

# An Examination of ISO 9001 Certifications in the BRIC Countries

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## ABSTRACT

*The ISO 9001 certification process provides companies an opportunity to assess business practices to improve operations. This voluntary process has gained popularity world-wide. The purpose of this paper is to analyze the impact of globalization on the number of ISO 9001 certifications issued in Brazil, Russia, India and China (BRIC countries). The International Organization for Standardization and the World Bank provides data for the analyses. The overall results show the change in foreign direct investment (FDI per Capita) is associated with the adoption of ISO 9001 for the BRIC countries. After controlling*

*for the country, analysis reveals that both the change in FDI per capita and the lagged change in FDI per capita are positively associated with the number of ISO 9001 certificates. Further investigation reveals that the conditions in Brazil and Russia are statistically associated with the number of organizations obtaining ISO 9001 certificates.*

*Keywords: ISO 9001, BRIC, globalization, quality management*

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## INTRODUCTION

The globalization and economic growth over the past two decades are linked with a significant increase in the spread of international management practices, specifically quality management systems (QMS) based on the ISO 9001 standard (Salgado et al., 2016). Researchers have examined a range of issues from cost/benefit analysis of a company to worldwide issues (Salgado et al., 2016). In this evolving field of research no studies have analyzed the influence of globalization on the number of ISO 9001 certifications in Brazil, Russia, India, and China (BRIC countries). Therefore, this study fills the gap by examining the role of Foreign Direct Investment and Gross National Product (FDI per Capita and GDP per Capita) have in the adoption of ISO 9001 standards in the BRIC countries. Studying the ISO 9001 data for the BRIC countries is important as they are a significant region for the global economy, with increasing numbers of certifications in the past decade. Understanding the association between the adoption rate of ISO 9001 and both economic growth and FDI is important to business leaders, government institutions and consumers. Both economic growth and FDI can lead to greater creation of wealth and opportunities. Determining whether ISO 9001 adoption is associated with economic growth and FDI at the country level should impact the leaders of individual companies considering adherence to the ISO 9001 standards.

In 1987, the International Organization of Standardization (ISO) published the first set of ISO 9001 standards with the goal of improving an organization's products and processes through a rigorous set of quality management systems. Sampaio et al. (2011) state the ISO 9001 certification is considered one of the best tools for improving quality management systems. The evolution of ISO 9001 certification in the world is consistently increasing despite the stabilization period in 2002 and 2003. Since 2004 there has been a robust growth in the number of certificates issued worldwide, totaling over 1.0 million certificates by nearly 180 countries in 2015 (Salgado et al., 2016; ISO 2016).

The value of ISO 9001 certification regarding improvement of performance is still highly questioned. Many researchers have tried different empirical approaches to determine the relationship between these two constructs (ISO 9001 and performance). Some research used a comparison of results between certified and non-certified companies to conclude that the former companies outperform the latter in reducing defectiveness, costs, and reworking. These studies also show a high level of profit and productivity for certified companies. Yahya and Goh (2001) reported that certified companies have higher profits than non-certified ones. In addition, Koc (2007) determined certified companies had a competitive advantage (volume flexibility, product variety, delivery results, and quality) over non-certified companies (Galetto et al., 2015).

The purpose of this paper is to analyze the influence of globalization on the number of ISO 9001 certifications in the BRIC countries. Other countries have been studied, but not specifically the BRIC countries in relationship of the influence of globalization. Given this gap, the following two questions guide this research: Is there a relationship between key

economic variables and the adoption of ISO 9001 for the BRIC countries? Is the relationship between the economic variables and the adoption of ISO 9001 uniform across the BRIC countries?



## LITERATURE REVIEW

This study focuses on the adoption of ISO 9001 standards in the BRIC countries. Consequently, the literature review's focus is on diffusion of ISO 9001 internationally and the economic factors. Considering the wide dispersion, which involves 187 countries in the world and every kind of organization, it is not surprising that a considerable amount of research focuses on ISO 9001 standards. Most empirical research (utilizing ISO 9001 data) on cross-national diffusion falls within two categories. The first category primarily deals with comparative practices adopted by nation-states or governments as opposed to firms or companies in a large sample of countries. The second category consists of comparative studies based on a limited number of countries. This would include Cole's (1985) analysis of the diffusion of small-group activities in the United States, Japan, and Sweden (Guler et al., 2002). Mussina and Buljan Barbaca (2017) examine the influence of globalization in ISO 9001 adoption in Kazakhstan, Croatia and Germany. The authors discovered that the adoption rate in Kazakhstan varied considerably from year to year.

Saraiva and Duarte (2003) found mixed results when analyzing a potential association between the number of ISO 9001 certificates in a country and its economic activity. Guler et al. (2002) determined that one of the leading factors potentially explaining the number of ISO 9001 certificates is the presence of large multinational firms. The results suggest that if a country has a relatively high number of large multinational firms, the large multinational firms tend to influence the decision of local organizations whether to obtain ISO 9001 certificates.

Sampaio et al. (2009a) examine several economic factors and the adoption ISO 9001 in the European Union. The author found that in countries with relatively higher amounts of R&D spending the typical ISO 9001 organization tends to be smaller. In addition, the authors' analyses reveal that a country's competitive rank, as measured by the Institute for Management Development, is inversely associated with the number of ISO 9001 organizations certified.

In the study by Salgado et al. (2016) the authors examine the adoption of ISO 9001 by organizations in North America and South America. Using Gross National Income as their key economic variable, the authors realized a positive relation between economic activity and the number of ISO 9001 certificates. Interestingly, only Argentina and Canada did not have a statistically significant relation between economic activity and the number of ISO 9001 certificates. The authors' results build upon and largely confirm previous work by Saraiva and Duarte (2003) and Sampaio et al. (2009a).

As ISO 9001 has gained acceptance and grown in popularity, many studies have tried to understand its effects on businesses and in the world [see Benner and Veloso (2008), Psomas and Fotopoulos (2009), Sampaio et al. (2009b);

Alolayyan et al. (2011), and Salgado et al. (2014)]. According to Sampaio et al. (2009a), when huge economic groups determine that their suppliers must have their quality systems certified, it results in an increase of the number of companies becoming ISO 9001 certified (Salgado et al., 2016).

Many papers study the evolution of ISO 9001 certification worldwide and specific regions such as Asia and the Middle East (Marmion et al., 2010; Al-Darrab et al., 2012), Europe (Franceschini et al., 2004; Franceschini et al., 2010; Llach et al., 2011; Sampaio et al., 2011), American Continent (Salgado et al., 2016), Portugal (Teixeira Quiros and do Rosario Fernandes Justino, 2013), Spain (Marin and Ruiz-Olalla, 2011), Australia and New Zealand (Feng et al., 2008), Spain (Martinez-Costa et al., 2008, 2009) and Italy (Galetto et al., 2015).

Several studies investigate the adoption of ISO 9001 certification globally and in specific areas (Salgado et al., 2016). Clougherty and Grajek (2008) examine trade and FDI and found that the amount of ISO 9001 certificates is associated with an increase in trade from developing nations to developed nations. In addition, there was no significant association among the developed world in terms of FDI. However, the authors were able to show an increase of FDI from developed nations to developing nations. Le (2009) found that the level of ISO 9001 saturation is associated with an increase in international trade, particularly for less developed countries. Unlike previous works examining the ISO 9001 standards at a country level, this study makes several improvements to the growing body of literature. The focus of this study is the BRIC countries, allowing for greater clarity of analysis. The BRIC countries contribute about 33 percent of the worldwide ISO 9001 certificates (ISO 2016), representing a significant portion of ISO certificates. In addition, the analysis focuses on the change of both GDP and FDI variables examine the dynamic association of the economic variables and the number of ISO 9001 certificates. Finally, lagged variables are included in the model to account for the ISO 9001 accreditation process can exceed a year.



**DATA AND METHODOLOGY**

In order to examine the potential association between the number of ISO certificates in the BRIC countries and key economic variables of globalization, data concerning the number of certificates for each country for the time period of 1993-2015 were collected from the International Organization for Standardization. The International Organization for Standardization is the entity responsible for the development and administration of the ISO standards. The key economic variables, represented by GDP per Capita and FDI per Capita, were collected from the World Bank. Both organizations are dedicated to making significant amount of data available to the public.

Given the distribution of the data, it is necessary to focus on the change of the variables from year to year. This effort also allows a closer examination on the change in GDP per capita and the change in FDI per capita have on the change in the number of ISO 9001 certificates in each of the BRIC countries. In addition to the current change in the two economic variables, the change in the prior year for both economic

variables were included in the analysis. The motive of including the change of the economic variables during the prior year is because obtaining the ISO 9001 certificate is a time-consuming process that may extend over multiple years.

The formal analyses of the association of GDP per Capita and FDI per Capita involves the two regression models. The first model examines the association of the change in the number of ISO 9001 certificates and the change and lagged change of the two economic variables. The second model includes country-specific dummy variables to indicate the potential unique situation that each country may possess.



**DESCRIPTIVE STATISTICS AND RESULTS**

Table 1 provides a snapshot of ISO 9001 certifications for each of the BRIC countries. Despite being first published in 1987, ISO 9001 certificates attained in the BRIC countries in 1993 are relatively few. Brazil led the BRIC countries with 113 organizations certified, followed by India with 73. By 2004 the number of certifications grown dramatically. China leads the BRIC countries with 132,926 certificates. Data concerning the number of certificates in 2015 reveal the continued adoption of ISO 9001. In fact, by 2015 each of the BRIC countries more than doubled their number of certificates from 2004. Table 1 also provides data concerning the number of ISO 9001 certificates per 1,000 inhabitants for each of the BRIC countries. Given the low number of total certificates for each country for 1993, none of the BRIC countries possess more than 0.001 certificates per 1,000 inhabitants. By 2004, all four of the BRIC countries witness a dramatic increase in both the total number of certificates and the number of certificates per 1,000 inhabitants. In terms of certificates per 1,000 inhabitants, China led the BRIC countries with 0.1026 followed by Brazil with 0.0331. In examining the data for 2015, China again leads the BRIC countries with 0.2134 certificates per inhabitants.

**Table 1: Snapshot of ISO 9001 certificates**

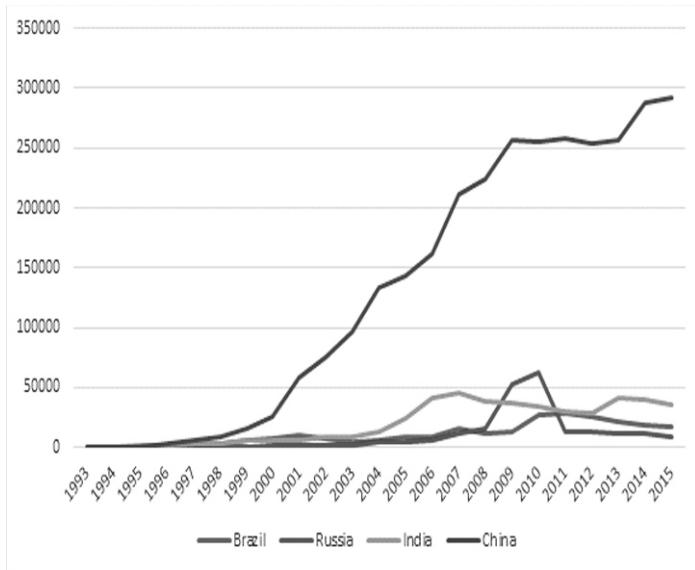
Country	1993		2004		2015	
	Total	Per Capita (per 1,000)	Total	Per Capita (per 1,000)	Total	Per Capita (per 1,000)
Brazil	113	0.0007	6,120	0.0331	17,529	0.0851
Russian Federation	5	0.0000	3,816	0.0265	9,084	0.0630
India	73	0.0001	12,558	0.0112	36,305	0.0281
China	35	0.0000	132,926	0.1026	292,559	0.2134

**Total** Total number of ISO 9001 Certificates. Data obtained from the International Organization for Standardization.

**Per Capita** Total number of ISO 9001 Certificates divided by the Country's population in terms of 1,000s. Data obtained from the International Organization for Standardization and the World Bank

Figure 1 plots the number of organizations certified as ISO 9001 in BRIC countries from 1993 to 2015. China experienced rapid growth in the number of ISO 9001 certificates starting in the year 2000. In India, the number of ISO 9001 certificates grew sharply after 2004. In contrast, Russia did not have substantial growth in the number of ISO 9001 counties until after 2008. However, the number of certificates in Russia declined after the year 2010. The number of certificates in Brazil grew at a steady pace.

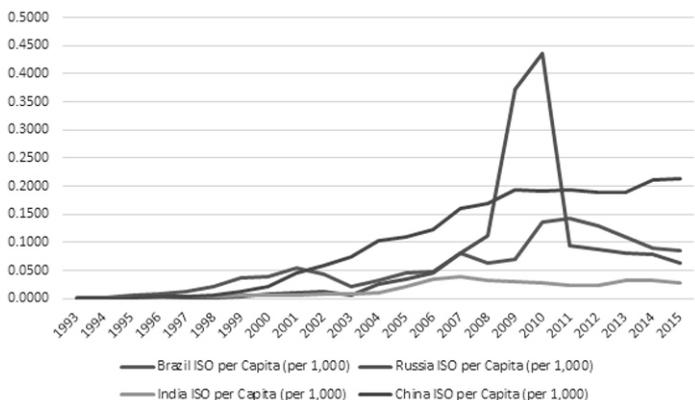
Figure 1 ISO 9001 Total numbers



Total number of ISO 9001 Certificates. Data obtained from the International Organization for Standardization.

In Figure 2 the number of ISO 9001 certificates for each of the BRIC countries is deflated by the number of inhabitants, in thousands. The data of certificates per 1,000 inhabitants shows the steady growth for China. In contrast, India's quantity has remained stable over the 1993-2015 period. The data in Figure 2 reveals greater volatility in the number of certificates per 1,000 inhabitants in Brazil and Russia than the other two BRIC countries, marked by periods of growth and reduction.

Figure 2 ISO 9001 per Capita



Per Capita Total number of ISO 9001 Certificates divided by the Country's population in terms of 1,000s. Data obtained from the International Organization for Standardization and the World Bank

Table 2 provides the descriptive statistics for the BRIC countries. China leads the BRIC countries with the most ISO 9001 certified organizations with a mean of 131,599.17 over the 1993-2015 time frame. For the other three countries, India is second with 19,638.17, followed by Brazil with 10694.22 and Russia 9,657.87. The Kruskal-Wallis statistic is 20.974, suggesting significant differences in the number of ISO 9001 organizations between the countries. The second row of data in Table 2 provides the number of ISO 9001 certified organizations for each country deflated by the country's population in the thousands. According to the data, China possesses the greatest number of certified organizations per 1,000 inhabitants with a mean of 0.0988 over the sample period. Russia has the second highest amount of certified organizations per 1,000 inhabitants with 0.0675. The Kruskal-Wallis statistic suggests significant differences among the BRIC countries in terms of the number of ISO 9001 certified organizations per 1,000 inhabitants. An examination of the standard deviation for the ISO 9001 variables reveal both the growth and volatility of the number of ISO 9001 certificates in the BRIC countries. The growth and volatility of the number of ISO 9001 certificates are also represented in Figures 1 and 2.

Interestingly, the difference among the BRIC countries of the year-to-year change in the number of ISO 9001 certificates, captured by the Change in ISO 9001 per Capita is not significantly different. Taken together, these two results suggest that even though the levels of ISO 9001 certificates in the BRIC countries are dissimilar, the trend or growth is not statistically different. The final four rows of Table 2 provide the economic information collected from the World Bank. Brazil has both the largest GDP per Capita and FDI per Capita. The Kruskal-Wallis statistic for both GDP per Capita and FDI per Capita is significant, suggesting significant differences exist between the countries. In terms of volatility, the greatest change in GDP per Capita exists for China. The Kruskal-Wallis statistic for change in GDP per Capita is significant, suggesting material differences exist within the BRIC countries. According to the final row of Table 2, Brazil has the greatest mean for the change in FDI per Capita. The Kruskal-Wallis statistic is not significant, suggesting that there are no material differences for the BRIC countries in terms of the change in the year-to-year FDI per Capita.

Table 2 : Descriptive Statistics

	Brazil	Russia	India	China	K-W Statistic
Total number of ISO 9001 Certificates					
Mean	10,694.22	9,657.87	19,638.17	131,599.17	20.974***
Standard Deviation	8,800.41	16,116.13	16,873.13	112,480.09	
ISO 9001 per Capita					
Mean	0.0553	0.0675	0.0163	0.0988	13.235***
Standard Deviation	0.0433	0.1129	0.0136	0.0831	
Change in ISO 9001 per Capita					
Mean	36.01	69.81	44.74	76.31	1.91
Standard Deviation	63.50	104.37	83.19	135.89	
GDP per Capita					
Mean	9,758.47	8,588.14	1,016.68	3,053.28	73.870***
Standard Deviation	1,306.23	2,336.95	367.03	1,751.76	
Change in GDP per Capita					
Mean	1.62	2.35	5.32	8.89	45.66***
Standard Deviation	2.47	6.09	2.05	1.91	
FDI per Capita					
Mean	198.98	156.86	13.02	91.46	40.317***
Standard Deviation	156.17	171.79	12.18	68.61	
Change in FDI per Capita					
Mean	32.22	27.03	28.65	11.63	1.40
Standard Deviation	64.09	69.51	50.21	22.99	

\*\*\* Significant at the 1% confidence level

Total number of ISO 9001 Certificates

GDP per Capita

FDI per Capita

Total number of ISO 9001 Certificates. Data obtained from the International Organization for Standardization

Gross Domestic Product, deflated by population. Data obtained from the World Bank.

Foreign Direct Investment, deflated by population. Data obtained from the World Bank. Changed variables are calculated by finding the percent change from the previous year for the previously defined variables.

Panel A of Table 3 provides the statistics of the base model examining the role of GDP and FDI in the number of ISO 9001 certificates for the BRIC countries. Given the effects of outliers with the data, each variable was winsorized at the 10 percent level. This process reduces the effects of the outliers on the results. According to the results there is a positive and significant relation between FDI per Capita and the number of ISO 9001 certificates. The coefficient for the GDP per Capita variable is not significant, suggesting no discernible relation between the size of the overall economy of the BRIC countries and the number of ISO 9001 certificates. Both coefficients for the lagged economic variables are not significant. It appears the prior year's economic performance does not impact the growth or decline in the number of ISO 9001 certificates of the current year.

The results of regression analysis utilizing indicator variables are presented in Panel B of Table 3. The use of indicator variables allows for analysis of the relation among the variables on a country-specific level. With the inclusion of the country-specific variables, both the current change in FDI per Capita and the lagged FDI per Capita have significant coefficients. These coefficients are positive, suggesting a direct relationship between the number of ISO 9001 certified organizations and the change in Foreign Direct Investment. The coefficients for both GDP per Capita variables are not significant. This result indicates that the change in the current year GDP and the prior year GDP are not associated with the current change in the number of ISO 9001 certificates. In the model, Russia serves as the base and the intercept. The other three BRIC countries are represented as indicator variables. The coefficient for the intercept (representing Russia) is significant and positive. The result suggests that the change in the number of ISO 9001 certificates in Russia is more sensitive to the volatility of the economic variables. The coefficient for

Table 3 : Regression Results

Panel A			
Variable	Coefficient	t statistics	p value
Intercept	35.228	2.502	0.014
Changed in GDP per Capita	2.425	0.814	0.418
Changed in FDI per Capita	0.303	1.748	0.084
Changed in GDP per Capita lagged	-2.885	-0.943	0.349
Changed in FDI per Capita lagged	0.253	1.506	0.136
			Adj. R Squared 0.037
Panel B			
Variable	Coefficient	t statistics	p value
Intercept	67.730	3.575	0.001
Changed in GDP per Capita	0.713	0.228	0.820
Changed in FDI per Capita	0.352	2.032	0.046
Changed in GDP per Capita lagged	-4.923	-1.515	0.134
Changed in FDI per Capita lagged	0.320	1.896	0.062
Brazil	-50.665	-2.274	0.026
India	-32.382	-1.425	0.158
China	12.909	0.447	0.656
			Adj. R Squared 0.091

Changed variables are calculated by finding the percent change from the previous year for the previously defined variables. Lagged variables represent the prior year's observations of the previously defined variables. Brazil is coded as 1 if the observation comes from Brazil, otherwise 0. India is coded as 1 if the observation comes from India, otherwise 0. China is coded as 1 if the observation comes from China, otherwise 0

Brazil is negative and significant. The negative coefficient demonstrates that despite the economic levels of the country it appears the change in the adoption rate of ISO 9001 is inversely related to the economic variables. The coefficients for India and China are not statistically significant. This result advocates that the two unique country-specific environments are not associated with the adoption rates of ISO 9001 in India and China.



**ONCLUSION**

Since the inception of the ISO 9001 standards, organizations have voluntarily chosen to go through the accreditation process. This worldwide adoption of the standards provides researchers an opportunity to study numerous issues. The most researched topics in this area are the current diffusion of quality, the motives for certification, the problems/benefits of

certification, and the influence of certification on economic performance.

Unlike previous studies, this research examines the role that two economic variables have in the adoption of ISO 9001 standards in the BRIC countries. Adoption of ISO 9001 in the BRIC countries remained relatively low until the early 2000s. Results show that the overall adoption of ISO 9001 differs significantly among the BRIC countries. China has the most ISO 9001 certified organization both in terms of overall numbers and ISO 9001 certificates per capita.

The outcomes represent an important contribution to both researchers and companies. The results show the change in FDI per Capita is associated with the adoption of ISO 9001 for the BRIC countries. After controlling for the country, further analysis reveals that both the current change in FDI per Capita and lagged change in FDI per are positively associated with the

number of ISO 9001 certificates. This result suggests that this economic activity is associated with the number of organizations voluntarily fulfilling the ISO 9001 requirements. In order to further examine the unique relation of the economic variables and the ISO 9001 certificates, each country was assigned an indicator variable. The results show that the coefficients for both Brazil and Russia are statistically significant, revealing an association between the economic variables and the number of ISO 9001 certificates.

Researchers are examining both the significant costs and potential benefits associated with the adoption of ISO 9001 that organizations face. In addition, researchers are examining ISO 9001 certification from a macro perspective. The authors believe the outcome of this study represents an important contribution to the macro examination of ISO 9001. This study shows that key economic variables are not universally associated with the adoption of ISO 9001 among the BRIC countries. Both Brazil and Russia appear to have a unique relationship between the economic variables and the

change in the number of ISO 9001 certificates. Future research is necessary to further explore these situations. In addition, further research must examine the role of business practices, including but not limited to ISO 9001, can have on economic development in order to gain greater insight into globalization.

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