires additional studies, should the necessary data on those quality programs become available.

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References