ASSESSING IMPACT OF ISO 9000 CERTIFICATION ON INTERNATIONAL TRADE

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ABSTRACT

Introduced by the International Organization for Standardization in 1987, the ISO 9000 family of standards is a 'generic quality management standard' that has been claimed to have a great impact on company performance and upon a company's ability to satisfy customers' expectations (ISO, 2009e). In addition, ISO 9000 standards also help to create consensus on requirements and standards all around the world and in doing so can facilitate trade. While many studies have examined claims about the impact of ISO 9000 standards as a trade facilitation tool results, thus far, are ambiguous. ISO 9000 standards also have different impacts across countries of different economic status.

To more rigorously assess the trade impacts of ISO 9000 certification, this paper builds a gravity model for the trade flows by taking into account the ratio of ISO 9000 certified firms within a particular country and industry. Alternative specifications also include measures of trading country's economic status. Results suggest that there is a significant interaction between the impact of ISO 9000 certification and trading partner economic status. This study shows that the adoption of ISO 9000 will have a significant and positive impact on trade of most countries. The scale of increase in trade flows, however, is different across economic levels. These results are consistent with findings of other authors (e.g. Clougherty and Grajek, 2008) that ISO 9000 standards have more impact on developing and least developed countries than developed ones. Suggestions for further research are provided.

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I. INTRODUCTION

Trade liberalization opens doors for every country to trade with each other and can help boost the global economy through facilitating trade between countries. The scale of increasing of trade volume, however, would be much higher if countries were to eliminate protection programs for domestic industries against the outside competition in the form of tariff and non-tariff barriers (Edwards, 1993). Today, with increasing number of free trade areas (FTAs) and regional trade agreements (RTAs), tariff barriers has been gradually reduced and removed and no longer considered a significant hindrance to trade (WTO, 2005). Instead, countries now tend to use non-tariff barriers and others, which, they claim, are for the national security, sanitary, environmental protection. These barriers, however, have been criticized as being imposed primarily as economic protection measures that are used to partly reduce the ability of foreign countries to penetrate into the domestic market (WTO, 2005).

Tariffs and non-tariff barriers, however, are imposed by government, therefore, it is essential to have international standards which can reconcile and harmonize the differences in countries' regulations, reduce obstacles to trade as well as connect trading partners from different countries. The International Organization for Standardization's (ISO) purpose is to form a bridge between the public and private sector, also create consensus on requirements of business and broader needs of society. Therefore, ISO standards are introduced, partly, in order to facilitate and promote trade. Standards offered by ISO cover a range of topics from traditional activities (agriculture and construction), through mechanical engineering, manufacturing and distribution, to

transport, medical devices, information and communication technologies, and to standards for good management practice and for services (ISO, 2009e).

Among those standards are ISO 9000 standards which were introduced with the intention provide guidance in the management of an organizations' operations in order to deliver products that satisfy customers' requirements and expectations. It can be considered a "passport" to enter a new market for penetrating companies due to the fact that having ISO 9000 certificates will be a competitive advantage over other competitors that do not have (Simmons and White, 1999). In addition, ISO 9000 certificate can act as a common language for every organization which will connect, align their operation and hence reduce information asymmetries, and minimize operational costs among them (Shannon et al., 1999). Those explain the wide use of ISO 9000 standards in millions organizations in 175 countries in the world and increasing number of companies seeking for its certification.

Research, however, also finds that ISO 9000 standards can be considered a barrier to trade as the documentation required by the registration process very time-consuming, costly and detailed. In addition, there is no international body that is in charge of assuring the quality of the organizations which provide ISO 9000 certification (accrediting organization). As such, the value of an ISO certification will depend, in part, on the relative stringency of the issuing country and auditing organization (Jones and Hudson, 1996). Besides, ISO seems to be more beneficial for developing countries than developed countries because implementing ISO 9000 standards is a way for developing countries to reduce transaction cost and information asymmetries as well as strengthen institutional

capacity (Clougherty and Grajek, 2008). Yet the implementation is more costly and time-consuming for them to pursue a certification then that of developed countries (Hudson and Jones, 2003). Furthermore, buyers may not show any special attention to a company's acquisition of ISO 9000 certification due to the fact that some industry experts and major investors do not feel that pursuing ISO 9000 certificate assures any improvement in a company's performance. (Martinez-Costa and Martinez-Lorente, 2003). That observation is also supported by the findings of Dunu and Ayokanmbi (2008) in their examination of the impact of ISO 9000 certification on an organization's finance performance. These authors found that ISO 9000 certification does not significantly increase the ratio of revenue to assets, or operating income to assets significantly. These findings then call to a question about the actual effect of ISO 9000 certification on international trade.

Hudson (2003) suggests, ISO 9000 may enhance trade more than hinder trade in developed countries, however, the enhancing effect may not be as significant as expected due to the fact that consumers in developed countries will rely on the domestic standards and consider the products are of 'high quality' rather than products from developing countries. As ironic as it is, ISO 9000 certificate is anticipated to bring more benefit to least developed, and developing countries than to developed countries; the cost of acquiring and maintaining accreditation for companies is rather high in comparison with their economic scale. This is one of the key reasons that ISO 9000 is adopted in developed countries than in countries with lower level of economic development. The net

effect of ISO 9000 certification on developing and least developed countries remains unclear.

The purpose of this paper is to evaluate the actual impact of ISO 9000 standards on international trade. In order to empirical evaluate the real effect of ISO 9000 certification in international trade, the analysis makes use of the gravity model. This model is commonly used to predict trade flows between two countries based on their economic size as well as other indicators which are expected to have impact on trade. Among those indicators, the information about ISO 9000 certification will be included in the model under three approaches in order to determine whether ISO 9000 certification is statistically significant to international trade flow across countries. As a first step, in the baseline model, ISO 9000 certification will be added as the variable about the ratio of number of ISO 9000 certificates to number of firm count in each industry for the importing and exporting country. The second step is to add to the baseline model the dummy variables about economic status of participating countries in trade. The last step is to take into account the interaction of the economic status and the ratio of number of ISO 9000 certificate to number of firm count data. The last two approaches are considered with the purpose of investigating whether there is any difference impact of ISO 9000 certification on trade of different countries with different economic status.

The rest of this paper is organized as follows. Part II provides a review of the literature about standards in general, and the ISO 9000 standards in particular. The impact of standards on trade will also be theoretically explored. Part III will introduce the methodology used to develop a model suitable to analyze the impact of ISO 9000

standards on international trade. This approach is novel and makes use of a new coding system for industries. Part IV represents the results and a discussion of this analysis. Part V provides conclusions of this paper and suggestions about future research.

II. LITERATURE REVIEW

1. Standards and Trade

a. Overview of importance of standards

Standards are introduced as a common language which can reduce variability, confusion and can help companies to take advantage of economies of scale to reduce labor and production costs, and as a consequence reduce products price (Kindleberger, 1983). Product variety is needed to satisfy different customers' varied tastes, however, in order to ensure profit, companies will have to optimize the benefit between the degree of product variety and the degree of economies of scale therefore, companies cannot take risk by producing too much variety in order to satisfy every customer in the (Lancaster, 1990). Standardization increases the compatibility of products hence increase the popularity of the products then reduce the difficulties in maintenance and repair of them (Kindleberger, 1983). In order to control too much variety, standards are products and process specifications that are used to harmonize the treatments of intermediates in the production process or the attributions of the final products (Moenius, 2004). Normally, a product's value can be evaluated by customers through the number of its users and customers care not only about the product itself but also about the whole system containing that product, about its availability, complementary goods and more important its popularity among consumers (WTO, 2005). That system cannot be obtained if there is no system acting as a "norm" to align and coordinate related activities in the market. In international settings, international standards can help facilitate technical compatibility among countries which, at the same time, can make information sharing become easier

and thus reduce transaction costs. Hence, compatibility function plays an important role in bolstering the development of many aspects in the society even though it may reduce the number of varieties available to customers (Caves and Roberts, 1975).

Different customers have different preferences and in order to gain market share, companies will have to diversify their products to satisfy different tastes. Product diversification, however, incurs high research and production cost for companies which, many of them cannot bear. Thus, companies have to optimize between cost saving gained through economies of scale and the expense of product diversification.

One of the ways to control the costs of production diversification is to take advantage of the compatibility function of standards. Also, by setting the 'minimum quality standards' – the certain level of quality that if products reach that level or above can be traded in the market (WTO, 2005) – product quality will be considered carefully and improved substantially, at the same time remarkably reduce the negative risk faced by customers (Leland, 1979). 'Minimum quality standards' also reduce cost of uncertainty and process of evaluation arising to customers who will be the final consumers or manufacturers that needs intermediate materials, hence customers have enough information to make judgments and are not misled by too much information (Hudson and Hudson, 2008). More than that, standards also provides a 'manual' for company to base their own quality control and provide benchmarks for their own self-improvement programs. When successful, such programs will gain customer's loyalty which will become a valuable intangible asset for company, and which, in turn, become the motivation for company to maintain high operational and product quality

(Kindleberger, 1983). In addition, common standards may also take environmental and safety issues into account in order to adapt to the general trend and requirements of social welfare consideration (Blind, 2002). With this, customers can consume the product with certain confidence in its safety, environmental impact and/ or the firms ethical business and manufacturing practices (WTO, 2005).

There are many kinds of standards, and many ways to categorize them. In the World Trade Report (WTO, 2005), the World Trade Organization describes several ways to classify standards. Firstly, standards can be differentiated vertically and horizontally. Vertical differentiation refers to "different varieties [that] can be ordered according to certain scales", while horizontal differentiation implies that "the characteristics used for differentiation cannot be ranked". The 'minimum quality standards' mentioned previously can be placed in the vertical differentiation categorize, while horizontally differentiation is about different in qualitative characteristics like color, style, etc. Secondly, standards can be divided into private and public standards due to the origination of that standard. However, the distinction between which standard will be considered "public" or "private" is not always clear, and may depend on the perspective of the observers. In general, "public" standards are the standards that take into account the benefits of all entities in the society. "Private" standards primarily are concern with the benefits of firms, and even they consider the benefits of customers, those benefits also correspond to firms' benefits as well. Non-governmental organizations (NGOs) like ISO also set their own standards, and those are considered "private standards" under the viewpoint of international trade law (WTO, 2005) . Thirdly, standards can be voluntary

or mandatory. With mandatory standards, only standardized products can be circulated in the market, while with voluntary standards, either standardized and non-standardized products can be distributed. Finally, standards can be used to standardize process or products, as compared to product standards which concern about the characteristics of a product, process standards are used to standardize the process of production in order to control how the goods are produced, how effective the production process is, and how it affects the environment.

Other authors have developed alternative categorization systems. Hebner (Hebner, 1998), for example, divided standards into four categories: (1) test and measurement standards are generic tools or 'infra' technologies, (2) product standards that establish the fitness of a product for a particular use, (3) documentary standards which set specifications for the function and operation of a device or a system, and (4) process and management standards that addresses 'quality and process management'. The ISO 9000 business management standards and the 'environmental management' standards are examples of this latter group (ISO, 2009e). Alternatively, standards can be divided into standards for minimal admissible attributes (for example: safety levels, product quality, etc.), standards for reference (definitional standards, for example: currencies, weights, measures, dimensions of materials, etc.), and standards for interface compatibility (for example: screw threads, codes, physical design of interfaces, etc.) (Jones and Hudson, 1996). Moenius (2004) categorized standards by their origin, he termed *de facto standards* as standards evolving out of the market process, *de jure standards* are standards imposed by law, and *institutional standards* as standards

resulting from coordination in committee and standardizations institution like the International Organization for Standardization.

b. ISO 9000

This paper is interested in examining the impact of business management standards on international trade. As among the most widely adopted standards in the world, the ISO standards will be examined as a case example. ISO 9000 can be placed into the category of an institutional (Moenius, 2004) , 'private and voluntary standards'(WTO, 2005).

The purpose of the ISO 9000 series of standards is to act as 'generic quality management standards'. This means that it is intended to be applied to the quality management of any organization, in the society in general and in business in particular regardless of the size of ownership or profit seeking status (i.e. privately owned, or state owned), industry or service. ISO 9000 is a management tool designed to improve an organization's management system. It, therefore, does not give organizations specific steps to run their business, instead this standard defines critical business elements (activities) that must be considered and for which procedures must be in place for quality business practices. ISO 9000 requires organizations to have their own "quality manual" in order to document procedures developed to address the ISO 'elements' and to log any activities that can affect the quality system. This process of procedure development and documentation is a required intermediate step to get ISO 9000 accredited.(Docking and Dowen, 1999).

It is worth noting, however, that ISO itself does not provide ISO 9000 certification, it is not compulsory to pursue certification. The standard may, instead, be used to guide internal process development. Without certification, however, companies cannot claim that they adhere to this standard. ISO 9000 certifications are issued by independent audit companies. Importantly also, ISO certification is not a 'once for life-long certification'. Firms must be re-audited every three years to ensure that they still adhere to the ISO 9000 requirements (ISO, 2009e).

In 1979, the ISO technical committee ISO/TC 176 was approved to be in charge of the ISO 9000 family of standards for quality management and quality assurance. At first, in 1979, it had 20 countries as active participants and 14 countries as observers (ISO, 2009e). By mid-January 2009, this number has increased to 81 active participants and 21 observers (ISO, 2009d).

In 1987, ISO/ITC 176 introduced the first version of ISO 9000, called ISO 9000:1987. Since that time, ISO 9000 has revised and introduced many updated versions (usually every four years). Names of the standard are adjusted to reflect each version of it, for example, a company could have been initially accredited to the ISO 9000:1994 version, ISO 9001:2000 version, or ISO 9001:2008 version.

While most standard revisions were relatively minor, in 2000, the International of Standard Organization (ISO) made a significant change to the ISO 9000 standards. Prior to December 2000, ISO 9000 consisted of a family of standards of ISO 9001, ISO 9002, and ISO 9003 standards. ISO 9001 standards were for companies and organizations whose activities included the creation of new products and who wanted to ensure quality

assurance in design, development, production, installation, and service. ISO 9002 standards were similar to ISO 9001, but did not include the requirements concerning new product development. ISO 9003 standards cover only for the final inspection of finished product, regardless of how the product was produced (Bizmanualz, 2009). After December 2000, ISO merged ISO 9001, ISO 9002, and ISO 9003 standards into revised ISO 9001 standards. To further distinguish between the old and new version, the new ISO 9001 standard is referred to as ISO 9001:2000 or ISO 9000:2000 (ISO9000Council.org, 2009). Today, the ISO 9000 family of standards is a general name, which refers to a collection of standards documents. These are: (1) ISO 9000 standard which provides the fundamentals and vocabulary used in the entire ISO 9000 family of standards; (2) ISO 9001, which describes quality management system; (3) ISO 9004 which is an extension of ISO 9001, and is used by companies who wish to introduce a program of continual quality improvement.

Due to the significant difference in the standard before and after 2000, in order to have a more accurate view to the development of ISO 9000 standards, this discussion will continue by separately examining the use of ISO 9000 standards before and after 2000.

i. Adoption of ISO 9000 before 2000

As of December 2000, there were at least 408,631 ISO 9000 certificates awarded in 158 countries worldwide, this value reflected an increase by 16% (64,988) compared to that of 1999 when only 150 countries had certified firms. In merely ten years since it was first introduced, the number of certificates increased twenty times and at increasing

rate of growth (Figure 1). The increase in number of ISO 9000 certificates in the first period of surveying showed partly the importance of it in the eyes of organizations.

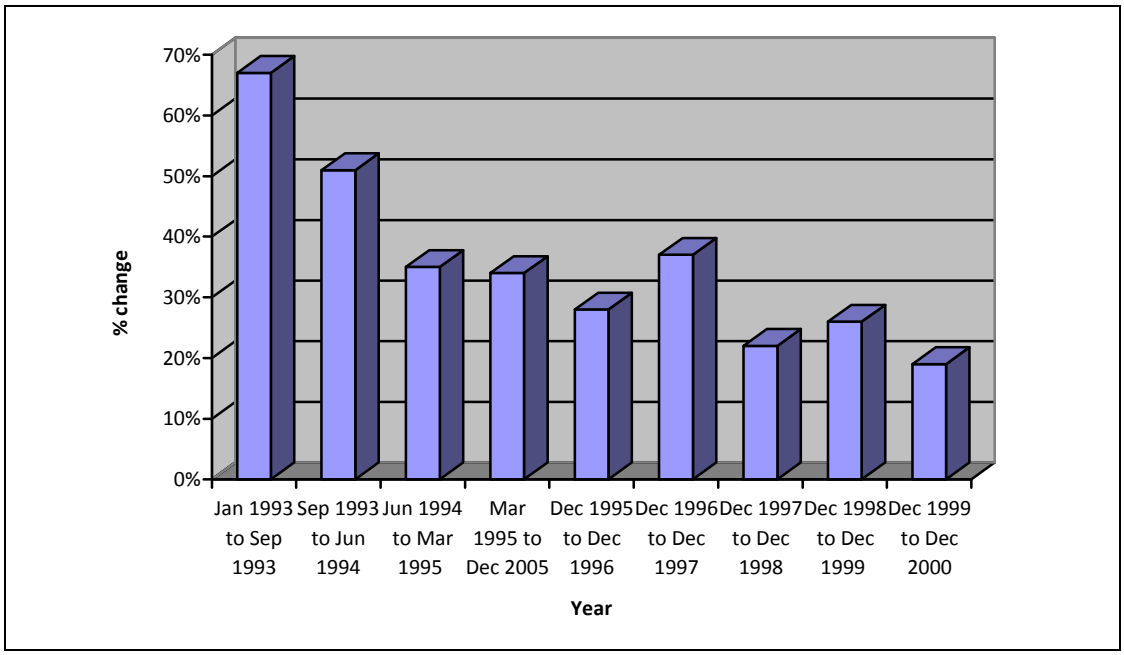

Figure 1: % change in world total of ISO 9000 certification in ten cycles (1993 - 2000)
*Source: The ISO survey of ISO 9000 and ISO 14000 Certificates (2000)

There are, however, many important geographic and inter-industry trends within these aggregate figures. When investigating the distribution among different regions in the world, Figure 2 clearly shows that Europe has always accounted for more than half of the number of ISO 9000 certifications. Further, despite a decreased share over the world total from 83.02% to 53.87% (January 1993 to December 2000), number of ISO 9000 certificates in Europe still increased dramatically in absolute terms (increase 29,879 new certificates in 2000). Comparing among regions, geographically, Europe has the relative high population with rather high living standards, therefore, it is reasonable that they have the most share of ISO 9000 certificates number. Following is North America (4.32% to 11.82% in the same period), where two big developed countries, Canada has

and the United States, especially the United States, are the bases for most of the biggest companies, organizations in the world. But their share in total ISO 9000 certificates does not change much through years, this may be due to the fact that they are among the most developed countries in the world, therefore, their quality can be considered base standards for others countries. Adopting ISO 9000 is not much attractive to them. Those characteristics make ISO 9000 certificates popular there. Similar reason for Australia and New Zealand which are developed countries. The shares of these developed countries in the total world ISO 9000 certificates map did not change much through time. Replacing it are the increasing share of developing and least developed economies which are Far East (from 2.46% to 20.05%), Africa and West Asia (from 3.42% to 4.945%), and Central and South America (from 0.1% to 2.64%). These countries, especially developing countries, have an increasing tendency to adopt ISO 9000 certification in order to increase their reputation, and to facilitate business transactions internationally.

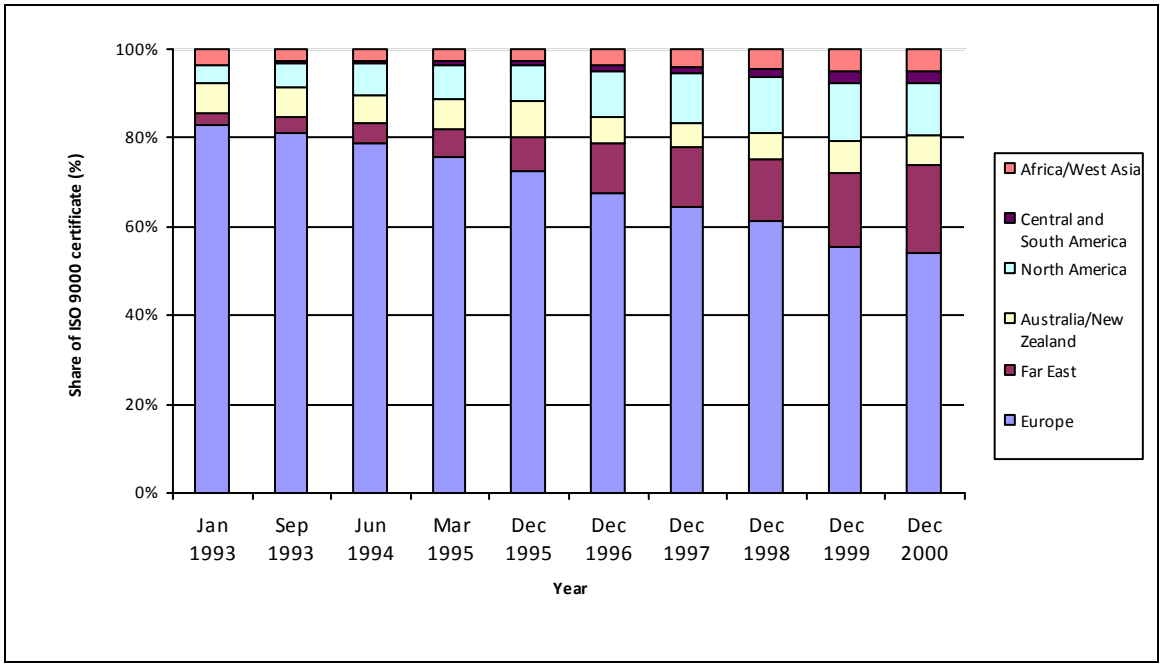

Figure 2: Regional share of ISO 9000 certificates (1993 - 2000)
*Source: The ISO Survey of ISO 9000 and ISO 14000 Certificates (2000)

Within these aggregate regional trends, there are strong countriy – specific trends in ISO 9000 adoption that are worth examining. Figure 3 shows more clearly ISO 9000 certificates by countries with the highest rate of adoption. As depicted, Asian and European countries are among those countries that have the highest increase of the number of ISO 9000 certificates annually; in 2000, China and Italy have the highest annual growth with 10,548 new certificates and 9,298 new certificates, respectively. Japan with 6,765 new certified companies is in the third position, and after that are Republic of Korea (3,891 new certificates), then Spain (3,877 new certificates) and Czech Republic (2,355 new certificates).

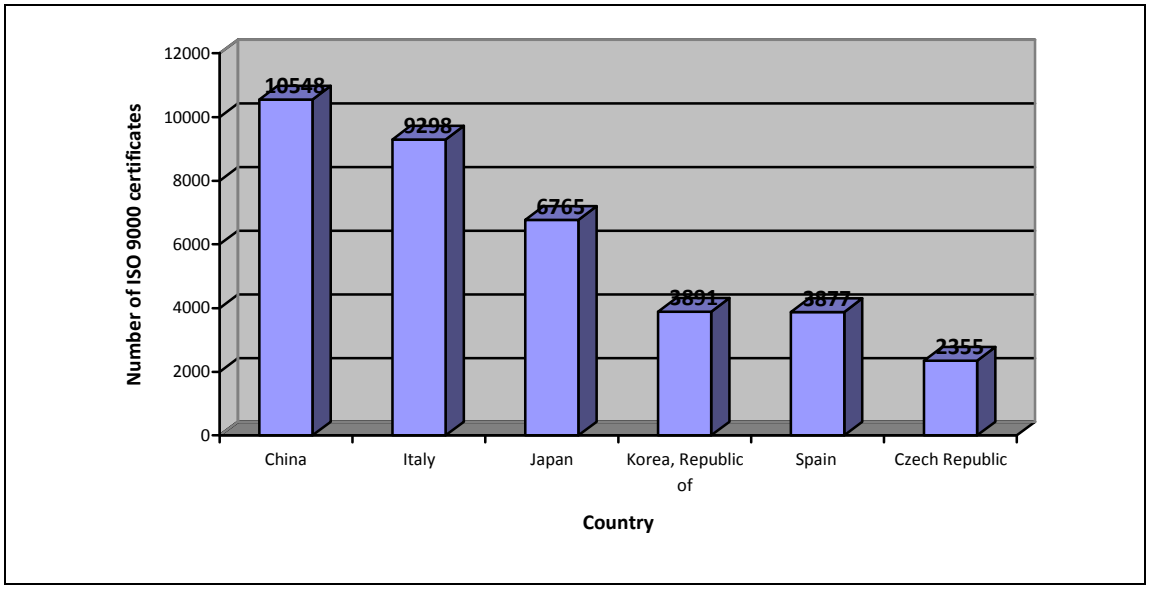

Figure 3: Countries with highest growth of ISO 9000 certificates in 2000
*Source: The ISO Survey of ISO 9000 and ISO 14000 Certificates (2000)

ISO certificates are also distributed differently across different industries. For most of the years between 1993 and 2000, the basic metal and fabricated metal products' industry has the most ISO 9000 certified firms (Figure 4). This is followed by electrical and optical equipment industry; the construction industry, and the machinery and equipment industry. The five industries that have most ISO 9000 certificates do not change during this time period.

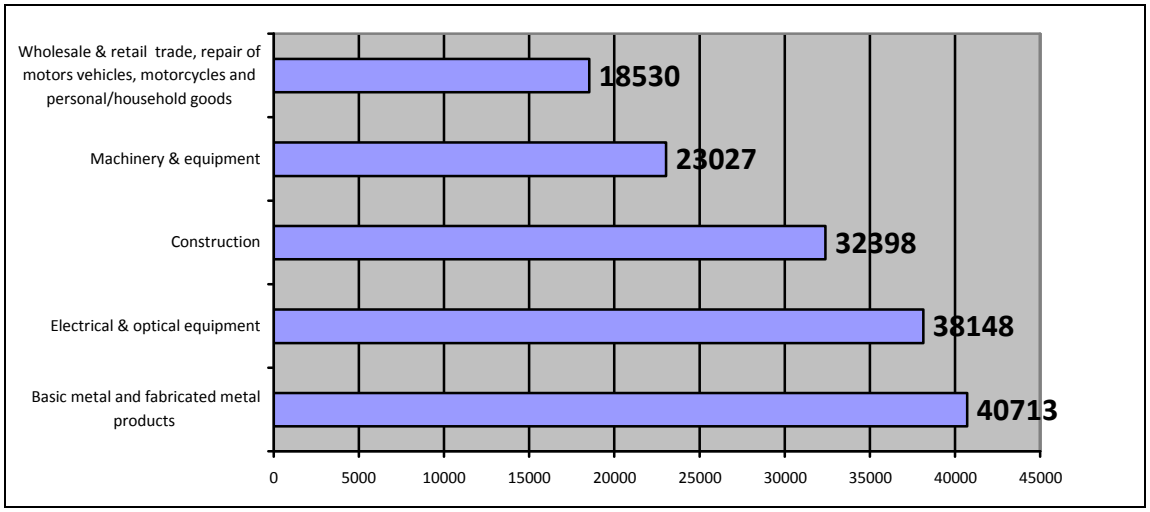

Figure 4: Highest number of ISO 9000 certificates by industrial sector in 2000
*Source: The ISO Survey of ISO 9000 and ISO 14000 Certificates (2000)

ii. Adoption of ISO 9000 after 2000

In 2000, ISO 9000 changed into ISO 9001:2000 with the combination of ISO 9001, ISO 9002, and ISO 9003 into one family of standards. December 15th, 2003 was the deadline for transitioning from the ISO 9000:1994 into ISO 9001:2000. Therefore, there is a big difference in the number of certificates before and after the transition of ISO 9000 standards due to the fact that there are not many certificate holders of the 1994 version can meet the transition deadline (ISO, 2003b). And as the matter of fact, in December 2001 there was only 8.7% of the total world certified entities could correspond to the new ISO 9001:2000 standards (Saraiva and Duarte, 2003), that explained why in 2001, the number of certificates dropped from 408,631 to 44,388.

By December 2007, five years after ISO 9001:2000 standards were first introduced, there are at least 951,486 ISO 9001:2000 certificates had been issues in 175 countries and economies. Compared to 2006 data (896,929), this reflects an increase of 5% (54,557 newcertificates) with 170 countries and economies. As shown in the graph,

the number of certifications is always increasing but with a slower growth rate in recent years.

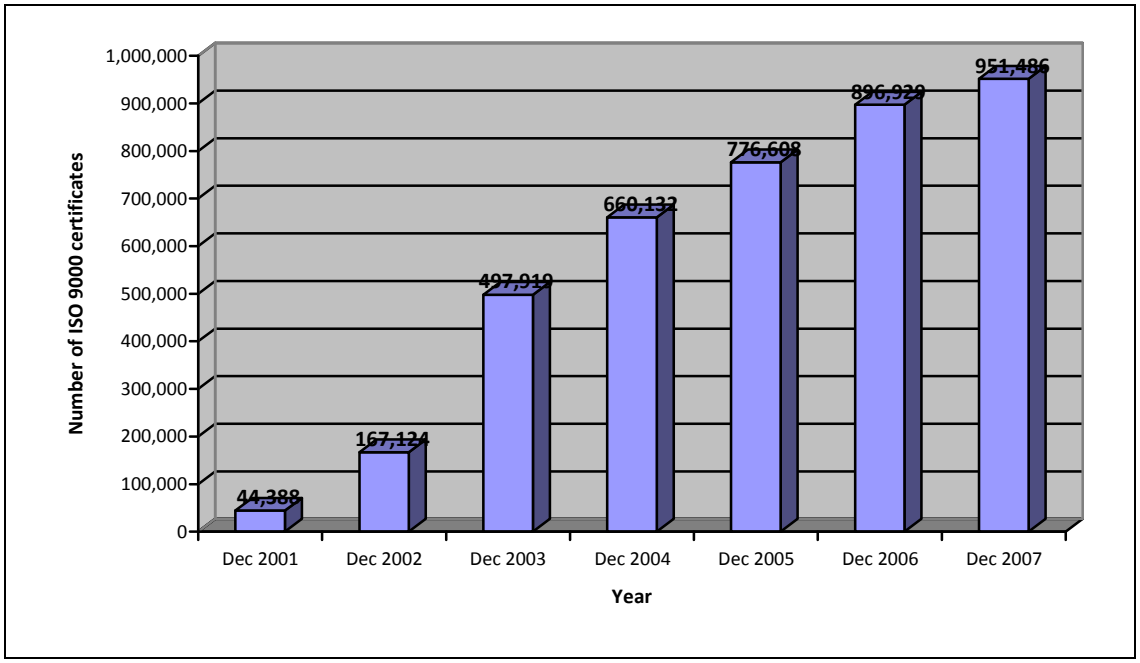

Figure 5: World total of ISO 9000: 2001 certificates from December 2001 to December 2007
*Source: The ISO Survey of Certification 2007

There is a big shift in the distribution of the ISO 9001 certificates throughout different areas compared to that before 2000 (Figure 6). Europe and Far East countries still take the first and second place with around two third of the world's certificates. Contrary to its stable position before 2000, since the standard revision, Australia and New Zealand have gradually lost share, whereas Africa and West Asia countries are increasing their share of the world total. Central and South America countries have maintained their previous relative levels of certification.

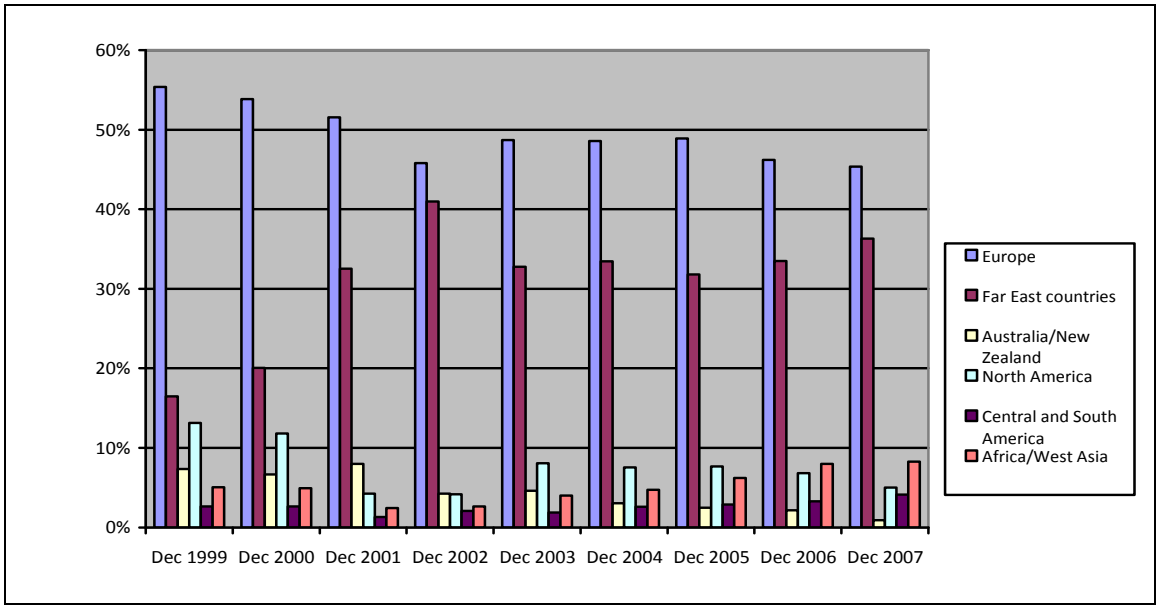

Figure 6: Regional share of ISO 9000 certificates from December 2001 to December 2007
*Source: The ISO Survey of Certification 2007

The rank of countries with highest growth in number of ISO 9000 certified companies changes dramatically after the standards revision. In 2007, for example, China has the incredible increase in number of ISO 9000 certificates granted, with 48,514 new ones, which is nearly five to nine folds the followers, like Italy, Spain, Brazil, Russian Federation, and India. Interestingly, Southeast Asia, for the first time, has a delegate, Thailand, in the ranking (Figure 7).

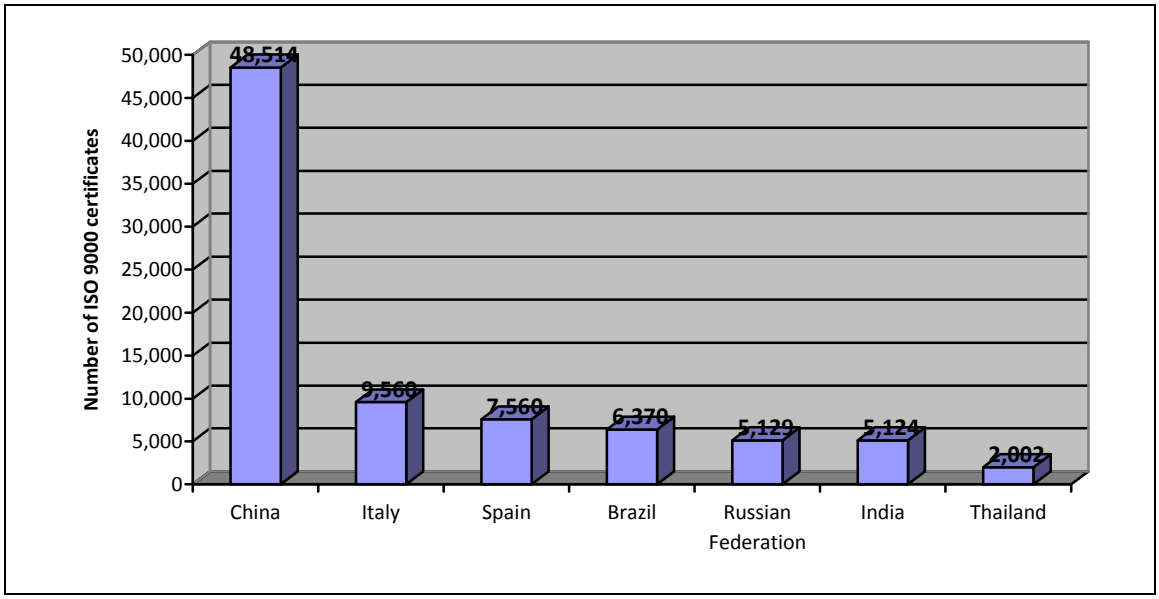

Figure 7: Countries with highest growth of ISO 9000 certificates in 2007
*Source: The ISO Survey of Certification 2007

Relative to the year before 2000, the top five industries that have the highest number of certificates do not change except the ranking among them. The construction industry is the largest adopter of the standard with 95,076 certificates (increase by 18% more than in 2006), followed in the second and third place are Basic metal and fabricated metal products industry with 92,230 certificates (increase by 29% compared to 2006), and electrical and optical equipment industry (increase by 24% more than in 2006). Machinery and equipment industry, and wholesale and retail trade, repairs of motor vehicles, motorcycles and personal and household goods industry in turn stand in the fourth and fifth position with increase of 18% and 15% compared to 2006.

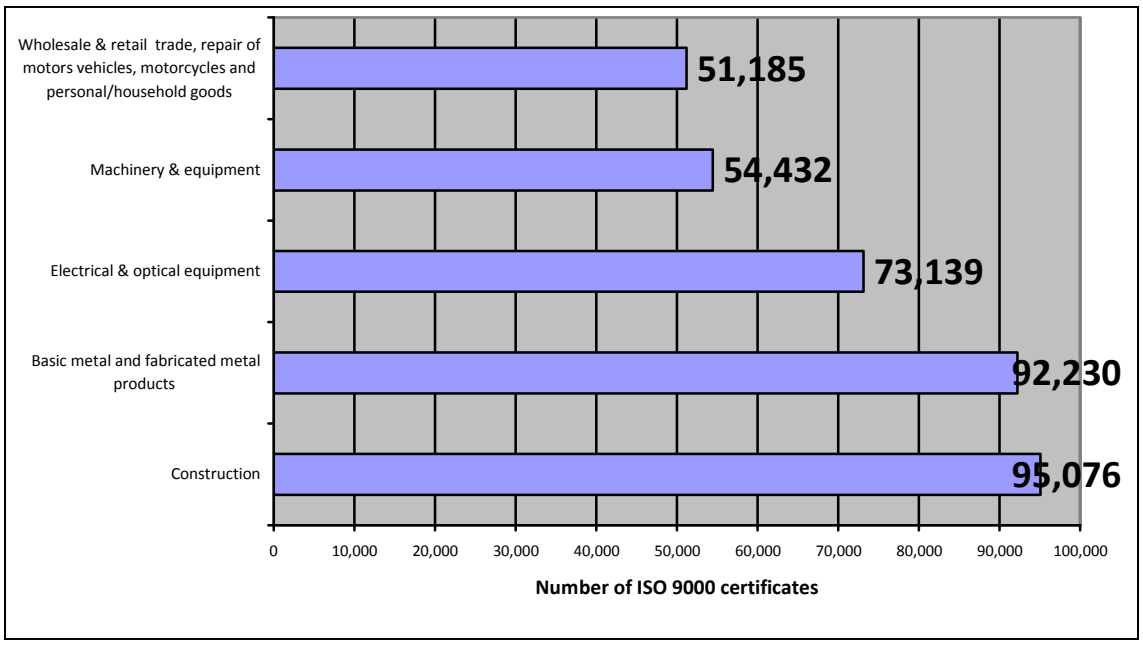

Figure 8: Highest number of ISO 9000 certificates by industrial sector in 2007
*Source: The ISO Survey of Certification 2007

c. Standards and trade

Standards were introduced by the setting-institutions with many purposes. From the national level, countries will argue that the standard is used to fix the market imperfection (WTO, 2005), or from the company and industry level, the standard is to create uniformity compatibility within and between products. However, most of the arguments in favor of standards claim that standards will increase trade more than prevent it (WTO, 2005).

Many empirical studies have examined the impact of standards on trade. On one hand, people reason that technology development creates favorable conditions for company to take advantage of the economy of scale. Companies now can produce in large quantity of products with low price which means they no longer compete in price but in quality and service (Amable and Verspagen, 1995). However, it is very difficult for

consumers to define what is high quality, what is not. They then have to use a wide range of sources to determine product quality, from self-experience to outsiders' recommendations, from logical thinking to sense, etc. Among these, "country of origin" is an important indicator of quality (Hong and Wyer, 1989). Normally, developed countries will have better reputation on product quality than developing countries. People usually assume that developed countries with higher living conditions, developed technology and management techniques will tend to have more attention on customers' safety as well as product quality. Hence, it will be difficult for new entering companies from developing countries to penetrate into the relatively lucrative markets of developed countries (Hudson and Jones, 2003). Besides, countries that want to protect their industry can argue that the products from another country do not meet the national minimum requirements to import to their country, this activity will hinder the flow of trade (WTO, 2005). To solve these problems, standards are introduced, in part, in order to improve trade with other countries; if a particular product meets the destination country's product standards regardless of economic, political or other reasons, the destination country cannot prohibit entry of those products.

In order to facilitate and enhance trade, the compatibility function of standards should solve network externalities problem which was defined by Katz and Shapiro (1985): "There are many products for which the utility that a user derives from consumption of the good increases with the number of other agents consuming the good... [T]he utility that a given user derives from the good depends upon the number of other users who are in the same network." and help producers to run their operations more

effectively, and understand foreign market customers' preferences (WTO, 2005). Given these business opportunities, this motivates firms to use standards to gain more profit (Moenius, 2004). Therefore, when network externalities are large and the conversion costs incurs when complying to local requirements and being able to trade in the local market for production line are high, companies have great incentive to harmonize standards or make them compatible with those of destination countries in order to increase trading activities between each other (Gandal and Shy, 2001). Besides that, information asymmetry is also another problem that affects trading efficiency. Asymmetry happens between producers and customers when producers have needed information about their products but customers do not have when purchase the products (WTO, 2005).This asymmetry can distort the market interpretation about demand and supply when, for example, high quality products offered by producer are not fully recognized by customers, and at the same time increase the cost of customers of assessing product quality (Jones and Hudson, 1996). As standards will specify the requirements of each country regarding a specific product, those who seek to export products can simply state that they meet a certain standard rather than writing, translating, and distributing the technical information themselves. Standards thus help to connect producers and customers. Customers gain base information to make decisions of purchase regarding the quality of the product; and producers with the importing government in the sense of obeying the regulations (Moenius, 2004).

Standards, however, may not always have a positive impact on trade; this is especially true when it concerns about environmental, safety, and ethical issues and costs

accruing from complying with importing country's standards of the exporting country. Otsuki et al. (2001) was interested in assessing the impact of the aflatoxin standard set by the European Union to the food exports from Africa by different scenarios, pre-EU harmonized standards, the new EU harmonized standards (scheduled to take effect in 2002), and the international standard by Codex (FAO/WHO Codex Alimentarius Commission) using the data on trade of fifteen European and nine African countries in the period of 1989 and 1998. In this research, aflatoxins are toxic substances which can cause liver cancer in human and cause 33,000 deaths in European with population of half billion every year, are found in stored agricultural crops (such as peanuts, pecan, walnuts, cotton seeds, etc.). Otsuki et al. estimated the decrease of liver cancer under the Codex standard is 2.3 persons, and 0.9 persons under the pre-EU harmonization, at the price of $670 million and $ 340 million for the loss of African food exports value, respectively. This reduction, however, is relatively small when comparing with the annual death from liver cancer, which raises a question about whether it is suitable to set such regulations with rather high cost to trade compared to low risk on human health.

The imposition of standards on certain agricultural products sometimes not influence those product themselves, it also affect other agricultural products even when they meet all the requirements about quality due to the business community perception about quality. This misleading perception can decrease trade of those agriculture products that do not have problems about quality.

The scenario that a low-tech country wants to export their product into a high-tech country which has specific standards on the products in order to expand their markets and

gain more profit is very common in international business. Yet, relatively 'low-tech' countries often have problems in complying with the standards. First, they have to fully understand the requirements of the standard, and then change their production accordingly in order to satisfy the requirements. Due to the cost of modifying production processes, if each country has different standards, the cost arising for exporting companies may be much higher than the profit they could hope to receive from the business (Moenius, 2004).

In the context of this paper, ISO 9000 is the standard that will be taken into consideration. This standard of business operation is about quality management, rather than about a product or service or specific environmental standards. ISO 9000 defines eight quality management principles for companies to follow in order to improve their performance: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, mutual benefit supplier relationships (ISO, 2009e).

As ISO 9000 standards require improvement in a business' management system, the results are somewhat difficult to evaluate. Further, the impacts of improvement to business system that can be attributed to ISO 9000 standards are often difficult to quantify. As the result, real contribution of ISO 9000 to the performance of companies is still a controversial issue (Gotzamani and Tsiotras, 2001).

Researchers divide into two opposite point of views. One agrees with the idea that ISO standards actually help companies to improve communication, reduce quality variation and related costs, increase customers' satisfaction and keep ongoing

improvement in the companies (Williams, 1997). Surveying 4,250 certificated companies in the United Kingdom about their motivation for pursuing ISO 9000 certification and the benefits of it, using the five-point Likert-type rating scale, Buttle (1996) found that certification improves profit, business process and operations, provides marketing benefits, and that businesses are willing to recommend ISO 9000 standards to their partners (Buttle, 1996). Similarly, using the data drawn by carrying out survey of ISO 9000 standards certified companies in Greece, Gotzamani and Tsiotras (2001) concluded that ISO 9000 standards do help companies improve their performance significantly, enhance their quality commitment, and other benefits to certified companies such as process management, product design, strategic quality planning. In another research concerning impact of ISO 9000 standards on only certified small to medium-sized enterprises (SMEs) in Greater Tehran region, Bayati and Taghavi (2007) surveyed companies' opinion and found the same positive impact of ISO 9000 standards on their performance. Dividing the impacts of ISO 9000 standards externally and internally, using cluster analysis for 288 Spanish companies, Casadesús and Giménez (2000) found that 65% of the companies using ISO 9000 standards benefit from it, both externally and internally, only 6% of them do not experience any benefit and the other 29% do not see the benefit big enough to be considered significant. Most of the surveyed companies (96%), however, all agree that ISO 9000 standards are useful for quality assurance.

Data gathered by survey, however, is not objective because it is based on subjective respondent opinion. The results would be more reliable when the data can reflect the real affect of ISO 9000 certification by using alternative approach such as

econometric methods. In a paper using data of 101 countries during from 1995 to 2001, Grajek (2004) built a gravity model to determine the effect of ISO 9000 adoptions on bilateral trade flows. This author concluded that using ISO 9000 standards does have significant positive impact on international trade. The effect, however, was found to be different under certain circumstances. For example, this study reported that the trade among certified firms with uncertified firms will not be boosted due to the fact certified firms tend to trade with certified partners. Also, the impact is not that big for developing countries and especially least developed countries. Examining ISO 9000 standards from a different angle by considering their impact on country-pair trade and foreign direct investment (FDI) using trade and FDI data in 7 years (1995 -2002) of 52 OECD and non-OECD members using gravity model, Clougherty and Grajek (2008) suggested a different impact compared to Grajek's result (Grajek, 2004) while their results still confirmed about the importance of ISO 9000 standards on trade. Clougherty and Grajek's findings reveal that trade and FDI of developed countries do not benefit much from adopting ISO 9000 standards while for developing countries; the benefit is positive and statistically significant. Not only popular in the manufacturing sector, ISO 9000 standards can be applied in the service management sector (Johannsen, 1995), the results by Johannsen showed that implementing ISO 9000 standards in a correct way will result in positive effect on the operation of an information sector organization.

Other authors, however, found that the impact of ISO 9000 certification is not positively clear. Dick (2000) found that there is no significant link between quality certification and improved business performance. This result was also found by many

other papers that have examined specific cases. A company acquires ISO 9000 certification both to improve its business activities but also to improve its image and reputation in the market. ISO 9000 certification, however, was found to not always bring much benefit to companies in these areas. Martinez-Costa and Martinez-Lorente (Martinez-Costa and Martinez-Lorente, 2003) used the stock price of a sample of Spanish companies to determine whether market perceives ISO 9000 registration as a sign of better performance in the future. Results of this study found that the market seems not to pay much attention to the certification, whereas in another paper (Nicolau and Sellers, 2002), the announcement of being certified has a positive effect of the stock price. Martinez-Costa and Martinez-Lorente argued that this was due to an "illusion effect" and, in long-term, certification generate a real affect on company's performance. Lima et al. (2000) also found the same result when comparing firms in Brazil that were ISO certified against those that did not. Lima et al.'s (2000) results did not indicate any significant difference in company's performance between the two groups of firms.

In addition to these motivations, some companies adopt ISO 9000 standards for the sake of having certification without any broader long-term commitment to quality. Although Johannsen (1995) see that this action can increase the bureaucracy and paper work for companies, it was seen as a useful marketing tool. Using seven-point Linkert scale to survey the opinion of 272 Australian ISO 9000 certificated companies about their primary motivation to pursue quality certificate, Jones and Arndt (1997) found that more companies seek certification under the pressure of external circumstances than companies seek certification for internal improvement. In the long term the benefit of certification

was not found to be significant for companies regardless of their primary purpose of seeking certification.

2. Assessing the impact of standards on international trade

Trading activities are popular and happen all over the world nowadays. The question is, however, why countries trade with each other, whether they benefit from trade or not, if yes, how much is the benefit, or how big the trade flow between countries is. In order to answer those questions and explain the cause of trade, many trade theories were developed, such as the absolute advantage by Adam Smith, comparative advantage by David Ricardo, Heckscher-Ohlin model, the new trade theory, or the gravity model. These trade theories to some extents can partly demonstrate the incentives of countries when trading, as well as, predict the magnitude of trade among trading partners.

a. Theoretical approach commonly used

i. Absolute and Comparative advantage

The concept of absolute advantage was introduced by Adam Smith (1776) who reasoned that in international trade countries will gain if they specialized their production when they have an absolute advantage in production. By this concept, a country with no absolute advantage would not gain from international trade. In practice, however, this is not true as many countries that do not have absolute advantage in the production of any goods still profit from trading internationally.

As an extension of the concept of absolute advantage, David Ricardo (1815) introduced the concept of comparative advantage. This theory stated that countries do not need absolute advantage and can still gain from international trade by specialization in

goods in which they have competitive advantage. The comparative advantage theory, however, also has some weaknesses. First, this theory assumes there would be an extreme in specialization; this, of course, cannot occur in reality. Second, it assumes that trade will affect on country as a whole, not on income distribution – which is not the real case. In fact, as Krugman and Obstfeld reasoned, income distribution within countries is affected strongly by international trade, because "resources cannot move immediately or costlessly from one industry to another and costlessly [and] industries differ in the factors of production they demand". Hence, trade may benefit the country's welfare as a whole but hurt its small groups, at least in short-term. And understanding the income distribution will be crucial in making trade policy process. Fourthly, it does not consider the concept of economies of scale when the larger the scale of the production, the more efficient it will be (similar to increasing returns – doubling inputs in an industry will cause more than doubling in its production) – which is thought to occur in some countries (Krugman and Obstfeld, 2003). Economies of scale motives countries to specialize and trade even when they are not different in resources and technology.

ii. Heckscher-Ohlin model

The Heckscher-Ohlin (H-O) model was developed by Eli Heckscher and Bertil Ohlin (Feenstra, 2003) to explain trade flow between two countries. This model describes trade between two countries with two goods and two factors of production. Importantly, this model is based on assumptions that the two countries have:

- identical production technology
- constant return to scale in the production of output

- mobile labor and capital within countries
- immobile labor and capital across countries
- same prices for goods and customer preferences
- perfect competition within each country, no market distortion
- differences in resource endowments (like land, capital and labor).

The H-O theorem suggests that each country will export the good that uses its abundant factor of production intensively and import the good that uses its scarce factor intensively. From the theorem with its assumption, it means that the countries are different only because of differences in the endowment of their factor of production. However, in 1953, Leontief (Feenstra, 2003) used US trade data and amount of labor and capital in 1947 to test the H-O model and found out that the result is inverse from that predicted by the H-O theorem. The findings are called "Leontief's Paradox". Future research (Feenstra, 2003) found that one of the reasons for the paradox is due to the assumption of identical production technology. Clearly, each country will have different levels of technology development, and ignoring this difference is thought to cause the bias in results (Feenstra, 2003).

iii. New trade theory

New trade theory was first introduced by Paul Krugman (1970s) to explain pattern in international trade could not be fully explained by classic trade theories. New trade theory takes into account specific country characteristics that may be relevant to explain trade between countries. First, customers in different countries have different preferences and/or customers' preferences are diversified, this explains why there are different

brands, color, style preferences for the same products. Second, there exists economies of scale where countries can save cost and produce at a larger scale. This opportunity to scale production and export to larger market provides an incentive for international trade. Third, there is imperfect competition where bigger firms can take advantage of economies of scale will gain advantage over smaller ones then markets will be dominated by one or few firms. Fourth, when countries have increasing return on scale of a product, they will take advantage of the economies of scale to specialize on producing such product, which will cause them to trade with other countries for other products that they cannot produce as efficiently. Fifth, the difference in economic geography which creates difference in transportation and thus productions costs is also another element to affect trade. Countries have different geography, hence each region tends to produce a specific product that can make the most of the benefit from that geographic location and the economies of scale, which induces them to trade with others as well as (Krugman, 1980, 1991, 1994).

b. Gravity model

Those classic and new trade theories above do explain why trade between countries happens and becomes a popular activity nowadays. They, however, cannot specify the magnitude of trade between countries. The gravity model was introduced and "has been a workhorse for cross-country empirical analyses of international trade flows" (Baier and Bergstrand, 2006).

i. What is gravity model?

The gravity model of international trade describes in general terms to explain the volume of trade between two countries which inspired by the "Law of Universal Gravitation" by Newton which depicts the attractive force between two objects as:

$$F_{ij} = \frac{GM_i M_j}{D_{ij}^2} \quad (1)$$

Where:

F_{ij} is the attractive force

M_i, M_j are the mass of two objects

D_{ij} is the distance of the two objects

G is the universal gravitational constant

In this model, the gravitational force between two objects is proportional to the product of the mass of those two objects and inversely proportional to the square of the distance of the two objects. Applied this concept to trade flow, in 1962, Jan Tinbergen first depicted the trade volume between two countries by using economic size of two countries instead of the mass of two objects as formula (1). Most usually, GDP or GNP is used to represent the economic size of countries. The "gravity model" for trade flow is then expressed as:

$$T_{ij} = \frac{KY_i Y_j}{D_{ij}} \quad (2)$$

Where:

T_{ij} is the total value of trade flowing from country i to country j

K is the constant term

Y_i , Y_j are the economic size of countries i and j

D_{ij} is the distance between two countries i and j

The model implies that the volume of trade is proportional to the economic size of the trading partners and is inversely proportional to distance between the countries. Due to its success in explaining trade flows, this concept is widely used to analyze cross-countries international trade flows. In empirical analysis, usually this model is expressed in the form of natural logarithm in order to make use of the regression analysis to access the impact of each independent variable on the dependent variable. Therefore, model (2) is transformed to become:

$$\ln T_{ij} = \ln K + \ln Y_i + \ln Y_j - \ln D_{ij} \qquad (3)$$

However, it was realized that trade is also affected by other factors. Results generate by the gravity model would be biased if those factors are not included as explanatory factors of the value of trade flow between two countries.

Through study and intuition, researchers have identified other factors that could affect trade flows (Anderson and Wincoop, 2003). For example, whether trading countries share border or not, which will facilitate trade across border a lot if they are adjacent to each other. Similarly, common language among trading partners is thought to help trade flow quicker with the help of convenient paperwork, communication. Countries with colonial ties are thought to trade more based on the fact that they may have same laws and regulations when under the colonial power, which will facilitate conducting legal transactions, and contract enforcement. A common currency is another

indicator thought to help boost trade between two countries as it reduces the effect of exchange rate risk. Relatively geographical isolation of countries, being landlocked or island, is another important element that can hinder or assist trade. When a country is landlocked, transportation is usually limited to air, rail and/or road which are relatively expensive. Island nations can take advantage of cheaper, convenient sea transportation. Membership in regional trade area (RTA) or free trade area (FTA) or World Trade Organization (WTO) can also help countries to trade more due to preferred trading access and tariff rates.

To incorporate the impact of these exogenous country characteristics the standard log-linear gravity equation to investigate the trade flow of two countries is denoted as a general:

$$\ln Trade_{ij} = \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \sum_{x=3}^{n} \beta_x Z_{ij} + \varepsilon_{ij} \quad (4)$$

Where:

$Trade_{ij}$ is the value of trade from country i to country j

GDP_i, GDP_j are the economic size of each country

Z_{ij} is a set of extraneous variables expected to affect trade flow from country i to country j

Using regression analysis, researchers can determine which factors have a positive or negative effect on trade flows.

ii. Use of the gravity model in evaluating the impact of standards on trade

Since its introduction in 1962, the gravity model has been widely used to analyze international trade flows. It can be applied widely to estimate the effect of a certain characteristic of countries on trade, from sharing FTA, RTA to forming a common monetary zone, etc.

Using a gravity model, Baier and Bergstrand (2006) sought to find empirical evidence of effect of FTA on two members' trade. These authors used real bilateral trade flows of ninety six potential trading partners (country pairs with no trade flows are excluded) from 1960 to 2000 with other dummy variables to account for exogenous country characteristics. These authors found that membership in an FTA will increase two member country's trade, and the impact will be larger in the later years, increase by 100% in 10 years (Baier and Bergstrand, 2006). Assessing the impact of RTAs on trade, Grant and Lamber (2008) used the trade data for agricultural and non-agricultural sector of eighty six countries/regions to draw to the conclusion that RTA increase more trade for agricultural sector than non-agricultural sector. The authors found that it takes longer time for members to realize the significant increase in their agriculture trade, increase by 149% after twelve years of being in RTAs. Further, the increase in agricultural trade facilitates through RTAs is much higher than the increase in non-agricultural trade. The result, partly, proves the importance of RTAs in liberalizing agricultural trade, because normally agricultural products receive higher protection than non-agricultural products. They also found out that the impact of RTA on agricultural and non-agricultural trade is different for different agreements. In estimating the impact of the West African Monetary

Zone (WAMZ), Balolgun (2008) built a gravity model and the estimates show that there is a significant and positive effect of the same monetary zone on trade flows, and the positive effect of it on intra-industry trade in agriculture commodities, as well as the positive effects of adjacency and negative effect of different currency and language.

Similarly, Grajek (2004) built a gravity model to investigate the diffusion of ISO 9000 standards on international trade using trade data from 101 countries in the period of 1995 – 2001, which clearly show the empirical role of ISO 9000 standards on international trade. The author found that bilateral export of a country will increase 0.27% when there is an increase of 10% in number of ISO 9000 certified firms and certified firms tend to trade with each other more than uncertified ones. In addition, the author also mentioned that the ISO 9000 diffusion seemed to have a more positive impact on trade of developed countries other than less developed countries. In a research by Clougherty and Grajek (2008), they used the gravity model to evaluate the impact of ISO 9000 certification on trade flows and FDI of OECD countries in the period of 1995-2002, comparing three different country-pair types: developing to developed, developed to developing, and developed to developed. They learned that ISO 9000 certification does not seem to impact trade and FDI of developed countries, while does increase trade (by exporting to developed countries) and FDI (investment from developed countries) of developing countries. Exports from developing countries to developed countries will increase 1.16% when number of ISO 9000 certificate increases 10% and FDI of developing countries from developed countries will increase $69,600 with one additional certificate.

To investigate the impact of ISO 9000 certification on trade of less developed countries where have high information asymmetries and quality assurance problems, Potoski and Prakash (2008) made use of trade data from 140 countries during the period of 1994 to 2004 to build the gravity model for that purpose. The study also separated the impact of ISO 9000 certification on different economic status for importing and exporting countries, by rich, medium, and poor categories based on World Bank's classification and for OECD and non-OECD countries. The results show that a 1% increase in number of ISO 9000 certifications of poor countries will lead to 0.021% increase in export to rich countries, and 0.046% to medium countries, as well as a 1% increase of that of medium countries will lead to 0.43% increase in export to rich countries. For OECD countries classification approach, a 1% increase in number of ISO 9000 certifications of non-OECD countries will increase export to other non-OECD countries by 0.053% and to OECD countries by 0.043%.

III. METHODOLOGY

The purpose of this study is to assess the effect of ISO 9000 on international trade flows by building a gravity equation based on variables considered to have impact on trade flows. At its core this model uses data about the bilateral imports from a country to another country in a specific industry, the sector-specific proportion of ISO 9000 certified firms in each country, as well as the GDP of the import and export country. Other factors which also may affect trade are included through the use of dummy variables.

1. Data

The study uses data from several sources; first the number of ISO 9000 certificates by country by industry using the EA codes system provided by International Standardization Organization. Second, the number of firm count data by country by industry using the ISIC Rev. 2 code system provided by the United Nations Industrial Development Organization's (UNIDO) Industrial Statistics Database at 3-digit level. Finally, the bilateral trade flows by industry (using the ISIC Rev. 2), GDP are provided by World Bank in Trade, Production and Protection database. Dummy variables about geographical characteristics, colonial tie, language, distance, member of RTA, etc. are provided by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

a. Sector concordance

Data used in this analysis was obtained from different sources that use different coding systems to categorize industries. Trade flow information is classified according to the 3-digit ISIC (the International Standard of Industrial Classification of All Economic Activities) Rev.2 introduced by the UN (United Nations) to categorize all economic

activities based on their products or process (ESDS International, 2009). In this system, all global manufacturing activities are classified into one of twenty nine industries (Table 4). The EA code system is introduced by the European co-operation for Accreditation, and has thirty nine industries in it (Table 5). It is under this coding system that the ISO 9000 certification information is classified. Due to differences in the sections under each of these systems, this study creates its own categorization for industry sectors (Table 1). This is required to merge data from those different sources into one database. The classification system which was developed is based on their relative similarity in the final products as well as the production process.

b. Description of ISO variables

The ISO variable is built by taking the ratio of the number of ISO 9000 certified firms in each industry to the total number of firms count in that industry. The purpose of taking the ratio of these two variables is to bring a more robust way of looking at the number of ISO certifications in a relative comparison with the total number of firms[1].

[1] A similar measure has been used by other authors (Sung and Reinert, 2009) to assess such approach as the "conformity capacity" to measure the ability of government of exporting countries in helping exporting companies to get accredited by offering a reasonable price as well as acting as a bridge to connect with internationally recognized accredited laboratory.

Table 1: Concordance of Industrial Sectors

New Code	Industry name	EA code	ISIC Rev.2 code
1	Food products, beverage and tobacco	3: Food products, beverage and tobacco	311: Food products
			313: Beverages
			314: Tobacco
2	Textiles and textile products	4: Textiles and textile products	321: Textiles
			322: Wearing apparel, except footwear
3	Leather and leather products	5: Leather and leather products	323: Leather products
			324: Footwear, except rubber or plastic
4	Manufacture of wood and wood products	6: Manufacture of wood and wood products	331: Wood products, except furniture
			332: Furniture, except metal
5	Pulp, paper and paper products	7: Pulp, paper and paper products	341: Paper and products
6	Printing and Publishing	8: Publishing companies	342: Printing and publishing
		9: Printing companies	
7	Chemicals, chemicals products and fibers	12: Chemicals, chemical products and fibers	351: Industrial chemicals
		13: Pharmaceuticals	352: Other chemicals
8	Manufacture of coke and refined petroleum products	10: Manufacture of coke and refined petroleum products	353: Petroleum refineries
			354: Miscellaneous petroleum and coal products
9	Rubber and plastic products	14: Rubber and plastic products	355: Rubber products
			356: Plastic products
10	Non-metallic mineral products	15: Non-metallic mineral products	361: Pottery, china, earthenware
		16: Concrete, cement, lime, plaster etc.	362: Glass and products
			369: Other non-metallic mineral products
11	Basic metal and fabricated metal products	17: Basic metal and fabricated metal products	371: Iron and steel
			372: Non-ferrous metals
			381: Fabricated metal products
12	Machinery, except electrical	18: Machinery and equipment	382: Machinery, except electrical
13	Electrical and optical equipment	19: Electrical and optical equipment	383: Machinery, electric
		21: Aerospace	385: Professional and scientific equipment
14	Transport equipment	20: Shipbuilding	384: Transport equipment
		22: Other transport equipment	
15	Other manufacture	11: Nuclear fuel	390: Other manufactured products
		23: Manufacturing not elsewhere classified	

i. Number of certifications

This study makes use of data about number of certification issued by ISO for 2005 (ISO, 2005c); at that time there were 607,140 certified firms globally in 147 countries and 39 industries. The reason to choose the data for ISO 9000 certificate in 2005 even when the latest update data for it is 2007 is due to the lack of trade flow data, GDP, and other needed data beyond. Therefore, ISO 9000 2005 database will be most suitable to be used in coordination with trade database.

It is important to note that although the ISO certification data is compiled by ISO, the source does not necessarily reflect an accurate number of ISO certifications due to the difficulties in collecting data. The difficulties are due to many reasons. First, as mentioned previously, ISO does not itself act as a certification body. Data regarding certifications is compiled from other sources. Such as ISO national member institutes, or accreditation and certification bodies that are members of International Accreditation Forum (AIF). However, there are still many accreditation and certification bodies not AIF members. Therefore, the ISO survey of certifications may miss those data from them. Second, in answering the survey, some surveyed entities are reluctant to answer due to privacy considerations when information is "used by competitors as 'business intelligence' about their rivals" (ISO, 2005c). In spite of those constraints, the ISO survey is the most reliable source of data about ISO 9000 certifications. Since 2003, ISO surveys have been conducted annually. As such ISO can update the incomplete information from the previous surveys.

In its original classification, the ISO 9000 certification data was divided among thirty nine industries. In the new coding system (Table 1), there are only fifteen industries. As such the new system combines some of the individual industries in the ISO survey into one industry under the new code. Therefore, the number of certifications will be added accordingly in order to truthfully reflect the number of certifications of each industry under the new system. It is also important to note that, the paper does not use some of the industries included in the ISO survey due to the fact that the firm count data does not have information about those industries. Such as industries 1, 2, and industries 24 to 29 (Table 4); these industries are primary and services industries.

ii. Firm count data

Firm count data from World Bank Database are the CD-ROM version of UNIDO's Industrial Statistics Database at 3 digit level of the ISIC classifications (Rev.2). As this source does not have complete information regarding the number of firms in each industry and in each country across time, some adjustments were required in the use of this source. To make the best use of the existing data as well as best reflecting the real situation, the study uses the maximum number of firms among years from 2000 to 2004 within each industry and country to be the number of firms in 2004. The reason for using the maximum data is due to the large variance in the reported number of firms and therefore, the maximum number of firms will be the most conservative estimate.

The technique used to deal with the firm count data under the new coding system is the same as that used for reclassifying the ISO 9000 certifications.

The ISO ratio is then calculated by taking the ratio of the number of ISO 9000 certifications to the maximum number of firms of industry k in country i, j among years from 2000 to 2004.

$$ISO\_ratio = \frac{Number\_of\_ISO\_9000\_certifications\_in\_2005_{i(j);k}}{\max_{2000}^{2004}(Number\_of\_firms)_{i(j);k}} \quad (5)$$

iii. Interaction variables

In order to further explore the impact of ISO 9000 certification in alternative specifications of the baseline gravity model, new variables are generated which interact ISO 9000 ratio with each country's development status (developed, least developed and developing). These interaction variables will reflect the effect of ISO certification given a specific economic status on international trade in the gravity model.

The data describes about the development status of countries comes from different sources. Developed countries data is taken from the IMF list of high-income countries. Least developed countries data is taken from WTO website. The remained countries are developing countries.

c. Description of other variables

The preeminence of the gravity model is that it takes into consideration all elements that are considered to have significant impact on international trade. Therefore, beside ISO 9000 data, it is necessary to use other data which are, of course, the dependent variable – trade flow between countries, independent variables such as economic size of countries (GDP), and other explanatory variables that can influence trade flows.

i. Trade flow measures

In building a gravity equation, the value of trade flowing to an importing country from an exporting country within in a specific industry is used as the dependent variable. The trade flow data is recorded using the ISIS 2 rev. code and is available through the World Bank database. This data thus also required some transformation in order to incorporate it into the new industrial classification code.

ii. GDP

Importing and exporting country's GDP is included in the gravity model to reflect the economic size (mass) of trading partners. This paper uses the real (1990) GDP data of importing and exporting countries in 2004, which are under ISIC rev. 2 code provided by World Bank database. This data is also needed to be transformed to the new classification system.

iii. Other explanatory variables

Some variables have been demonstrated to have a significant effect on trade flow between countries, and for the sake of removing the impact of country effects, it is necessary to include those variables in the gravity model. The analysis includes several variables that are normally considered to affect trade flows. Those variables are $CONTIG$ (if two countries share common border), $LANG$ (if two countries share common language), $COMCOL$ (if either country was common colonizer post 1945), $COL45$ (for country pairs in colonial relationship post 1945)[2], $SMCTRY$ (if two

[2] For the colonial tie, there are four dummy variables to describe that, $COLONY$ (dummy = 1 for country pairs ever in colonial relationship), $COMCOL$ (dummy = 1 if importer and exporter was common colonizer post 1945), $CURCOL$ (dummy = 1 for country pairs currently in colonial relationship),

countries were ever the same country), *DIST* (distance between two countries), *ISLANDI* (if export country is an island nation), *ISLANDJ* (if import country is an island nation), *LLI* (if export country is a landlocked nation), *LLJ* (if import country is a landlocked nation), and *RTADUM* (if two countries were party to the same RTA in year 2004). These variables and their expected impact on trade flows (impediment or facilitator) are summarized in Table 2.

Besides, in order to taking into account the status of economic development of importing and exporting and the effect of it on trade flow, in some model specifications, this analysis also uses dummy variable for 3 levels of economic development: *DEVELOPED* , *DEVELOPING* , *LDC* (least developed).

2. Analytical approach

a. Hypotheses

Based on the ambiguity of the real effect of ISO 9000 certificate on international trade through the literature review, the paper intends to build a gravity model that can answer that question statistically based on some hypothesis:

Hypothesis 1: The ratio of ISO 9000 certification in an industry does have a significant and positive impact on international trade.

- The impact is greater for exporter than importer.

Hypothesis 2: The effect of ISO 9000 certification on trade is significantly different for each development status.

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*COL*45 (dummy = 1 for country pairs in colonial relationship post 1945). After checking the correlation among those variables as well as considering the exclusive notion among them, the paper will use two among four of them, they are *COMCOL* and *COL*45.

Hypothesis 2a: ISO 9000 certification has a positive and significant effect on the value of trade exported from developed countries to developed countries.

Hypothesis 2b: ISO 9000 certification has a positive and significant effect on the value of trade exported from developing countries and least developed countries to developed countries.

- The impact is more for less developed countries than the developed countries.

b. Baseline model

Baseline model uses the simple data of real GDP, ratio of number of ISO 9000 certificates to number of firms and other indicator variables capture other characteristics of import and export country.

The baseline gravity model will be:

$$\ln FLOW_{ijk} = \beta_o + \beta_1 \ln RGDPI + \beta_2 \ln RGDPE + \beta_3 \ln RATIOI + \beta_4 \ln RATIOE + \beta_5 CONTIG + \beta_6 LANG + \beta_7 COMCOL + \beta_8 COL45 + \beta_9 SMCTRY + \beta_{10} \ln DIST + \beta_{11} ISLANDI + \beta_{12} ISLANDJ + \beta_{13} LLI + \beta_{14} LLJ + \beta_{15} RTADUM + \varepsilon_{ijk} \quad (6)$$

Table 2: Expected Sign for Baseline Model

Variable	Variable description	Units	Expected sign
	BASELINE MODEL (EQUATION 6)		
LNRGDPI	Natural log of real (1990) GDP of importer in 2004	1$	+
LNRGDPE	Natural log of real (1990) GDP of exporter in 2004	1$	+
LNRATIOI	Natural log of ratio of ISO 9000 certificate of importer		+/-
LNRATIOE	Natural log of ratio of ISO 9000 certificate of exporter		+/-
CONTIG	Dummy = 1 if importer and exporter share common border		+
LANG	Dummy = 1 if importer and exporter share common language		+
COMCOL	Dummy = 1 if either country was common colonizer post 1945		+
COL45	Dummy = 1 if country pairs in colonial relationship post 1945		+
SMCTRY	Dummy = 1 if importer and exporter were ever the same country		+
DIST	Distance between importer and exporter	1km	-
ISLANDI	Dummy = 1 if exporter is an island nation		+
ISLANDJ	Dummy = 1 if importer is an island nation		+
LLI	Dummy = 1 if exporter is a landlocked nation		-
LLJ	Dummy = 1 if importer is a landlocked nation		-
RTADUM	Dummy = 1 if importer and exporter were party to same RTA in 2004		+
	MODEL ALTERNATIVE SPECIFICATION – DEVELOPMENT STATUS (EQUATION 7)		
DEVELOPEDI	Dummy =1 if importer is a developed country		+
DEVELOPINGI	Dummy = 1 if importer is a developing country		+
LDCI	Dummy = 1 if importer is a least developed country		+
DEVELOPEDE	Dummy = 1 if exporter is a developed country		+
DEVELOPINGE	Dummy =1 if exporter is a developing country		+
LDCE	Dummy =1 if exporter is a least developed country		+

Table 2 (cont.)

Variable	Variable description	Units	Expected sign
MODEL ALTERNATIVE SPECIFICATION – ISO RATIO INTERACTION WITH DEVELOPED STATUS (EQUATION 8)			
LNDEVRATIOI	Natural log of interaction between ratio of ISO 9000 certificate and developed status of importer		+
LNDEVINGRATIOI	Natural log of interaction between ratio of ISO 9000 certificate and developing status of importer		+
LNLDCRATIOI	Natural log of interaction between ratio of ISO 9000 certificate and least developed status of importer		+
LNDEVRATIOE	Natural log of interaction between ratio of ISO 9000 certificate and developed status of exporter		+
LNDEVINGRATIOE	Natural log of interaction between ratio of ISO 9000 certificate and developing status of exporter		+
LNLDCRATIOE	Natural log of interaction between ratio of ISO 9000 certificate and least developed status of exporter		+

In this model, $FLOW_{ijk}$ is the dependent variable and reflects the bilateral imports of industry k from exporting country i to importing country j, and is expected to be explained by other independent variables. GDP measures are expected to have a positive and significant effect on the bilateral trade flow; the higher the GDP of a country is, the higher trade flow it is anticipated to have. The ISO ratios are anticipated to have a positive impact on trade flow; the higher the ratio of ISO 9000 certified to total firms, the larger the trade flow. Dummy variables such as $CONTIG$, $LANG$, $SMCTRY$, $RTADUM$, $COMCOL$, $COL45$, $ISLANDI$, $ISLANDJ$ are all expected to have a positive impact on the value of trade between two countries. When two countries share border, have same common language, were ever same country, are parties to same RTA, were common colonizer relationship or in colonial relationship post 1945, and are island nations trade will be increased significantly. Whereas $DIST$ will have negative impact on trade, the farther the distance between the trading partners, the less they will trade. Similarly, when two countries are landlocked (LLI and LLJ), they will tend to trade less. The error term of the model is denoted by ε_{ijk}, has homogeneous variance, and is normally distributed (mean = 0, variance = 1).

However, the baseline model does not consider all the impacts of the economic development status of countries on trade which when added will be expected to bring different scenarios with different status. Therefore, this analysis evaluates the alternative specifications that include the economic status into the model with the purpose to have deeper understanding about real effect of ISO 9000 certification on trade.

c. Alternative model specifications

The paper takes two more approaches to build the gravity equation for assessing the effect of ISO 9000 certification on trade flow which use different independent variables and taking into account the development status of trading partners. The two models still use the trade flow of each industry as the dependent variable, and independent variables will again include the real (1990) GDP of each country in 2004, and other dummy variables as indicators. However, the difference between them is the way the economic status and the ratio of ISO 9000 certification are included into the model.

In general, when a country with a lower level of development exports to a country with a higher level country, it will have more difficulties in meeting the quality requirements of the higher level country than the reverse direction. Further, countries that have the same level of development will tend to trade more than countries in different development status (Hudson and Jones, 2003). However, the question is whether ISO 9000 certificate is not useful at all for companies in those less developed countries to take up. Taking into account the trading country's development status in conjunction with ISO 9000 ratio will provide insights into this question.

In the first alternative approach, the model is similar to the baseline model; this model (Equation 7) includes GDP, the logarithm of the ratio of ISO 9000 certification to the total number of firms, and the same series of dummy variables to account for country characteristics. In addition, to isolate the effect of a country's level of economic

development on trade, this model specification also includes dummy variables that reflect the relative development status of the importing and exporting countries.

The gravity model for adding effect of economic status is:

$$\begin{aligned}\ln FLOW_{ijk} &= \beta_o + \beta_1 \ln RGDPI + \beta_2 \ln RGDPE + \beta_3 \ln RATIOI + \beta_4 \ln RATIOE \\ &+ \beta_5 STATUSI + \beta_6 STATUSE + \beta_7 CONTIG + \beta_8 LANG + \beta_9 COMCOL + \beta_{10} COL45 \\ &+ \beta_{11} SMCTRY + \beta_{12} \ln DIST + \beta_{13} ISLANDI + \beta_{14} ISLANDJ + \beta_{15} LLI + \beta_{16} LLJ \\ &+ \beta_{17} RTADUM + \varepsilon_{ijk}\end{aligned} \quad (7)$$

In this model, the purpose of taking into account the economic status is to isolate the impacts of the adoption of ISO 9000 certificate and the trading country's economic status. Due to the expected variability in the importance of ISO 9000 depending on a country's level of development, isolating this affect should make ISO 9000 certification's role much clearer compared to the baseline model. Countries with different levels of development often have different opportunities to trade. Developed countries are normally assumed to have high quality products and least developed and developing countries will have lower quality products. This assumption will create more advantage for developed countries in trade than less developed countries. ISO 9000 certification is a way to prove organizational quality but as reported by Hudson and Jones (2003), customers tend to believe in the existing quality of those developed countries rather than quality based on a certification. Less developed countries will use such certification to partly prove their quality. Therefore, the impact of ISO 9000 on trade is likely to differ across countries with different development status. Therefore, *STATUSI* and *STATUSE* are dummy variables that represent the economic development status of the import and export country (Section 2, Table 2). For this analysis, three levels of economics

development are considered: developed, developing and least developed countries. This new variables about the economic status of a country, the model is expected to have a more specific result of the effect of them on trade flow.

GDP and country specific indicator variables in this model (Equation 7) are expected to have the same sign and effect on trade as in the baseline model. With regard to ISO 9000 ratio, it is expected that higher ratio of ISO 9000 certified firms to the total number of firms in an importing and/or exporting country, the higher the value of trade between those two countries regardless of their economic status. The impact of the ISO ratio on trade, however, is expected to be different for countries of different economic status. The higher the economic status, the less it is anticipated that that country will benefit from ISO 9000 certification. Therefore, it is anticipated that the impact on trade of ISO 9000 for a country with least developed country status will be the largest, followed by developing and then developed country status.

While the modeling approach outlined by Equation 7 is useful to disentangle the affect of a country's development status on trade, it does not account for the joint impact of ISO 9000 certification and development status. Therefore, a second approach is also used which takes into account the interaction between the dummy variable of the status of economic development and the ISO 9000 ratio. It is anticipated that this approach will give a better view on the real effect of ISO 9000 certification on trade between countries of various levels of economic development. The gravity model for considering interaction between ratio of ISO 9000 with economic status is described in Equation 8 below:

$$\ln FLOW_{ijk} = \beta_o + \beta_1 \ln RGDPI + \beta_2 \ln RGDPE + \beta_3 \ln STATUSRATIOI$$
$$+\beta_4 \ln STATUSRATIOE + \beta_5 CONTIG + \beta_6 LANG + \beta_7 COMCOL + \beta_8 COL45 + \beta_9 SMCTRY \quad (8)$$
$$+\beta_{10} \ln DIST + \beta_{11} ISLANDI + \beta_{12} ISLANDJ + \beta_{13} LLI + \beta_{14} LLJ + \beta_{15} RTADUM + \varepsilon_{ijk}$$

In this model, $STATUSRATIOI$ and $STATUSRATIOE$ are interaction variables of the status of economic development and the ratio of ISO 9000 certificates of import and export country (Section 3, Table 2). Other variables are the same as in the baseline model, and have the same expected effect on trade flow between to trading partners (Table 2). The interaction of development status and ratio of ISO 9000 certified firms is expected to support the hypothesis that there is a significant and different affect of ISO 9000 certification for countries with different economic status. Specifically, it is anticipated that the interaction variable will indicate a more positive impact for trade flows between partners in which one has a lower level of development than the other. Further, where both countries have the same level of economic status, the higher the ratio of ISO 9000 certificates a country has, the larger the trade flow is anticipated to be. The magnitude of increase in trade is expected to be different for each economic status.

d. Analytical approach

The study uses SAS (Statistical Analysis System) to perform the analysis. The PROC REG and MODEL statements will execute the basic OLS (Ordinary Least Squares) estimation in order to determine which variables are statistically significant in the final model.

For the baseline model (Equation 6), the dependent variable, ($\ln FLOW_{ijk}$) between country i and j in industry k between is generated by taking the natural log of

real (1990) trade flow in 2004. Using the same technique by taking the natural log of the independent variables, ln *RGDPI* and ln *RGDPE* are natural logs of real (1990) GDP of importing and exporting country in 2004, respectively; ln *RATIOI* and ln *RATIOE* are natural logs of the ratio of the number of ISO 9000 certifications to the total number of firms. For other dummy variables, the value will be 1 for "yes", and 0 for "no".

To evaluate the alternative models, minor adjustments of the baseline model were required. For alternative model specification with development status (Equation 7), two dummies variables for the economic status of the importing and exporting countries were added. As there are three levels of economic status considered, this will generate nine models reflecting nine pairs of combination of the economic status for importing and exporting countries

For alternative model specification with the interaction of ISO 9000 ratio and development status (Equation 8), instead of using the ISO ratio, this model explores the interaction of ISO 9000 certification and country development status by taking the multiplication of the ratio and the status. Again, this will bring about nine models for the nine pairs of importing and exporting countries across the three levels of development status.

IV. RESULTS AND DISCUSSION

Using the gravity model with trade flows between countries in 2004 and ISO 9000 ratio, this study examines the impact of ISO 9000 certification on international trade from three ways. First, in the baseline model, the study modifies the standard gravity model by also taking into account the ratio of ISO 9000 certified firms as an independent variable. Second, to this baseline model, dummy variables that capture the economic status of importing and exporting countries are added. Third, besides GDP, and other country characteristics, the study considers the interaction of the ISO 9000 ratio and the economic status of importing and exporting country.

1. Results from Baseline Model

Results for the baseline model – Model 1 (Table 7) reveals that the independent variables are statistically significant and have the expected effect on trade flow. Also as expected, results show that the impact varies among each variable.

In general, an increase in GDP will positively increase the trade flow between two countries, and an exporter's GDP will contribute to trade flow more than that of importer. For real GDP indicator, the coefficient for importer and exporter β_1 and β_2 are from 0.661 to 1.041, respectively.

With regard to the dummy variables, some have a positive impact on trade flow, whereas other has a negative impact. Among those that have a positive impact, when countries have colonial relationship after 1945 ($COL45$) have biggest affect on trade, with coefficient is 1.110 (p-value <0.0001) which translates to an increase of 203% ((exp(1.110) – 1) x 100%) in trade between two countries. This can be explained due to

the fact that when countries have colonial ties they also tend to have similar characteristics in culture, law, population, language and also have statistically significant on trade flow.

When countries pairs are members of the same RTA in 2004, and have a common border, those characteristics also have a large affect on trade; the coefficients on these variables are 0.926 (p-value <0.0001) and 0.818 (p-value < 0.0001), respectively. That means when two countries are members of same RTA, trade flow will increase 152% ((exp(0.926) – 1) x 100%) and when they are contingent (*CONTIG*), trade flow will increase 127% ((exp(0.817) – 1) x 100%) compared to two otherwise similar countries, all else being constant. This large effect is anticipated. Being members in the same RTA (*RTADUM*) helps countries to improve their trade flow due to the fact that normally countries in the same regional trade agreement will remove many of their tariff, and non-tariff barriers, and will create more harmonized standards and technical agreements which will facilitate trade within the RTA region. Intuitively, when two countries are contingent to each other, the trade between them will be enhanced due to companies will have reduced transportation costs and time, ability to quickly meet the demand and adapt to the change in the market, and often will have a better understanding about the market.

Similar to countries have colonial relationship after 1945 (*COL*45), when countries pairs were common colonizer after 1945 (*COMCOL*), they also have statistically significant on trade flow. The baseline results indicate that these nations will trade with an additional of 118% ((exp(0.780) – 1) x 100%) (p-value < 0.0001) more than countries that do not have colonial ties.

For nations that were once the same country, there often remain many similarities in terms of population characteristics, language, culture, and law. Not surprisingly, it is much easier to trade with those countries that have similar characteristics. In the baseline model, the *SMCTRY* variable, which reflects whether two countries were ever the same country, has statistically significant effect on trade flow which increase trade flow; trade increased by 41.5% ((exp(0.347) – 1) x 100%) (p-value = 0.0083) over that of otherwise similar countries who were not once the same country.

Sharing the same language (*LANG*) is also an advantage in doing business. If countries share the same language, they can reduce misunderstanding and miscommunication in establishing and carrying out business transaction, and can save cost of translating paper work. As such, sharing a common language will facilitate information flow between two trading partners, and the result will boost trade. Countries which share a common language on average experience an increase of trade of 43.6% ((exp(0.362) – 1) x 100%) (p-value < 0.0001) to trade relative to otherwise similar countries.

When a country is an island, it may make great use of the coastal line to use sea transportation, which makes it much more convenient to do business with other countries through their maritime port system. When an importing country is an island nation, its imports can be expected to increase by 41.2% ((exp(0.345) – 1) x 100%) (p-value = 0.0001) higher than that of non-island importers. Similarly, when an exporter is an island, the increase in trade is expected to be 20.6% ((exp(0.187) – 1) x 100%) higher (p-value = 0.0001). The increase in trade for island importer is higher than for the island exporter

maybe because when an importing country has a coastal line; it may become more attractive in terms of reducing transportation cost and time compared to non-island countries. And, of course, when exporting country has a coastal line, they will take advantage of that to lower their transportation cost which can lead to lower price.

This scenario is inverse when two countries are landlocked – trade will decrease significantly due to the increase in transportation cost when they have only air, rail and road transportation which are not cheap. When importing countries are landlocked, trade will be reduced significantly by 33.8% ((exp(-0.291) – 1) x 100%) (p-value < 0.0001) for importer, but does not really impact exporter (p-value = 0.2451).

With regard to impact of *DIST* variable, the more distant the two countries are, intuitively the less they will trade due to increased transportation cost and time, and other logistics challenges. As expected, baseline results indicate that distance will have a negative impact on trade. The impact is not big at all, an increase of one unit of the natural log of the distance between countries will reduces trade at about 68% ((exp(-1.138) – 1) x 100%) (p-value < 0.0001).

Finally, the impact of the ratio of ISO 9000 certified firms does have a significant and positive impact on the export of exporting country. This result is as intuitively expected and lends support to the benefits of ISO 9000 as an international marketing tool. The effect of ISO 9000 ratio for importing country, however, contrary to expectation, however, is not significant (p-value = 0.2097). As ISO 9000 certificate is essentially as a "passport" to enter some markets. Exporters with ISO 9000 certification will have more opportunity to increase their exports. As such, the certification ratio is expected increase

trade flows significantly. This hypothesis is supported by the baseline results. Findings indicate that with one unit increase in the natural log of the ratio of ISO 9000 certified firms, will induce an increase in trade of 29.6% ((exp(0.259) – 1) x 100%) (significant level of 1%).

2. Results from Alternative Models

Countries vary considerably in their potential capacity to benefit from international trade. Baseline results suggest nothing about development status because these measures about development status are not included in this model. Intuitively, developed countries (DEV) with higher skill in management, advanced technology and established transportation networks are likely to benefit more than developing (DEVING) and especially least developed countries (LDC). The question remains, however, whether when taking into consideration development status, the benefit of ISO 9000 certification differ across country types. Further and importantly, the question remains whether ISO 9000 certification has provided any benefit to developing and least developed countries who seek to trade internationally.

The baseline model specification does not allow these questions to be addressed. This analysis proceeds by exploring alternative model specifications that take into consideration the development status of trading partners.

a. Model with including Importer and Exporter Economic Status

Taking in consideration the economic status of trading countries allows the gravity model to offer more specific insight into questions about the real impact of ISO 9000 certification (Table 7). At the first glance, adding economic status for countries

brings a different view on the role of ISO 9000 certificate on international trade. The p-values of the ANOVA of nine models (Model 1.1 to Model 1.9) show that it is statistically significant (p-value < 0.0001), and offers R-squared results that range from 0.5169 to 0.5198 (compared to that of 0.498 of the baseline model). The R-squared results show that the model is being used has reduced the variability of the trade flow to nearly 51.69% to 51.98%. Again, in this specification, most variables in the model have a significant impact on trade flow; here, however, that somewhat impact differs depending on the economic status under consideration.

Comparing the impact of GDP on international trade across the nine models, it is clear that GDP is an important explanatory variable when modeling trade flow; consistently across models it is observed that the higher a country's GDP is, the larger the trade flows. As with the baseline model, however, the exporter's GDP has more of an impact on trade than does importer's GDP. The coefficient estimates for GPD importing country are from 0.655 to 0.678 (p-value < 0.0001), which means with one unit increase in the natural log of importer's GDP, trade will be increased by 92.5% ((exp(0.655) – 1) x 100%) to 97% ((exp(0.678) – 1) x 100%). While the percentage increase of exporting countries with one unit increase in the natural log of GDP range from 180% ((exp(1.031) – 1) x 100%) to 183% ((exp(1.041) – 1) x 100%). (p-value < 0.0001).

Results of dummy variables are similar to those in the baseline model. As expected, dummy variables about contiguity, common language, colonial ties, same country, membership in the same RTA, island-nation status exporter all increase trade. Trade, however, again was found to be reduced when countries are landlocked and

located far from each other. For all models, the magnitude of the coefficients of these variables is similar to that of the baseline model.

With regard to the impact of economic status on trade flows, results are not completely as expected. From the importer perspective, developed country status does not significantly affect trade flow. Developing and least developed country status, however, were found to have a significant impact on trade. More specifically, compared to the baseline model, developing countries experience an increase in trade (positive coefficient estimate) relative to those with developed and LDC country status, and those with least developed country (LDC) status experience a decrease in trade (negative coefficient estimate) relative to those with developed and developing country status. With the developing country status, trade will be increased around 10.7% ($0.001 < p\text{-value} < 0.002$), and decreased around 67.5% (p-value < 0.0001) for the least developed country status.

But when examined from the exporter perspective, compared to the baseline model, countries with developed status do not impact trade significantly, countries with LDC status experience a decrease in export (negative coefficient estimates). On average, this decrease is 90% (p-value < 0.0001). Developed country status, however, reflects significant increases in trade flow (positive coefficient estimates) with around 7.9% increase ($0.0119 < p\text{-value} < 0.0267$).

Examining the effect of ISO 9000 certification across the nine models shows that the ISO 9000 ratio of importing countries do not have significant impact on trade (p-value > 0.1). From an exporting country's perspective, a higher ratio of ISO 9000

certification is demonstrated to be an advantage for them in international trade. This result is expected. ISO 9000 certification will help exporting countries meet the administrative requirements of the importing businesses. Furthermore, implementing ISO 9000 will help exporting countries efficiently survey and better understand their customers' needs, and thus bolster their own business activities. Coefficient estimates range from 0.258 (p-value < 0.0001) to 0.267 (p < 0.0001), reflecting a 29.4% to 30.6% increase in trade.

Model 1.1 examines the case of a developed country importer and developed country exporter. Results show from this model that for countries of this status, the ratio of ISO 9000 of importing countries do not significantly impact trade flow (p-value = 0.1955). However, the result is different for exporting country; ISO 9000 ratio does have significant impact on trade (coefficient = 0.259, p-value < 0.0001). When exporter with developed country status, it will cause an increase of 7.9% (p-value = 0.018) in trade.

Model 1.2 examines trade between a developed country importer and developing country exporter. The developing and developed country status of exporting countries does not have a statistically significant impact on trade relative to that of other economic status pairings (p-value = 0.8488 and 0.1283, respectively). Considering the impact of ISO certification shows that for the exporting country the higher the ISO 9000 ratio, the larger the flow of trade (coefficient estimate = 0.260, p-value < 0.0001), which is not the same case for importing country for which the ISO 9000 ratio does not reflect a statistically significant impact on trade (p-value = 0.1998).

Model 1.3 considers trade between country pairs in which the importer is developed and the exporter is an LDC. Least developed status countries have a significant lower trade flow than other exporting countries (90%, p-value < 0.0001) whereas countries with developed status do not significantly impact trade. In this case as well, the impact of the ISO 9000 ratio is still positive for exporting countries (coefficient estimate = 0.267, p-value < 0.0001) but not significant for importing countries (p-value = 0.1441).

Model 1.4 examines trade between the country pair of a developing country importers and developed country exporters. If an exporter has developed country status, trade flow will be increased 7.3% (p-value <0.0001) and developing country status for importer results an increase of 10.5% (p-value = 0.002) relative to other economic status pairings. This could be explained based on the rationale that companies in developed countries are often assumed to have higher standards of product quality; this perception is particularly attributed to products from developed countries especially when their business partner is a country of lower economic rank. When considering ISO 9000 certificate, the reasoning above, however, makes the impact of ISO 9000 certification on trade not clear. A higher ratio of ISO 9000 certification leads to a higher trade to exporters (which is developed, coefficient = 0.259, p-value <0.0001) but does not significantly impact trade of importer (which is developing, p-value = 0.2087).

Model 1.5 explores the case when two developing countries trade with each other. Specifically, if an exporter is a developing country, that will have no significant impact on trade (p-value = 0.9618). For developing country importers, it will increase trade by 11.2% (p-value = 0.001) relative to other economic status country pairs. An increase in

the ratio of ISO certificates for developing exporters will increase trade remarkably (0.259, p-value < 0.0001), and does not have significant impact trade of developing country importers (p-value = 0.2146).

Model 1.6 examines trade between a developing country importer and an LDC exporter. Developing country status leads to an increase in importer trade flow of 10.7% (p-value = 0.0015) and a decrease of 90% in that of the exporter (p-value < 0.0001). For developing – LDC trade, the role of ISO 9000 certificate is still positive and significant for exporting country, and not significant for importing country (p-value = 0.1499). Export will be increased with an increase in the ratio of ISO 9000 certification for developing exporter (0.267, p-value = 0.0015).

In model 1.7, the exporting country is developed, and importing country is a least developed country. Results are that the trade imported by the LDC will decrease trade by 67.5% (p-value < 0.0001), while developed country exporters will increase trade by 8.3% (p-value < 0.0119) compared to other economic status country pairs. When an exporting country is Developed, ISO 9000 certification will have large and positive impact on trade (coefficient estimate = 0.258, p-value < 0.0001). From the LDC importing country perspective, ISO 9000 certification does not have a significantly affect on trade (p-value = 0.6014). The explanation for this is when exporting countries are developed; they are associated with 'high quality' status, which makes them easy to do business with abroad. Therefore, higher ratio of ISO 9000 will lead to higher exports to developed country exporter and less trade to importer as a least developed country.

Model 1.8 investigates the trade relationship between LDC importers and developing country exporters. Results shows that for developing country exporters, exports will not be significantly affected (p-value = 0.7137). The status of least developed countries will decrease their trade by 67.5% (p-value < 0.0001). From a developing country exporter perspective, an increase in ISO 9000 ratio will lead to an increase in exports (0.258, p-value <0.0001), while it does not significantly impact trade of importer (p-value = 0.6124)

Model 1.9 gives a very different result compared with the baseline model. Through this model, it is apparent that least developed country status of two trading countries will not increase trade, and, in fact, was found to decrease it considerably; relative to 66.5% trade flow by LDC importing country (p-value < 0.0001), 90% of LDC exporting country (p-value < 0.0001). For a unit increase in the ratio of ISO 9000 certification, exporters would have chances to increase export significantly by 30% (p-value < 0.0001) and does not have significant impact on importers (p-value = 0.4716).

Using this approach of adding economic status into the model seems not to support the hypothesis. ISO 9000 certification does not have a significant impact on importer and have a positive and significant impact on exporter, as well as the impact of ISO 9000 certification on different economic status is not clear. This approach generates an ambiguous picture about the real impact of both ISO 9000 certification as well as the economic status on the value of trade flows of a trading country. It appears that separately considering the impact of the ISO 9000 ratio and economic status does not adequately

address the likely interplay between these impacts. As such, an alternative model specification which jointly considers the impact of these factors is explored.

b. Model with interaction between the ISO 9000 Ratio and Country Economic status

Findings from Model 1.1 to 1.9 raise the question as to whether or not it is necessary to include economic status into an analytical consideration of the impact of ISO 9000 on trade. The question is not fully answered because adding variables of ISO 9000 certification and economic status separately into the model does not seem to bring the actual picture that the hypotheses seek to test about the impact of ISO 9000 certificate given a country's economic status. As such, this analysis proceeds by reexamining trade between these nine country pairs by instead including a term that reflects the interaction between a country's development status and their relative use of ISO 9000.

For all models variants which were examined, the p-value of the ANOVA (Table 8) shows that they are statistically significant (p-value < 0.0001), R-squares are around 0.488 which means using the model, the variability of the trade flow is reduced 48.8%. Comparing these results given to those generates by the first approach (Model 1.1 – 1.9), second approach portrays a very different picture about the joint impact of ISO 9000 certification and economic status.

Constant with earlier models, these alternative specifications find that GDP is still one of the main variables that can be used to predict the approximate trade flow between two countries. The impact on trade of GDP on importing countries is similar in each of nine model specifications. Coefficient estimates on the importing country GDP range

from 0.648 to 0.673 (p-value < 0.0001). These values are much lower than those for the exporting country GDP which range from 1.015 to 1.120 (p-value < 0.0001).

With regard to other independent variables, several dummy variables have positive and significant affect on trade for each of the three approaches: contingency, same language, colonial tie, same country, party to the same RTA, island nation. All of them have a significant effect in increasing trade flow. As usual and as expected, distance has a negative impact on trade.

Another difference in the model results is the impact if of geographic location has on trading countries. For landlocked importing countries, the location will impede trade approximately 26% (coefficient ranges from -0.284 to 0.304, p-value < 0.0001). While for exporting countries, however, landlocked country status does not appear to be a big problem to trade, it still increases international trade by nearly 11.6% (coefficient range from 0.099 to 0.132, p-value < 0.05).

For most of the cases, the coefficient and the p-value of the interaction of the ISO 9000 certification ratio and the country's economic development status indicates a significant and positive interaction affect on trade flow. While the specific magnitude differs for each different status, statistically results show that LDCs with higher level of ISO certification will benefit from trade more than developing countries and developed countries. From the importer's perspective, the coefficient estimates for the interaction of ratio of ISO 9000 with least developed, developing and developed countries are around 0.136, 0.016, 0.022 (significant at level of 5%), respectively. From the exporter's perspective, the coefficient estimates are around 0.091, 0.126, 0.281, respectively

(significant at level of 1%). This result supports the hypotheses above concerning the significant and positive impact of ISO 9000 certification on trade flows, and specifically exports from one country to another as well as the different magnitude of impact for different countries that have different economic status.

The picture is much clearer when investigating each individual model specification with different interaction of ratio of ISO 9000 and economic status.

Model 2.1 considers the trading relationship between two developed countries. As expected, when considering trade between developed, the interaction between the ISO 9000 ratio and the developed economic status reflects a positive, significant impact on trade flow. The higher the ratio of ISO 9000 certificate each developed country has, the more trade they will create between them. The coefficient estimate for the interaction is 0.091 (p-value < 0.0001) for exporter and 0.038 (p-value < 0.0001) for importer. The effect, however, is not big. For exporting country, one unit increase in ISO 9000 ratio will lead to 9.5% increase in export. Same for importing countries, the percentage increase in trade will be 3.8% (p-value = 0.0395).

Model 2.2 considers the circumstance where the developed country is an importer, and the exporter is developing country. In this situation, given the developed status of importer, its interaction with ratio of ISO 9000 certification shows a positive and significant impact on trade flow (p-value = 0.0120), similarly, the interaction of developing exporter significantly increase trade export (coefficient = 0.124, p-value < 0.0001). That means, with one unit increase in the natural log of ratio of ISO 9000 certification, developing exporter will increase trade 13.2% compared to Model 2.1

where developed countries can increase 9.5% in exports. The higher the ratio of ISO 9000 certificate a developing exporter has, the easier for them to export to developed countries.

Model 2.3 is interested in the impact of ISO 9000 certificate given the importer is developed and exporter is a least developed country. The result shows that one unit increase of the natural log of ISO 9000 certificates, when importer is developed, will increase trade flow by 4% (p-value < 0.0001), and greater increase in trade flow for least developed exporter with 32.4% (p-value < 0.0001). Compared to the increase in export of a developed and developing exporter from Model 2.1 and Model 2.2, the magnitude of trade increase of least developed country is highest when there is more ISO 9000 certification. The result supports the hypothesis about the more important role of ISO certificate on less developed country than developed country.

Model 2.4 considers trade between a developed country exporter and developing importer. For this scenario, with an increase in number of ISO 9000 certificate, compared to other economic status pairings, a developed country exporter will trade 9.5%, (p-value < 0.0001) more. While that the impact of the economic status and ISO 9000 ratio interaction is not significant for developing country importer (p-value = 0.4434). This result is reasonable in the sense that developed exporter always has advantageous in international trade based on their reputation about high quality products. The higher the relative number of ISO 9000 certificates they have, the more the positive impact of their perceived quality will be augmented.

Model 2.5 compares the impact of ISO 9000 adoption on trade between developing countries. The adoption of ISO 9000 standards has a significant impact on trade flow between such nations: if two developing countries trade with each other, an increase in number of ISO 9000 certificate will remarkably increase their trade flow. The percentage increase is 1.5% for importer (p-value = 0.0533) and 13.4% for exporter (p-value < 0.0001). Compared these to the scale of increase in trade between two developed countries (Model 2.1), the result supports the hypothesis that ISO 9000 certificate will help developing countries boost trade more than it will help developed countries.

Model 2.6 examines the impact of ISO 9000 certification on trade between developing country importer and LDC exporter. Results indicate that trade flow between two countries is positively affected by an increase in the number of ISO 9000 certificate. However, the magnitude of this impact is different for the exporter and importer. Given a unit increase in natural log of ratio in ISO 9000 certification, results suggest that on average a least developed country can increase its export by 32.4% (p-value < 0.0001), a developing country would increase trade by 1.6% (p-value = 0.0408) compared to that of other economic status country pairs. This result once again emphasizes the importance of ISO 9000 certification in facilitating trade from less developed countries to higher developed level countries.

Model 2.7 assesses the impact of ISO 9000 certificate on trade between a least developed importer and a developed exporter. The result shows that given the economic status of importer and exporter, the ratio of the number of ISO 9000 certificate significantly increase trade, coefficient estimates are 0.135 (p-value = 0.0067) and 0.092

(p-value < 0.0001) for importer and exporter, respectively. In this case, the impact of ISO certification on trade of less developed country is higher than for developed country exporter This suggest that least developed country will have gain more in international trade when they have more ISO 9000 certificates. Considering that developed countries with big multinational firms will open their branches in LDCs, which will help LDCs firms to learn the techniques in supply chain management as well as quality management from developed countries. And as an exporter to a least developed country, developed country is normally considered as possessing high quality regardless of having big number ISO 9000 certification. Therefore, they will not gain much from it compared to least developed countries.

Model 2.8 compares the effect of ISO 9000 certificate between a least developed country importer and a developing country exporter. For reasons similar to those described for Model 2.7, the impact is positive for both countries and effect of increase in number of ISO 9000 certificate is higher for least developed country (0.140, p-value = 0.0048) than that of developing country (0.127, p-value < 0.0001). This further underlines the remark above about least developed country will benefit most from ISO 9000 certificate then higher level countries.

Model 2.9 investigates ISO 9000 certification's role when two LDCs trade with each other. The result gives total different view compared to the same model of the first approach (Model 1.9). This model reveals that least developed countries still benefit from ISO 9000 certificate when they trade with each other, and the benefit is statistically significant, which translates to an increase of 14.6% for importer (p-value = 0.0064) and

32.3% for exporter (p-value < 0.0001). Two least developed countries can increase more trade flow if they have more ISO certificates. Compared to the magnitude of increase in trade for two trading partners with the same economic status of Model 2.1 and Model 2.5, the result by this model once again support the hypothesis about the greater impact of ISO 9000 certification on less developed countries than developed ones.

Using the interaction between development status and ratio of ISO 9000 certification, the second approach answers to some extent the question about the real effect of ISO 9000 certificate on international trade given different economic status of participating countries.

For Hypothesis 1, the study found that ISO 9000 certification has a positive and significant effect on trade between countries, and the impact is more for exporter than importer.

For Hypothesis 2, the study found that ISO 9000 certification's impact on trade is different across different countries. Specifically, LDCs and developing countries benefit the most from ISO 9000, while developed countries benefit not much from ISO 9000 certification.

The result of this analysis support the findings by Clougherty and Grajek (2008) about different benefit from implementing ISO 9000 standards for different countries with different economic status. This author found that ISO 9000 certification in developed countries does not substantially increase trade flow, whereas it has significant role in developing countries thanks to the three characteristics of ISO 9000 (quality signal, common language, and conflict settling) that reduce their cost of cross-border

trade as well as information asymmetries. The results are also similar to the findings by Potoski and Prakash (2008) when they considered the impact of ISO 9000 certification on trade of countries with different economic status using two different classifications by WTO (rich, medium, and poor) and OECD membership (OECD and non OCED). The study also showed that ISO 9000 certification does augment trade significantly, especially for that of poor countries. And the magnitude of impact of ISO 9000 certification on exports of countries to rich countries, specifically, is decreasing from poor to medium then rich countries.

V. SUMMARY AND CONCLUSIONS

Empirical research to date as found that ISO 9000 standards have an ambiguous affect on improving companies' performance in general and in boosting international trade in particular. Some studies show that ISO 9000 certification simply is certification that demands little commitment to quality, therefore it does not help companies in doing business (Docking and Dowen, 1999; Jones and Arndt, 1997). In the context of international trade, however, some studies show that implementing ISO 9000 standards have significant role in facilitating trading between countries (Casadesús and Giménez, 2000; Gotzamani and Tsiotras, 2001). The magnitude of potential impact has been found to be different for different countries (Clougherty and Grajek, 2008; Grajek, 2004). The purpose of this study is to shed light on the issue of whether adopting ISO 9000 standards has a significant impact on trade between countries, and how this impact vary according to the economic status of countries. This study proceeds by building a gravity model to explain trade flows between countries. This model makes use of information about trade flow between country pairs, their GDP, and a series of variables that capture geographic and political relationships between countries. Information about the ratio of the number of ISO 9000 certifications to the total number of firms in an industry, and the country's economic status are also included in various combinations in alternative model specifications.

The paper examines the impact of ISO 9000 standards on trade using three approaches. First, a baseline model that includes information about GDP, country characteristics and the ratio of ISO 9000 certificates was examined. Secondly, the

baseline model was reevaluated after adding the development status of trading countries to the model. Finally, a third approach was used which considers the interaction of trading country development status and ratio of ISO 9000. This latter approach permitted the effect of ISO 9000 certification for different level of development to be examined. The empirical test based on three approaches yields some findings.

First, ISO 9000 certification helps countries in facilitating trading business in general more than impeding it, which supports the hypothesis about whether ISO 9000 certification in an industry has a significant and positive impact on trade. And the impact was found to be greater for exporter than importer.

Second, ISO 9000 certification have a significantly different impact on trade on countries with different development status. The impact was found to have a larger positive impact on less developed countries' exports to developed countries than that of developed countries. These findings met the hypotheses which were interested in finding different impact of ISO 9000 certification on each development status. The results show that when exporting to developed countries, with one unit increase in the natural log of ISO ratio, least developed country can increase 32.4% its exports to developed and developing countries. With the same amount increase in ratio of ISO 9000 as of least developed countries, exports to developed countries of developing countries will increase 13.2%. Export from developed countries to developed countries can increase 9.5% with the same increase in ISO 9000 ratio.

The findings imply some implications in the adoption of ISO 9000 certification.

In general, ISO 9000 standards can augment trade through reducing information asymmetries among all trading partners (Potoski and Prakash, 2008).

From the view of administrative considerations, ISO 9000 quality management system can be seen as an institution that connects, coordinates exporters, importers and other partners to facilitate them in doing business (Clougherty and Grajek, 2008). Establishing such institution will bring many benefits to the business community as a whole, and individual firm as a part.

From the view of policy makers, considering that ISO 9000 certification will help least developed and developing countries to increase their exports to developed countries, therefore, adopting ISO 9000 certification can be understood as implementing export-oriented policy by country.

ISO 9000 certification helps firms in developing and least developed countries not only improve their performance internally, but also acts as a quality certification which can certify partly their product quality when those products are exported to higher developed countries. Therefore, adopting ISO 9000 certification will help

Last but not least, from the consumers' perspective, the adoption ISO 9000 certification helps them to distinguish the quality and non-quality products from the same countries which are normally assumed not to have high quality products (Potoski and Prakash, 2008).

Trade flows between trading partners, however, have great variability among countries, regions and industries. The impact of ISO 9000 certification will be evaluated more robustly if future study can take into account the country, regional and industry fix

effects which can mitigate the effect of the variability of country, regional and industry on trade flows and bring a “pure” impact of ISO 9000 certification on trade flows. Therefore, further research can take into account the country, regional or industry fixed effects to investigate the impact of ISO 9000 certification on trade.

Table 3: Variables Descriptive Statistics

Variable description	N	Minimum	Maximum	Mean	Std. Deviation
Trade flow between two countries	191959	.96	6.64E10	3.6549E7	4.56186E8
Real (1990) GDP of importer (isoimp) in year t	190320	15853200	9.E12	3.24E11	1.072E12
Real (1990) GDP of exporter (isoexp) in year t	190820	15853200	9.E12	4.20E11	1.179E12
ISO 9000 ratio of importer	92288	.00000	4.52632	.1045163	.26615561
ISO 9000 ratio of exporter	110636	.00000	4.52632	.1170669	.27857119
Dummy = 1 if isoimp&isoexp share common border	190362	0	1	.03	.180
Dummy = 1 if isoimp&isoexp share common language	190362	0	1	.17	.373
Dummy = 1 for country pairs in colonial relationship post 1945	190362	0	1	.02	.135
Dummy = 1 if imp or exp was common colonizer post 1945	190362	0	1	.08	.275
Dummy = 1 if isoimp&isoexp were ever the same country	190362	0	1	.02	.135
Distance between isoimp&isoexp (kms)	190362	60	19951	6801.70	4553.375
Dummy = 1 if isoexp is an island nation	191959	0	1	.14	.343
Dummy = 1 if isoimp is an island nation	191959	0	1	.17	.377
Dummy = 1 if isoimp is a landlocked nation	191959	0	1	.14	.348
Dummy = 1 if isoexp is a landlocked nation	191959	0	1	.12	.323
Dummy=1 if isoimp&isoexp were party to same RTA i year t	191959	0	1	.06	.230
Dummy=1 if isoimp is least developed	192230	0	1	.11	.310
Dummy=1 if isoimp is developed	192230	0	1	.25	.431
Dummy=1 if isoimp is developing	192230	0	1	.65	.478
Dummy=1 if isoexp is least developed	192230	0	1	.06	.241
Dummy=1 if isoexp is developed	192230	0	1	.33	.471
Dummy=1 if isoexp is developing	192230	0	1	.61	.489

Table 4: European Accreditation (EA) Code Industry

EA Code	Industry name	EA Code	Industry name
1	Agriculture, Fishing and Forestry	21	Aerospace
2	Mining and quarrying	22	Other transport equipment
3	Food products, beverage and tobacco	23	Manufacturing not elsewhere classified
4	Textiles and textile products	24	Recycling
5	Leather and leather products	25	Electricity supply
6	Manufacture of wood and wood products	26	Gas supply
7	Pulp, paper and paper products	27	Water supply
8	Publishing companies	28	Construction
9	Printing companies	29	Wholesale & retail trade; repairs of motor vehicles, motorcycles & personal & household goods
10	Manufacture of coke & refined petroleum products	30	Hotels and restaurants
11	Nuclear fuel	31	Transport, storage and communication
12	Chemicals, chemical products & fibres	32	Financial intermediation, real estate, renting
13	Pharmaceuticals	33	Information technology
14	Rubber and plastic products	34	Engineering services
15	Non-metallic mineral products	35	Other Services
16	Concrete, cement, lime, plaster etc.	36	Public administration
17	Basic metal & fabricated metal products	37	Education
18	Machinery and equipment	38	Health and social work
19	Electrical and optical equipment	39	Other social services
20	Shipbuilding		

Table 5: International Standard of Industrial Classification of All Economic Activities (ISIC) Rev. 2 Code

ISIC Rev.2 code	Industry name
300	Total manufacturing
311	Food products
313	Beverages
314	Tobacco
321	Textiles
322	Wearing apparel, except footwear
323	Leather products
324	Footwear, except rubber or plastic
331	Wood products, except furniture
331	Furniture, except metal
341	Paper and product
342	Printing and publishing
351	Industrial chemicals
352	Other chemicals
353	Petroleum refineries
354	Miscellaneous petroleum and coal products
355	Rubber products
356	Plastic products
361	Pottery, china, earthenware
362	Glass and products
369	Other non-metallic mineral products
371	Iron and steel
372	Non-ferrous metals
381	Fabricated metal products
382	Machinery, except electrical
383	Machinery, electric
384	Transport equipment
385	Professional and scientific equipment
390	Other manufactured products

Table 6: Pearson Correlation for Colonial Tie Variables

	COLONY	COMCOL	CURCOL	COL45
COLONY	1	-.052*	.302*	.793*
COMCOL	-.052*	1	-.016*	-.041*
CURCOL	.302*	-.016*	1	.381*
COL45	.793*	-.041*	.381*	1

* Correlation significant at the 1% (2-tailed)
n=190362

Table 7: Gravity Equation Coefficient Estimates for Model with Economic status

Variable	Model 1	Model 1.1	Model 1.2	Model 1.3	Model 1.4	Model 1.5	Model 1.6	Model 1.7	Model 1.8	Model 1.9
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
INTERCEPT	**-18.975***	-18.898*	-19.094*	-19.013*	-19.160*	-19.364*	-19.258*	-18.684*	-18.854*	-18.802*
	(-56.23)	(-52.21)	(-51.56)	(-54.45)	(-51.73)	(-51.13)	(-53.89)	(-53.75)	(-53.01)	(-55.85)
LNRGDPI	**0.661***	0.668*	0.668*	0.671*	0.675*	0.675*	0.678*	0.656*	0.655*	0.658*
	(84.41)	(74.01)	(74.02)	(74.49)	(76.00)	(76.01)	(76.46)	(83.33)	(83.26)	(83.84)
LNRGDPE	**1.041***	1.031*	1.040*	1.032*	1.031*	1.040*	1.032*	1.032*	1.041	1.034*
	(129.53)	(113.39)	(115.48)	(128.11)	(113.44)	(115.52)	(128.12)	(113.63)	(115.71)	(128.50)
LNRATIOI	**-0.011**	-0.011	-0.011	-0.013	-0.011	-0.011	-0.012	-0.005	-0.004	-0.006
	(-1.25)	(-1.29)	(-1.28)	(-1.48)	(-1.26)	(-1.24)	(-1.44)	(-0.52)	(-0.51)	(-0.72)
LNRATIOE	**0.259***	0.259*	0.260*	0.267*	0.259*	0.259*	0.267*	0.258*	0.258	0.265*
	(29.14)	(29.19)	(29.14)	(30.02)	(29.17)	(29.12)	(30.01)	(29.04)	(29.00)	(29.87)
DEVELOPEDI		-0.044	-0.051	-0.048						
		(-1.32)	(-1.52)	(-1.46)						
DEVELOPINGI					0.100*	0.106*	0.102*			
					(3.09)	(3.28)	(3.17)			
LDCI								-1.125*	-1.125*	-1.095*
								(-7.93)	(-7.92)	(-7.73)
DEVELOPEDE		0.076**			0.071**			0.080**		
		(2.37)			(2.22)			(2.52)		

Table 7 (cont.)

Variable	**Model 1**	**Model 1.1**	**Model 1.2**	**Model 1.3**	**Model 1.4**	**Model 1.5**	**Model 1.6**	**Model 1.7**	**Model 1.8**	**Model 1.9**
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
DEVELOPINGE			-0.006			-0.002			-0.011	
			(-0.19)			(-0.05)			(-0.37)	
LDCE				-2.298*			-2.293*			-2.276*
				(-12.52)			(-12.50)			(-12.41)
CONTIG	**0.818***	0.824*	0.809*	0.820*	0.812*	0.798*	0.810*	0.837*	0.824*	0.833*
	(11.70)	(11.69)	(11.48)	(11.71)	(11.53)	(11.33)	(11.57)	(11.95)	(11.76)	(11.96)
LANG	**0.362***	0.360*	0.365*	0.371*	0.364*	0.370*	0.376*	0.368*	0.372*	0.379*
	(6.00)	(5.95)	(6.04)	(6.16)	(6.03)	(6.11)	(6.23)	(6.09)	(6.17)	(6.30)
COMCOL	**0.780***	0.781*	0.778*	0.800*	0.780*	0.776*	0.799*	0.802*	0.798*	0.820*
	(11.25)	(11.27)	(11.21)	(11.56)	(11.25)	(11.20)	(11.55)	(11.57)	(11.52)	(11.86)
COL45	**1.110***	1.110*	1.112*	1.125*	1.113*	1.114*	1.127*	1.116*	1.117*	1.130*
	(11.06)	(11.06)	(11.07)	(11.22)	(11.08)	(11.09)	(11.25)	(11.13)	(11.14)	(11.29)
SMCTRY	**0.347***	0.353	0.347*	0.353*	0.352*	0.347*	0.353*	0.349*	0.344*	0.349*
	(2.46)	(2.69)	(2.65)	(2.69)	(2.68)	(2.64)	(2.69)	(2.66)	(2.62)	(2.67)
LNDIST	**-1.138***	-1.137*	-1.139*	-1.130*	-1.137*	-1.13878	-1.130*	-1.130*	-1.132*	-1.124*
	(-61.80)	-61.70	(-61.79)	(-61.46)	(-61.73)	(-61.82)	(-61.48)	(-61.34)	(-61.42)	(-61.11)
ISLANDI	**0.187***	0.165*	0.186*	0.176*	0.168*	0.18903	0.178*	0.162*	0.183*	0.175*
	(3.86)	(3.34)	(3.78)	(3.66)	(3.40)	(3.84)	(3.69)	(3.28)	(3.71)	(3.63)

Table 7 (cont.)

Variable	**Model 1**	**Model 1.1**	**Model 1.2**	**Model 1.3**	**Model 1.4**	**Model 1.5**	**Model 1.6**	**Model 1.7**	**Model 1.8**	**Model 1.9**
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
ISLANDJ	**0.345***	0.356*	0.360*	0.360*	0.372*	0.376*	0.375*	0.333*	0.335	0.335*
	(7.12)	(7.18)	(7.27)	(7.28)	(7.53)	(7.61)	(7.61)	(6.85)	(6.90)	(6.93)
LLI	**0.047**	0.049	0.046	0.083**	0.048	0.045	0.082**	0.052	0.049	0.086**
	(1.16)	(1.20)	(1.14)	(2.04)	(1.17)	(1.10)	(2.02)	(1.28)	(1.21)	(2.11)
LLJ	**-0.291***	-0.291*	-0.292*	-0.290*	-0.289*	-0.290*	-0.288*	-0.260*	-0.261*	-0.260*
	(-7.39)	(-7.38)	(-7.41)	(-7.38)	(-7.34)	(-7.36)	(-7.33)	(-6.59)	(-6.61)	(-6.61)
RTADUM	**0.926***	0.918*	0.938*	0.945*	0.935*	0.955*	0.960*	0.910*	0.927*	0.936*
	(21.37)	(20.33)	(20.77)	(21.40)	(20.72)	(21.16)	(21.76)	(20.65)	(21.05)	(21.67)
P-value	**<.0001**	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
F-value	**2542.02**	2243.81	2243.13	2262.23	2244.76	2244.16	2263.20	2251.25	2250.49	2269.27
R-square	**0.5169**	0.5170	0.5169	0.5190	0.5171	0.5170	0.5191	0.5178	0.5177	0.5198

* significant at 1%, ** significant at 5%, *** significant at 10%
t-statistic in parentheses
dependent variable is natural log of real (1990) bilateral flows between two countries in industry k in 2004

Table 8: Gravity Equation Coefficient Estimate for Model with Interaction between Ratio of Number of ISO Certificate to Number of Firm Count and Economic Status

Variable	Model 1	Model 2.1	Model 2.2	Model 2.3	Model 2.4	Model 2.5	Model 2.6	Model 2.7	Model 2.8	Model 2.9
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
INTERCEPT	**-18.975***	-22.003*	-19.239*	-21.294*	-21.595*	-18.777*	-20.715*	-21.677*	-18.997*	-20.954*
	(-56.23)	(-64.29)	(-53.44)	(-63.25)	(-59.71)	(-50.49)	(-58.66)	(-64.70)	(-54.33)	(-63.66)
LNRGDPI	**0.661***	0.669*	0.669*	0.673*	0.651*	0.652*	0.648*	0.653*	0.659*	0.655*
	(84.41)	(78.42)	(78.59)	(78.71)	(73.45)	(73.77)	(73.08)	(83.82)	(84.78)	(84.07)
LNRGDPE	**1.041***	1.119*	1.016*	1.081*	1.120*	1.016*	1.083*	1.120*	1.015*	1.083*
	(129.53)	(129.37)	(112.58)	(134.99)	(129.46)	(112.57)	(135.19)	(129.58)	(112.56)	(135.19)
LNRATIOI	**-0.011**									
	(-1.25)									
LNRATIOE	**0.259***									
	(29.14)									
LNDEVRATIOI		0.038*	0.022**	0.039*						
		(4.30)	(2.51)	(4.43)						
LNDEVINGRATIOI					0.006	0.015***	0.016**			
					(0.77)	(1.93)	(2.05)			
LNLDCRATIOI								0.135*	0.140*	0.136*
								(2.71)	(2.82)	(2.72)
LNDEVRATIOE		0.091*			0.091*			0.092*		
		(10.65)			(10.54)			(10.70)		

Table 8 (cont.)

Variable	**Model 1**	**Model 2.1**	**Model 2.2**	**Model 2.3**	**Model 2.4**	**Model 2.5**	**Model 2.6**	**Model 2.7**	**Model 2.8**	**Model 2.9**
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
LNDEVINGRATIOE			0.124*			0.126			0.127*	
			(15.95)			(16.36)			(16.38)	
LNLDCRATIOE				0.281*			0.281*			0.280*
				(4.51)			(4.52)			(4.50)
CONTIG	**0.818***	0.738*	0.866*	0.789	0.762*	0.888*	0.819*	0.760*	0.881*	0.811*
	(11.70)	(10.40)	(12.23)	(11.13)	(10.74)	(12.55)	(11.56)	(10.73)	(12.48)	(11.47)
LANG	**0.362***	0.446*	0.411*	0.448*	0.446*	0.406*	0.445*	0.448*	0.411*	0.449*
	(6.00)	(7.33)	(6.76)	(7.35)	(7.32)	(6.68)	(7.29)	(7.35)	(6.75)	(7.37)
COMCOL	**0.780***	0.762*	0.829*	0.793*	0.776*	0.841*	0.810*	0.774*	0.837*	0.806*
	(11.25)	(10.86)	(11.85)	(11.30)	(11.06)	(12.02)	(11.53)	(11.04)	(11.98)	(11.49)
COL45	**1.110***	1.060*	1.075*	1.057*	1.057*	1.074*	1.055*	1.058*	1.074*	1.055*
	(11.06)	(10.45)	(10.61)	(10.40)	(10.42)	(10.61)	(10.38)	(10.43)	(10.61)	(10.38)
SMCTRY	**0.347***	0.437*	0.424*	0.451*	0.430*	0.415*	0.440*	0.430*	0.419*	0.444*
	(2.46)	(3.29)	(3.20)	(3.40)	(3.24)	(3.13)	(3.31)	(3.24)	(3.16)	(3.35)
LNDIST	**-1.138***	-1.113*	-1.115*	-1.106*	-1.112*	-1.116*	-1.106*	-1.111*	-1.114*	-1.103*
	(-61.80)	(-59.93)	(-60.18)	(-59.47)	(-59.84)	(-60.18)	(-59.44)	(-59.78)	(-60.07)	(-59.32)
ISLANDI	**0.187***	0.231*	0.063	0.150*	0.226*	0.059	0.146*	0.223*	0.059	0.146*
	(3.86)	(4.67)	(1.28)	(3.07)	(4.58)	(1.20)	(2.98)	(4.60)	(1.20)	(2.99)

Table 8 (cont.)

Variable	**Model 1**	**Model 2.1**	**Model 2.2**	**Model 2.3**	**Model 2.4**	**Model 2.6**	**Model 2.6**	**Model 2.7**	**Model 2.8**	**Model 2.9**
Importer	**BASELINE**	DEV	DEV	DEV	DEVING	DEVING	DEVING	LDC	LDC	LDC
Exporter		DEV	DEVING	LDC	DEV	DEVING	LDC	DEV	DEVING	LDC
ISLANDJ	**0.345***	0.358*	0.330*	0.347*	0.321*	0.300*	0.302*	0.324*	0.309*	0.312*
	(7.12)	(7.21)	(6.66)	(6.99)	(6.49)	(6.08)	(6.10)	(6.60)	(6.32)	(6.36)
LLI	**0.047**	0.104**	0.099**	0.127*	0.107*	0.102**	0.132	0.107**	0.100**	0.130*
	(1.16)	(2.51)	(2.41)	(3.08)	(2.60)	(2.47)	(3.19)	(2.58)	2.43	(3.15)
LLJ	**-0.291***	-0.304*	-0.292*	-0.300*	-0.303	-0.295*	-0.302*	-0.295*	-0.284*	-0.291*
	(-7.39)	(-7.66)	(-7.37)	(-7.55)	(-7.62)	(-7.43)	(-7.58)	(-7.42)	(-7.16)	(-7.31)
RTADUM	**0.926***	1.035*	0.833*	0.956*	0.994*	0.797*	0.906*	1.001*	0.811*	0.921*
	(21.37)	(22.92)	(18.46)	(21.45)	(22.00)	(17.79)	(20.38)	(22.53)	(18.35)	(21.01)
P-value	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	<0.0001
F-value	2542.02	2439.06	2458.06	2426.52	2436.64	2457.71	2424.44	2437.55	2458.28	2424.88
R-square	**0.5169**	0.5066	0.5085	0.5053	0.5063	0.5085	0.5051	0.5064	0.5085	0.5051

* significant at 1%, ** significant at 5%, *** significant at 10%
t-statistic in parentheses
dependent variable is natural log of real (1990) bilateral flows between two countries in industry k in 2004

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