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EFFECTS OF THE QMS ISO 9000 CERTIFICATION ON RUSSIAN MANUFACTURING COMPANIES

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Here is an analysis of the effect of the ISO 9000 certification on the economical results of Russian companies through the use of the propensity score matching (PSM) method, a method which had proven itself reliable at dealing with the selection problems that were highly likely to arise in this research. Informational dataset is built on the basis of a sample of the Industrial companies competitiveness monitoring project, conducted in 2009 by the Institute for Industrial and Market Studies at HSE. The empirical study methodology is given: hypothesis, informational dataset and model of effects evaluation. The main finding of the paper is that holding the ISO 9001 certificate by a Russian manufacturing company stimulates its profitability and reduces costs, but does not lead to sales and asset turnover rises.

JEL Classification: C31, L15, P23.

Keywords: quality management system, ISO 9000 certification effect, manufacturing companies.

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[1] National Research University Higher School of Economics, International Laboratory for Education Policy Analysis at the Institute of Education, Junior Researcher; E-mail: vavinarik@hse.ru

[2] Christian-Albrechts-University, Kiel & Institute for the World Economy, Professor; E-mail: aoife.hanley@ifw-kiel.de

Introduction

In a quarter of a century the ISO 9000 standard has achieved worldwide recognition and wide distribution[4]. Normative requirements that the standard contains allow companies to implement and certify ISO 9000 quality management system (QMS). Though certification to the standard is not obligatory, most of the companies obtain the ISO 9001 certificate in order to demonstrate to stakeholders their commitment to the ideas of quality and permanent improvement. At present the Russian market share of companies - possessors of ISO 9001 certificate – is very large. In 2009 and 2010 Russia was the first and the second respectively of the top-10 countries, which provided the largest annual increase in the number of certificates awarded. Despite the extreme popularity of the ISO 9000 certification in Russia, there are very few papers with quantitative analysis of the certification effects in Russian companies. The majority of papers are based on personal experience of the authors, who work in companies with QMS ISO 9000, or on questionnaires, which are made in certified companies.

Once the company has obtained the certificate they hope to experience its potential signal effect. The fact that Russian companies, at the moment, do not have a clear vision about the attainable effects often leads to unrealistic expectations from the QMS implementation. Therefore a question of justification the decision to implement the QMS in terms of its effectiveness rises.

This paper aims to analyse the economic effects of the QMS ISO 9000 certification on Russian manufacturing companies, with the help of econometrical methodology – PSM.

Background

ISO 9000, created by the International Organization for Standardization, represents an important certification standard. Under the provisions of this standard, the firm must be able "to consistently provide products that enhance customer satisfaction and meet applicable statutory and regulatory requirements" (ISO, 2009). Audits take place at intervals of 3 years.

Among certified companies industrial companies prevail: 83% in the world and 91% in Russia. Notably, in Russia and in the world economy the list of the industries in which standard implementation is the most active is almost the same and combines generally manufacturing industries: construction, electrical and optical equipment, machinery and equipment, basic metal & fabricated metal products and engineering services (The ISO Survey of Certifications, for 2013).

The main reasons for the popularity of the QMS ISO 9000 throughout the world come from the pressure which companies experience from their stakeholders, as well as from the expectations from the possible market signal, interpreted by Joseph Stiglitz as information for market participants about services and products quality, after obtaining the ISO 9001 certificate (Stiglitz, 1979). Below these two aspects are discussed. Pressure from stakeholders on a company to introduce the QMS makes the standard spread in the industries, as it is believed to be useful in international trade and investment facilitation (Neumayer, Perkins, 2005), in sidestepping problems associated with product complexity where the quality is difficult to ascertain (Uzumeri,

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[4] According to the data of the International Organisation for Standardisation 1 129 446 certificates were issued in more than 187 countries in 2013.

1997), in decreasing transaction costs and information asymmetry (Cole, 1998). In case of dominance in an industry of one or several large companies that require from their suppliers the implementation of the ISO 9000 standard, other companies experience strong sectorial pressure that can make quality management standards spread in the industry. At the same time researchers have shown that companies within one industry are exposed to different levels of institutional pressure which leads to the situation when transnational companies, leaders and outsiders, experience greater pressure and reacting to it stand a better chance for benefits from standard implementation (Delmas, Toffel, 2004).

Terlaak and King (2006) have pointed out that even if there is little external pressure on companies to introduce certification, the voluntary act of doing so can help an organisation to communicate its quality and help it to garner an advantage vis-à-vis its competitors.

The second aspect of the ISO popularity comes from an ability of the certificate to signal to a customer about the level of quality that a company has reached (Cole, 1998). The renowned economist and Nobel Memorial Prize recipient, Michael Spence, once likened a student's attainment of a college diploma to a market signal (Spence, 1973). Irrespective of whether the students actually learned anything from their experiences at college, prospective employers interpret the diploma as a signal of a graduate with higher human capital, as weaker students are weeded out and fail to obtain the diploma. Analogously, when a firm is successful in attaining certification status, it sends a positive signal to the market. This signal is arguably more important for Russian industrial companies as they operate in a market with lower levels of trust or transparency, with high information asymmetry, which as George Akerlof showed has negative consequences on both suppliers and customers, with still high corruption levels (Russia was ranked 136 out of 175 countries in 2014 according to Transparency International) (OECD Economics Surveys Russian Federation 2014; Akerlof 1970). A company that is successful in using the certification signal potential has an opportunity to enter new markets, including foreign ones, to increase its sales and competitiveness.

The signal must be costly to firms however, otherwise the effort of pursuing certification would be so low that all firms would choose to introduce certification and there would be no separation between high- and low-quality firms (Darnall and Edwards, 2004). The marginal cost of certification for the highest quality firms is relatively low compared to those incurred by the lowest quality firm (Darnall and Edwards, 2004; Hutchins, 1997). The value of certification is intuitive. To tell what is the average cost of certification for a company is difficult as it varies in each case. Compliance with the standard requires a firm to employ a specific set of management practices which are invariably verified by an external auditor.

Paucity of empirical evidence for Russian companies on whether it is beneficial for them to implement and certify the QMS gives us grounds to formulate the aim of the study - to analyse economic effects of the QMS ISO 9000 certification on Russian manufacturing companies.

Manufacturing companies were chosen as a study object for the following reasons:

1) Manufacturing acts an important part of the Russian economy as it contributes significantly to the technological power of the country, is of high importance for the competitiveness of the national economy and openness to industrial and managerial innovations. Manufacturing sector share in Russian GDP in 2012 was 13% (to compare in 2010 in Russia it was 14%, in the USA –

12%, in the UK – 10%). The share of manufacturing within Russian industrial production was 66% in 2009. Manufacturing is also leading among Russian industries in the number of employed – 77% in 2010.

2) Manufacturing in Russia is at the forefront in quantity of the issued ISO 9001 certificates in different industries: 47% of manufacturing companies were certified to the requirement of the ISO 9000 standard in 2012.

Hypotheses

The signaling quality of certification as well as its distribution across manufacturing sectors in Russia leads us to formulate our main research hypothesis, which suggests that the QMS ISO 9000 implementation and certification improves a company's economic performance, which is considered as the overall outcome of different positive effects. We can assume that the main sources of certified company economic results improvement are revenue increase and cost reduction.

The basic assumption is specified in three hypotheses, first of which is formulated below.
H1: Russian manufacturing companies that introduce the ISO 9000 standard are more profitable, all things equal, compared to firms that remain without certification.

Terlaak and King (2006) examined the issue of certification as a signaling mechanism for a 10 year panel of US manufacturing companies. Certified firms grew faster after certification and importantly there was a moderating effect of supplier transparency with the growth outcome. When buyers experienced greater difficulty about suppliers, the growth effect was more pronounced.

What is interesting about the Terlaak and King analysis is the moderating effect of supplier market thickness (larger number of buyers imposes higher search costs and heightens the need for a quality signal) and lack of transparency (firms in service sector or those with higher rates of intangible assets also rely more heavily on a certification generated signal).

Another interesting result of the Terlaak and King research, crucial for our analysis, states that the bigger the industry in which a company operates is, the more sales increase as the result of the certification.

Other researchers point out that once the QMS is introduced companies acquire opportunity for income increase due to gaining access to new markets (Corbett, Montes-Sancho, Kirsch, 2005).

Häversjö, in his analysis of Danish companies, justified another cause of the income increase after certification – quality rise. He manages to find two effects: 1) after certification Danish companies showed significant income increase comparing to the period prior to certification 2) return rate proved to be significantly higher at certified firms compared to similar uncertified ones (Häversjö, 2000).

Feng et al and Sharma in different works obtained the same finding – the QMS introduction positively affects a company's internal (operational) efficiency (Feng, Terziovski, Samson, 2007; Sharma, 2005).

The degree of influence of ISO 9000 certification on a company's efficiency results is often estimated by means of two financial indicators: ROA (return on assets) (Corbett et al. 2005; Heras et al. 2002; Martínez-Costa et al. 2008) and ROS (return on sale) (Heras et al. 2002). Along with these indicators, for the estimation of economic effects the indexes of operational performance (Casadesus et al. 2001), staff profitability (return on one worker) (Martínez-Costa et al. 2008) and labour productivity (Martínez-Costa et al. 2008) are used.

The above discussed empirical evidence and orientation to a trial of assessing the economic results, after certification, on companies within a particular industry leads us to the following choice of financial indicators for the first hypothesis testing –ROA and ROS which measure two sides of profitability. Profitability changes analysis allows for evaluating the QMS implementation impact on the efficiency of production and commercial activity.

H2: Companies with the ISO 9001 certificate experience lower production costs compared to uncertified ones.

Literature suggests that the QMS implementation initiates elimination of unproductive activities, reduction of waste, defects and reclamations. As a result of business process rationalisation a certified company's activity becomes more efficient, which leads to higher quality production without doubled operations, resources loss and excessive costs (Corbett, Montes-Sancho, Kirsch, 2005).

Evidence from Russian literature (which mostly consists of expert views and interviews) suggests that certification leads to reclamations and production cost decreases (Tverskaya, 2005) and waste drop (Feigenson et al, 2012).

That which is mentioned above brings us to a conclusion of possible production costs decrease due to the certification in correspondence to the ISO 9000 standard requirements. As a financial measure of the level of production efficiency in hypothesis H2 we chose costs per rouble of sales.

H3: Companies with the ISO 9001 certificate are more likely to improve their market position compared to those without the certificate.

Due to the signal effect of the ISO 9001 certificate, a certified company acquires an opportunity to increase the confidence level of consumers and suppliers, which in turn raises the likelihood of new contracts. This suggests a possible increase in the number of customers and sales, and thus – an increase in the market share.

Empirical studies confirm these suggestions. Thus, Casadesus, Gimenez and Heras (2001) in their analysis of Spanish companies showed that 58% of them increased their market share and sales as a result of certification. Studies of Sharma (2005), Corbett et al (2002), Terlaak and King (2006), Levine and Toffel, (2010) also confirm that certified companies achieved higher sales growth.

An empirical research of Korean companies from the electronic industry determined significant differences in strategy and tactics of undertaking business between certified and uncertified companies. According to obtained results certified companies are more open to business globalisation and establishment of relations with foreign partners (Lee, 2003).

Reputational benefits gained from the QMS implementation allow companies to use the ISO 9001 certificate as a promotional instrument. This opportunity has been indicated in research conducted in the UK (BS5750/ISO 9000 - Setting Standards for Better Business), where certification is defined as an important marketing instrument, which leads to greater potential contracts and to considerable facilitation of international markets penetration.

In order to assess how successfully a company acts on a market, asset turnover is used in this study to test the hypothesis H3. In the analysis of change in this indicator we estimate whether the ISO 9001 certificate improves a certified company's market position in reference to its competitors.

Methodology

Typically two research approaches are used to estimate the effects of QMS ISO 9000 certification: comparison of company achievements obtained before and after certification and comparison of achievements of certified and uncertified companies. In the presented study economic results of certified companies to uncertified companies were compared using propensity score matching (PSM) methodology, suggested by Rosenbaum and Rubin (Rosenbaum & Rubin 1983). The decision to apply this method for the purposes of the study comes from its capacity to deal with selection problem, which prevents from revealing the genuine certification effect. Selection problem, in our case, arises from the fact that certified companies, even before they have obtained the certificate, could have shown better financial results than uncertified companies. Therefore regardless of certifying their QMS, we would have expected from them better results than from uncertified companies.

In other studies, for instance in Terlaak and King (2006), ex ante selection effects are not accounted for, which may lead to a biased assessment: performed in the study difference in differences analysis does not allow to control for it. PSM analysis in contrast is designed to control for ex ante differences. PSM method approaches a control group of uncertified companies to a main group of certified ones by chosen observed characteristics with the help of propensity score. This coefficient is assessed by using probit regression and it combines the observed characteristics of companies into a composite index. On the basis of propensity score control groups are divided into similar subgroups, which are then used for when comparing financial results of certified and uncertified companies.

Mathematically the effect of obtaining ISO 9001 certificate can be written in the form of the following expression:

$y_{1,t+s} - y_{0,t+s}$, where

$y_{1,t+s}$ – financial results of a company i in a year t+s, $s \geq 0$;

$y_{0,t+s}$ – financial results of a company i in a year t+s, $s \geq 0$ if this company didn't have a certificate.

$y_{0,t+s}$ is unobserved factor as it describes an average financial result which would have been achieved by certified companies if they hadn't had a certificate. J. Heckman defined this average effect in the form of the mathematical expression (1):

$$E\{y_{1,t+s} - y_{0,t+s} \quad |ISO_{it} = 1\} = E\{y_{1,t+s} \quad |ISO_{it} = 1\} - E\{y_{0,t+s} \quad |ISO_{it} = 1\},$$

where ISO is an indicator of whether the company has ISO 9001 certificate.

Unobserved factor in the expression should be changed to an observed one, for the role of which J. Heckman suggested $E\{y_{0,t+s} \quad |ISO_{it} = 0\}$ – an average financial result of uncertified companies. Of course in order to conduct genuine analysis the control group of uncertified companies should be carefully constructed with the help of propensity score coefficient (Heckman et al. 1998). Dehejia and Wahba specified PSM steps in the following two-step algorithm:

1. Propensity score estimation by running logit or probit regression, which includes all of a company's observed characteristics that may have an impact on the fact that a company has the ISO 9001 certificate. After propensity score estimation data is divided into blocks (using STATA procedure pscore), the number of which depends on the results of hypothesis testing of whether propensity score is equal in a control subgroup of uncertified companies and in a main subgroup of certified companies. If the hypothesis is not confirmed, the division into blocks continues until propensity scores of two subgroups are equal.

2. Estimation of an average treatment effect from the QMS ISO 9000 certification using propensity score assessed at the first step (Dehejia & Wahba 1999).

Informational database

The informational database was formed on the basis of a sample of the monitoring of the competitiveness of manufacturing industries project, made in 2009 by the Institute for Industrial and Market Studies (Higher School of Economics, Moscow, Russia). This sample is transformed into a database by adding to a sample companies' financial information from the information resource "SPARK-Interfax"[5] and information about obtained certificates from the companies' corporate websites. The database contains 1004 Russian companies, from 8 manufacturing industries, 214 of which have the ISO 9001 certificate.

Table 1 presents quantity of certificates issued to companies of the database. We can see that the number of certified companies which can be added to a main group of certified companies each year is not large.

Tab.1. Number of companies that received the ISO 9001 certificate

Year	Companies quantity
1996	4
1997	3
1998	1
1999	4
2000	2
2001	7

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[5] SPARK-Interfax (Professional Market and Company Analysis System) is one of the largest databases which combines information from more than 10 million of Russian, Ukrainian and Kazakhstan juridical entities.

2002	11
2003	14
2004	4
2005	33
2006	16
2007	30
2008	11
2009	25
2010	37
2011	12
In total	214

To carry out an adequate analysis using PSM methodology it was decided to combine certified companies that received ISO 9001 certificate from 2005 to 2007 (79 companies) into one group and to assess long-term effects of the certification (gained by these companies in 2008-2010) using financial factors as indicators of these effects.

Propensity score estimation

To obtain reliable results it is necessary to use the most complete set of a company's observed characteristics (Dehejia & Wahba 1999; Caliendo & Kopeinig 2008). On the basis of the study of factors of the QMS ISO 9000 implementation conducted by the author of this paper on BEEPS 2002-2012 samples, and on the basis of the empirical studies on motivating factors for the QMS ISO 9000 implementation (Singels et al. 2001; Vynaryk & Dolgopyatova 2011) there were selected observable characteristics listed below which were used for propensity score estimation. It should be noted that all of the observed characteristics were taken with a time lag of several years prior to the receipt of the ISO 9001 certificate by companies from the sample, which required the used statistical method.

Factors that showed significance in the study of factors for the QMS ISO 9000 implementation on BEEPS samples:

Export - dummy variable which equals "1" if a company has exported products;
State - dummy variable indicating a state owned company;
Foreign_owner - dummy variable which equal "1" if a company has a foreign owner;
Import - dummy variable which equal "1" if a company has imported products;
Large_2003 - dummy variable which indicates if a company was large in 2003 (more than 250 employees);
Medium_2003 - dummy variable which indicates if a company was medium in 2003 (50-250 employees);

Additional factors:
Investment_2005 – dummy variable which equals "1" if a company had investments in 2005;
Part_group – dummy variable which equals "1" if a company is independent, not part of a holding;
CostRevenue_2003 – costs per rouble of sales in 2003;
RevenueAssets_2003 – assets turnover in 2003;

ROS_2003 – return on sales (ROS) in 2003;
ROA_2003 – return on assets (ROA) in 2003;
Age – natural logarithm of a company age.

Additional factors used in the analysis were chosen based on the following reasons. Companies that have implemented QMS and decided to certify it in correspondence to the requirements of the ISO 9001 standard face the necessity of significant investments. Costs associated with the implementation and certification include, not only, the investment in organisational processes development and employees retraining, but also a detailed documentation of procedures. Procedure documentation is one of the main requirements of the ISO 9001 certificate, as it ensures a standardised procedure fulfillment, which leads to the maintenance of a constant level of product quality (Singels et al. 2001). Since implementation and certification processes are rather expensive, it seems logical to use the variable, which reflects investments in a company in the year of certification or a few years prior.

The variable responsible for age of a company has been included in a group of observable characteristics, following Finley and Buntzman who in their study showed that company age affects its efficiency (Finley & Buntzman 1994).

The following values of financial indicators in 2003 (prior to certification) were included in probit regression to improve the model: costs per rouble of sales *CostRevenue*, asset turnover *RevenueAssets*, return on assets *ROA* and return on sales *ROS*. The same parameters are tested as indicators of company efficiency at the second step of PSM analysis algorithm in the post-certification period, namely in 2008-2010.

To account for sectoral differences, financial indicators and company age variable were modified by the method used in the paper (Criscuolo & Hagsten 2007): from logarithmical values of these variables there were subtracted mean logarithmic values for the industry.

Dependent variable *ISO* is a dummy variable which equals "1" if a company has the QMS ISO 9001 certificate.

Thus, using the probit model a composite index (propensity score) is constructed, and then average treatment effect is calculated with the help of STATA procedures *attk* and *atts.* Standard errors are obtained with bootstrap method.

Descriptive statistics of variables in pre-certification period by groups of certified and uncertified companies is presented in Table 1 of the Appendix, which shows that uncertified and certified companies, before certified companies obtained the ISO 9001 certificate, are significantly different from each other in some indicators. For example, certified companies export significantly more. Companies are also significantly different in costs per rouble of sales and company age.

The main research question was to identify the effects of the QMS ISO 9000 implementation. With the help of t-tests there were tested hypotheses about the significance of the differences in the financial indicators of certified and uncertified companies in the years after certification - 2008-2010. Some financial indicators show a statistically significant difference between certified

and uncertified companies. Detailed table with hypotheses testing results is presented in Table 2 of the Appendix.

The process of hypotheses testing using PSM methodology and the results of calculations for both steps of the algorithm are described in detail. Probit model evaluation showed the results presented in table 2.

Tab. 2. Results of the probit model used for propensity score estimation

Variable	Comment	Coefficients and robust standard errors
Ln_age_rel	Logarithmical company age -mean logarithmic company age for the industry	0,72 (0,50)
CostYield_2003_rel	Logarithmical company costs - mean logarithmic company costs for the industry	-0,68 (0,57)
YieldAssets_2003_rel	Logarithmical company assets turnover - mean logarithmic assets turnover for the industry	-0,00003* (0,00001)
ROS_2003_rel	Logarithmical company ROS -mean logarithmic ROS for the industry	-0,0001 (0,003)
ROA_2003_rel	Logarithmical company ROA -mean logarithmic ROA for the industry	0,0001 (0,003)
Large_2003	Large company, dummy	-0,35 (0,35)
Medium_2003	Medium company, dummy	-0,13 (0,35)
Part_group	Company isn't part of a holding, dummy	-0,05 (0,17)
Export	Company exports, dummy	0,47** (0,17)
State	Company is state owned, dummy	0,002 (0,32)
Investment_2005	Company invested in 2005, dummy	-0,12 (0,15)
Foreign_owner	Company has a foreign owner, dummy	0,13 (0,23)
Import	Company imports, dummy	-0,002 (0,16)
Pseudo R^2 Nagelkerke		0,06
Percent correctly predicted		92%
Number of observations		641

Notes: 1 coefficients significance:
** - 5% level
2 robust standard errors in parentheses

The main aim of PSM analysis is to obtain a balanced distribution of observable characteristics between certified and uncertified companies. At the same time it is not overly important to perfectly predict the set of observable characteristics (Caliendo & Kopeinig 2008; Lee 2013). The used probit model showed that companies that have the ISO 9001 certificate export more than those which do not have the certificate. Also a certified company shows slightly lower asset turnover than uncertified. The remaining variables in the model were insignificant. The model correctly classifies 92% of observations.

Estimation of an average treatment effect from the QMS ISO 9000 certification on company financial indicators

When estimating the average treatment effect *common support* option has been used. It helps not to include in the analysis those observations of a main group of certified companies, propensity score of which exceeds the maximum propensity score of a group of uncertified companies. Thus, the final group of analysed companies consists of 585 companies, which are divided into 3 blocks, so that the propensity score of the control subgroup of uncertified companies is not significantly different from the propensity score of companies from a main subgroup of certified companies. Such a division of sample observations is considered balanced. Table 3 shows the final division of the companies into blocks.

Tab. 3. Division of companies from the sample into blocks with the same propensity score

	Uncertified companies	Certified companies	In total
Block 1	363	25	388
Block 2	153	26	179
Block 3	16	2	18
In total	532	53	585

Rosenbaum, Rubin and Wahba, Dehejia point to the importance of testing balance of independent variables within blocks: t-tests reveal significant differences between the independent variables of certified and uncertified companies' subgroups (Dehejia & Wahba 1999; Rosenbaum & Rubin 1983). If such differences are not found, then the variables are considered balanced within a block. Tests results are presented in Table 3 of the Appendix. It should be stated that all variables within the three blocks are balanced. This finding suggests that the chosen specification of probit regression (namely independent variables) used for propensity score estimation is effective. We can state that data was divided into blocks well, as in each block there are companies from both control and main groups and hypotheses about propensity scores equality between these groups within the blocks are not rejected.

After observable differences between certified and uncertified groups of companies within the blocks were eliminated, average treatment effect of having the ISO 9001 certificate on companies' financial indicators was assessed. This effect is calculated as the average difference between the financial indicators of certified and uncertified companies in 2008-2010.

Since it is impossible to find two companies with the exact same propensity scores, there exist various methods to find companies that are suitable for comparison with each other. In this study the kernel method was used as the main one, robustness check is made with the stratification method. In the kernel method for each certified company, a company for comparison was selected by kernel-weighted average. Afterwards when calculating treatment effect each pair is assigned weights inversely proportional to the distance between propensity score of a company from a control and a main group. In Stata 13 average treatment effect was calculated with the procedure *attk*.

The stratification method (*atts* procedure in Stata 13), when assessing an average treatment effect, uses division of data into blocks obtained when propensity score is measured. Inside the blocks the difference between the results of groups of certified and uncertified companies is calculated. Afterwards when measuring average treatment effect weighted mean of differences obtained in the previous step is calculated. Table 4 shows average treatment effects derived by using the kernel method and the stratification method.

Tab. 4. Average treatment effect from the QMS ISO implementation on company's financial indicators in 2008-2010

Financial indicator	Certified companies quantity	Uncertified companies quantity	Method specification			
			Kernel method		Stratification method	
			Average treatment effect	Change compared to 2003, in %	Average treatment effect	Change compared to 2003, in %
ROA_2008	53	532	3,184* (1,711)	48	3,176* (1,71)	47
ROA_2009	53	532	3,764 (2,396)		3,838* (2,332)	57
ROA_2010	53	532	1,919 (1,919)		1,327 (1,976)	
ROS_2008	53	532	3,466* (1,805)	102	3,353** (1,47)	99
ROS_2009	53	532	6,462* (3,981)	190	6,359* (3,909)	187
ROS_2010	53	532	1,422 (2,797)		0,896 (2,689)	
CostRevenue_2008	53	532	-0,037* (0,021)	-5	-0,031* (0,018)	-4
CostRevenue_2009	53	532	-0,058** (0,025)	-7	-0,051** (0,021)	-6
CostRevenue_2010	53	532	-0,046 (0,034)		-0,042 (0,028)	
RevenueAssets_2008	53	532	-0,423* (0,16)	-24	-0,345** (0,161)	-19
RevenueAssets_2009	53	532	-0,01 (0,239)		0,027 (0,24)	
RevenueAssets_2010	53	532	-0,291* (0,152)	-16	-0,226 (0,16)	

Notes

1 significant results are highlighted in gray (* - at 10% level, ** - at 5% level)

2 bootstrapped standards errors

3 presented changes reflect fixed changes in the values of certified companies' financial indicators in relation to the uncertified companies.

Results show that ROA to a less extent and ROS to a greater extent increases in the long term due to QMS implementation, which confirms the hypothesis H1. Increase in ROA in the long term allows admitting acceptable achieved level, as a result of the certification, of asset management quality. The increase in ROS demonstrates growth in the revenue share of profit, which indicates steady consumer confidence.

Costs per rouble of sales decrease, which confirms the hypothesis H2. This testifies to the effectiveness of measures to strengthen discipline, to rationalise the use of resources etc. Incentive to all these transformations is the ISO 9000 certification. Continuous monitoring and timely actions to eliminate defects revealed in the initial stage, allow these to be fixed with low-cost methods. Standardising and documenting of operating procedures leads to increased productivity. Therefore revealed costs reduction per rouble of sales achieved by a certified company reflects its more efficient use of productive resources.

At the same time a decrease in asset turnover does not allow the acceptance of the hypothesis H3. The reason for this phenomenon may lie in the fact that assets of certified companies are growing faster than assets of uncertified companies from a control group. The ISO 9000 certification favours the development of a company's innovative initiatives, activates the implementation of advanced, technical, technological and organisational solutions, and these processes are accompanied by the growth of total assets.

Conclusions

Empirical study results show that after the QMS ISO 9000 implementation a certified company, as a whole, achieves better economic results than a similar uncertified company, but at the same time it does not show evidence of market position improvement.

According to critical expert appraisals those companies that decided to receive the QMS certification demonstrated, long before this decision, better results compared to other companies. However, given the used method specification 1) we choose for comparison uncertified companies from the control groups with similar characteristics to a certified company prior to the ISO 9001 certificate receipt 2) all intangible aspects not related to the certification are eliminated. Therefore, we can assume that the transformations that have taken place in a company after the event, are most likely connected with the restructuring of its internal organisational processes in accordance with the requirements of the ISO 9001 standard.

More perceptibly positive changes in the economic results show themselves in increased profitability and reduced production costs. These achievements can be interpreted as a consequence of organisational changes related to the implementation and certification of the quality management system, ISO 9000. A significant increase in ROS is due to the increase in net income. At the same time this increase is not enough to ensure a similar increase in ROA: likely increase in total assets oppositely influences ROA. The increase in total assets is also one

of the reasons for the negative changes in asset turnover, which prevents us from talking about improvements of a company's market position achieved due to the certification. The results of the study indicate internal effects of the QMS ISO 9000 implementation, while assumption of positive external effects is not supported.

Absence of external effects demonstrates a paradoxical consequence of manufacturing industry domination among other industries by number of certified companies in Russia (46.8% - in 2012): signal of a certified company's high economic results is partly ignored by the market. It is also possible that no market effect from the certification comes from novelty effect loss: precisely, companies that implemented the QMS ISO 9000 before others (during the first years of its extreme popularity) could have achieved relatively larger effects from the certification. There also exists the distrust problem of companies' stakeholders to the ISO 9000 certificate that can influence signal effect development. This problem is especially timely for Russian market, where a company's stakeholders, knowing about often formal QMS implementation and dishonest certifying companies, pay particular attention to certificate "quality".

Thereby, revealed internal effects (even though skeptics may interpret them as mainly imitational effects) justify the decision made to implement the QMS ISO 9000. At the same time absence of external effects leads to an understanding that QMS implementation and even successful certification do no necessarily guarantee competitive benefits to a certified company compared to a similar uncertified one. Certification only gives an opportunity for a company to improve its market position. This opportunity in many respects explains the great demand for the QMS ISO 9000. Competitive potential of the QMS depends on institutional environment, pressure from its agents and on a company's ability to correctly assess available resources to reorganise work in order to apply quality management principles and to appraise market readiness to perceive, sent to it by the ISO 9001 certificate, signal of successfulness of this work.

References

"Selection and use of the ISO 9000 family of standards". 2009. International Standard Organization, Geneva.

"The ISO Survey of Certifications, for 2013". 2014. http://www.iso.org/iso/iso-survey

Stiglitz, J.E. 1979. "Equilibrium in product markets with imperfect information", The American Economic Review, pp. 339–345.

Neumayer, E. & Perkins, R. 2005. "Uneven Geographies of Organizational Practice: Explaining the Cross-National Transfer and Diffusion of ISO 9000", Economic Geography, vol. 81, no. 3, pp. 237–259.

Uzumeri, M.V. 1997. "ISO 9000 and other Metastandards: Principles for Management Practice?", Academy of Management Executive, no. 11, pp. 21-36.

Cole, R.E. 1998. "Learning from the quality movement: what did and didn't happen and why?", California Management Review, vol. 41, no.1, pp. 43–73.

Delmas, M. & Toffel, M.W. 2004. "Stakeholders and environmental management practices: an institutional framework", Business Strategy and the Environment, vol. 13, no. 4, pp. 209–222.

Terlaak, A & King A.A. 2006. "The effect of certification with the ISO 9000 Quality Management Standard: a signaling approach", Journal of Economic Behavior & Organization, vol. 60, no. 4, pp. 579–602.

Spence, M. 1973. "Job market signaling", The Quarterly Journal of Economics, pp. 355–374.

"OECD Economics Surveys Russian Federation". 2014. http://www.keepeek.com/Digital-Asset-Management/oecd/economics/oecd-economic-surveys-russian-federation-2013_eco_surveys-rus-2013-en#page1

Akerlof, G.A. 1970. "The market for «lemons»: Quality uncertainty and the market mechanism", The Quarterly Journal of Economics, pp. 488–500.

Darnall, N. & Edwards, D. 2004 "Predicting the Cost of Environmental Management System Adoption", Paper presented at the 2004 Academy of Management Meeting, New Orleans.

Hutchins, G. 1997. "ISO 9000: A comprehensive guide to registration, audit guidelines and successful certification", 2nd ed. New York: Wiley.

Corbett, C.J.; Montes-Sancho M.J. & Kirsch D.A. 2005. "The financial impact of ISO 9000 certification in the United States: an empirical analysis", Management Science, vol. 51, no. 7, pp. 1046–1059.

Häversjö, T. 2000. "The financial effects of ISO 9000 registration for Danish companies", Managerial Auditing Journal, vol. 15, no. 1/2, pp. 47–52.

Feng, M.; Terziovski, M. & Samson, D. 2007. "Relationship of ISO 9001:2000 quality system certification with operational and business performance: a survey in Australia and New Zealand-based manufacturing and service companies", Journal of Manufacturing Technology Management, vol. 19, no. 1, pp. 22–37.

Sharma, D.S. 2005. "The association between ISO 9000 certification and financial performance", The International Journal of Accounting, vol. 40, no. 2, pp.151–172.

Heras, I. et al. 2002. "ISO 9000 certification and the bottom line: a comparative study of the profitability of Basque region companies", Managerial Auditing Journal, vol. 17, no.1/2, pp. 72–78.

Casadesus, M. et al. 2001. "Benefits of ISO 9000 implementation in Spanish industry", European Business Review, vol. 13, no. 6, pp. 327–336.

Martínez-Costa, M; Martínez-Lorente, A.R. & Choi, T.Y. 2008. "Simultaneous consideration of TQM and ISO 9000 on performance and motivation: an empirical study of Spanish companies", International Journal of Production Economics, vol. 113, no. 1, pp. 23–39.

Tverskaya, I.V. 2005. "Otsenka effektivnosti system menedjmenta kachestva" [Evaluation of the quality management systems efficiency], Report at the International congress „Successful business management". http://www.makb.ru/news/docklad.html

Feigenson, N.B. et al 2012. "Berejlivoe proizvodstvo i sistemy menedjmenta kachestva" [Lean production and quality management systems], CSR North-West.

Corbett, C.J.; Montes M.J.; Kirsch D.A. & Alvarez-Gil M.J. 2002. "Does ISO 9000 certification pay?", ISO Management Systems, vol. 2, no. 4, pp. 31–40.

Levine, D.I. & Toffel, M.W. 2010. "Quality management and job quality: How the ISO 9001 standard for quality management systems affects employees and employers", Management Science, vol. 56, no. 6, pp. 978–996.

Lee, C.Y. 2003. "A comparative study of manufacturing strategies and business performance between ISO 9000 and non-ISO 9000 firms: a case in the Korean electronics industry", Pittsburg, USA: Pittsburg State University.

"BS5750/ISO 9000 - Setting Standards for Better Business". 1994. Croyden, UK: Lloyds Register Quality Assurance Ltd.

Rosenbaum, P.R. & Rubin, D.B. 1983. "The central role of the propensity score in observational studies for causal effects", Biometrika, vol. 70, no. 1, pp. 41–55.

Heckman, J..J.; Ichimura, H. & Todd, P. 1998. "Matching as an econometric evaluation estimator", The Review of Economic Studies, vol. 65, no. 2, pp. 261–294.

Caliendo, M. & Kopeinig, S. 2008. "Some practical guidance for the implementation of propensity score matching", Journal of economic surveys, vol. 22, no. 1, pp. 31–72.

Vynaryk, V.A. & Dolgopyatova T.G. 2011. "Quality Management System Certification in Companies from Transition Economies: Empirical Analysis", Russian Management Journal, vol.9, no. 1, pp. 29-56.

Singels, J.; Ruel, G. & Van de Water, H. 2001. "ISO 9000 series-Certification and performance", International Journal of Quality & Reliability Management, vol. 18, no.1, pp. 62–75.

Finley, L.; Buntzman, G.F. 1994. "What does affect company performance", Arkansas Business and Economic Review, vol. 27, no. 2, p.1.

Criscuolo, C. & Hagsten E. 2008. "Offshoring and productivity: the case of Ireland, Sweden and the United Kingdom. In: Staying Competitive in the Global Economy", OECD: Paris, France.

Lee, W.S. 2013. "Propensity score matching and variations on the balancing test", Empirical economics, vol. 44, no. 1, pp. 47–80.

Tab. 1. Mean differences t-test of variables values between certified and uncertified companies in years prior the receipt by the first the ISO 9001 certificate

Variable	Certified companies		Uncertified companies		Significant difference
	N	Mean	N	Mean	
	79	50,6		48,0	No
Large_2003, %		(0,06)	807	(0,02)	
	79	45,6		47,2	No
Medium_2003,%		(0,06)	807	(0,02)	
Export, %	73	76,7	806	51,5	Yes ***
		6,3	674	11,4	No
State, %	63	(0,03)		(0,01)	
		12,9	638	10,7	No
Foreign_owner,%	62	(0,04)		(0,01)	
		57,0	808	51,1	No
Import,%	79	(0,06)		(0,02)	
		57,3	755	52,2	No
Investment_2005,%	75	(0,06)		(0,02)	
		73,3	805	72,3	No
Part_group,%	79	(0,02)		(0,05)	
		0,84	781	0,9	Yes**
CostRevenue_2003	76	(0,01)		(0,01)	
		1,8	783	2,0	No
RevenueAssets_2003	77	(0,15)		(0,06)	
		3,4	781	-3,0	No
ROS_2003, %	77	(0,79)		(2,5)	
		6,7	784	2,7	No
ROA_2003, %	78	(1,13)		(1,25)	
		19,7	808	19,1	Yes *
Age, years	79	(0,35)		(0,13)	

Notes

1 Significant at:

*** - 1% level

** - 5% level

* - 10% level

2 standard errors in parenthesis

Tab. 2. Mean differences t-test of financial indicators values between certified and uncertified companies in 2008-2010

Variable	Certified companies		Uncertified companies		Significant difference
	N	Mean	N	Mean	
ROA_2008, %	77	7,5	750	3,8	Yes*
		(1,24)		(0,62)	
ROA_2009, %	76	5,3	744	1,1	Yes **
		(1,53)		(0,64)	
ROA_2010, %	72	6,0	669	2,8	No
		(1,52)		(0,68)	
ROS_2008, %	77	3,4	749	-1,04	No
		(0,94)		(0,92)	
ROS_2009, %	76	2,3	741	-22,0	No
		(2,43)		(16,47)	
ROS_2010, %	73	3,2	664	14,4	No
		(1,78)		(14,02)	
CostRevenue_2008	76	0,8	756	0,85	Yes **
		(0,01)		(0,02)	
CostRevenue_2009	75	0,81	746	0,9	No
		(0,02)		(0,02)	
CostRevenue_2010	72	0,79	671	0,89	No
		(0,03)		(0,03)	
RevenueAssets_2008	77	1,56	757	2,04	Yes *
		(0,14)		(0,09)	
RevenueAssets_2009	76	1,45	748	1,6	No
		(0,18)		(0,05)	
RevenueAssets_2010	72	1,37	675	1,68	Yes *
		(0,12)		(0,06)	

Notes

1 Significant at:

*** - 1% level

** - 5% level

* - 10% level

2 standard errors in parenthesis

Tab. 3. Testing the balancing property of unobservable variables within the blocks

Variable	Block 1, Mean values			Block 2, Mean values			Block 3, Mean values		
	uncertified	certified	Mean difference t-test		uncertified	certified	Mean difference t-test		uncertified
Ln_age_rel	-0,01	-0,001	0,766	0,05	0,05	0,928	0,12	0,05	0,058
CostRevenue_2003_rel	0,02	0,002	0,634	-0,06	-0,05	0,844	-0,11	-0,23	0,307
RevenueAssets_2003_rel	1,2	1,3	0,446	1,1	1,4	0,521	1,15	1,2	0,621
ROS_2003_rel	-1,46	1,37	0,752	5,41	2,94	0,200	3,17	2,69	0,955
ROA_2003_rel	-2,61	0,87	0,721	3,75	0,04	0,212	1,11	4,51	0,641
Large_2003	0,53	0,48	0,637	0,40	0,42	0,816	0,06	0,00	0,735
Medium_2003	0,45	0,48	0,744	0,52	0,5	0,878	0,94	1,00	0,735
Part_group_1	0,72	0,64	0,417	0,69	0,81	0,235	0,75	0,50	0,486
Export	0,40	0,48	0,413	0,97	1,00	0,407	1,00	1,00	0,420
State	0,05	0,08	0,556	0,06	0,04	0,678	0,06	0,00	0,735
Investment_2005	0,53	0,52	0,847	0,54	0,54	0,970	0,31	0,50	0,621
Import_dummy	0,48	0,52	0,735	0,68	0,62	0,521	0,38	1,00	0,105
Foreign_owner	0,06	0,08	0,698	0,25	0,23	0,795	0,06	0,00	0,735

Note All variables are balances therefore propensity score is not statistically different in the blocks 1-3

Authors:

Veronika A. Vynaryk

National Research University Higher School of Economics (Moscow, Russia).

International Laboratory for Education Policy Analysis at the Institute of Education, Junior Researcher; E-mail: vavinarik@hse.ru, Tel.: +7(495) 772-95-90*22147

Aoife Hanley, PhD

Christian-Albrechts-University, Kiel & Institute for the World Economy (Kiel, Germany).

Professor

E-mail: aoife.hanley@ifw-kiel.de, Tel.: +49 431 8814 339