Information Asymmetries as Trade Barriers: ISO 9000 Increases International Commerce

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Abstract

Spatial, cultural, and linguistic barriers create information asymmetries between buyers and sellers that impede international trade. The International Organization for Standardization's ISO 9000 program is designed to reduce these information asymmetries by providing assurance about the product quality of firms that receive its certification. Based on analyses of a panel of 140 countries from 1994 to 2004, we find that ISO 9000 certification levels are associated with increases in countries' bilateral exports, particularly for developing countries' exports, which may be due to their more severe quality assurance challenges. © 2009 by the Association for Public Policy Analysis and Management.

Buyers' uncertainty about the quality of products offered for sale impedes international trade (Greif, 1992). Spatial, cultural, and linguistic barriers in international commerce accentuate buyers' difficulties in discerning product quality. Developing country exporters face greater challenges in credibly signaling product quality because international buyers tend to infer product quality from the generally poor reputations of products' country of origin (Hudson & Jones, 2003). A credible mechanism that distinguishes higher-quality products from lower-quality products from the same country would help developing country firms increase their exports. Purging the negative country-of-origin stigma from high-quality products should mitigate a lemons market problem (Akerlof, 1970) and boost international trade. As Chiang and Masson (1988) observe, "Information imperfections may cause consumers to practice 'statistical discrimination' against imports from developing countries. . . . Consumers often associate the quality of such goods with their country of origin. If consumers are, on average, correct about their perceptions of the quality of products from a country then a 'Lemons' effect emerges."

International trade agreements target impediments such as tariff and regulatory barriers to international trade. By and large, there have been fewer policy efforts targeting information asymmetries as international trade barriers.[1] International trade research has underappreciated the extent to which a nongovernmental regime such as private international standards might help overcome informational barriers and promote trade. Recognizing that an international "brand" certifying product quality could mitigate information asymmetries and encourage trade, in 1987

[1] At the domestic level, policies to mitigate the information problems associated with "experience goods" and "post-experience goods" include certification, product testing, and product liability laws (Riley, 2001).

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the International Organization for Standardization launched the ISO 9000 quality certification program. ISO 9000 is an international standard established by a nongovernmental actor in which firms, rather than countries, can participate.

To receive ISO 9000 certification, a firm must adopt and document extensive quality assurance management systems that require nontrivial investments in personnel and training, and then receive regular third-party audits to demonstrate that their management system meets the ISO 9000 standards. Thus, in addition to its signaling function, ISO 9000 also serves to improve firms' internal quality assurance practices. Most important, firms can use the ISO 9000 brand to signal to international buyers the quality of their products. ISO 9000 has a widely recognized brand for product quality (Corbett, 2005; Faganel & Piskar, 2007), and ISO 9000's rapid growth suggests its potential for enhancing international trade. In September 1993 there were 46,571 ISO 9000 certified firms in 60 countries. By December 2005, over 750,000 facilities in 161 countries had received ISO 9000 certification, with over 200,000 of them in the developing world (ISO, 2006).

This paper presents analyses of countries' international trade and ISO 9000 certifications which indicate that ISO 9000 has stimulated international trade, particularly developing countries' exports, where the information asymmetry and quality assurance problems are likely to be most severe. The data and method build on the gravity model of international trade, which has become the standard in the literature (Rose, 2004; Goldstein, Rivers, & Tomz, 2007; and Tomz, Goldstein, & Rivers, 2007). The empirical model evaluates bilateral exports from 140 countries from 1993 through 2002 as a function of the number of ISO 9000 certifications in exporting countries and importing countries. The results suggest that for developing countries, a 1 percent increase in ISO 9000 certifications increases their bilateral exports by 0.035 to 0.063 percent for poor countries and by about 0.026 percent for medium-wealth countries. With ISO 9000's rapid growth in the developing world, for countries with average ISO 9000 growth rates for their level of wealth, these translate into annual export increases of 5.7 to 10.3 percent for poor exporting countries and 3.8 percent for medium-wealth exporting countries. We find no effects, or generally smaller effects, for ISO 9000 certifications on developed countries' bilateral exports and for ISO 9000 certifications on countries' imports. These results are based on a strong panel research design, including controls for fixed effects and time series dynamics, and are robust across several alternative model specifications.

The case of ISO 9000 suggests that private international regimes can be effective if they target salient market failures and harness participants' self-interests. ISO 9000 addresses an important problem of market failure for developing country exporters: The "brand reputation" of developing countries is generally poor (Tybout, 2000; Hudson & Jones, 2003). Because buyers are unable to discern product quality differences among firms and products from the same country, they are only willing to pay the price appropriate for low-quality products, lest they be caught paying higher prices for low-quality "lemons." ISO 9000's focus on mitigating information asymmetries serves both buyers' and sellers' interests because both enjoy the win–win fruits from enhanced trade.

Our paper assumes added significance in light of recent discussions of the GATT/WTO's effects on international trade. While Rose (2004) concludes that the World Trade Organization (WTO, previously known as the General Agreement on Tariffs and Trade, or GATT), the preeminent international trade regime, has not increased international trade, Goldstein, Rivers, and Tomz (2007) and Tomz, Goldstein, and Rivers (2007) suggest that the WTO has been effective through analyses that take into account the fact that some countries have rights and obligations under the WTO even if they are not formal members.[2] The WTO and other

[2] Also see the contributions of Subramanian and Wei (forthcoming), Baier and Bergstrand (2007), and Gowa and Kim (2005).

intergovernmental trade regimes focus on removing tariff, coordination, and regulatory trade barriers. On this count, ISO 9000 is a useful nongovernmental policy initiative in that it focuses on mitigating a market failure that intergovernmental regimes have tended to overlook.

The next section of this paper discusses the information asymmetry problem in global commerce. The paper then presents the ISO 9000 certification system and evaluates its potential for mitigating information asymmetry problems. We then present the data, analyses, and results before concluding the paper.

INFORMATION ASYMMETRIES AND INTERNATIONAL MARKETS

To sell their products in world markets, exporters need to offer products with desirable attributes and to credibly convey information about those attributes. International trade is impeded by a lemons market, where product (or seller) quality is heterogeneous and buyers cannot discern product quality (Akerlof, 1970; Chisik, 2003; Chiang & Masson, 1988).[3] Buyers face high transaction costs in identifying quality exporters because spatial, cultural, and linguistic distances hamper the credible communication of product quality from sellers to international buyers, although the precise magnitude of the effect of quality in international trade is difficult to identify precisely (Hummels & Klenow, 2005; though see Hallak, 2006, p. 251).

According to the Word Trade Organization's 2005 *World Trade Report*:

> Information asymmetries occur when producers have information about the characteristics of goods they produce which users do not possess. Whether as end consumers or as producing firms acquiring inputs, buyers may be at a significant disadvantage compared to sellers because the latter possess information about the good or service not available to the buyer. This asymmetry can significantly hamper the efficient functioning of markets, and standards can help solve the problem and increase efficiency. (World Trade Organization, 2005, xxvi–xvii)

For centuries, sellers have sought to signal product quality through firm and product brands (Greif, 1989, 1992; Kreps & Wilson, 1982; Milgrom & Roberts, 1986; Smallwood & Conlisk, 1979), and governments have sought to solve "lemons" markets through government regulations such as mandatory information disclosure, product standards, refund laws, and so on (Riley, 2001). In international contexts, buyers infer sellers' product quality partly from the overall reputation of the country in which the seller is located (Hudson & Jones, 2003; Tybout, 2000). Recent examples include concerns about the quality of "Chinese" products and the fear that NAFTA would unleash a flood of poor-quality "Mexican" products. One tends not to hear similar complaints about product quality from developed economies such as Germany or Britain. Indeed as Van Ham (2001) insightfully observes: "Image and reputation have become essential parts of a state's strategic capital. Like branded products, branded states depend on trust and customer satisfaction." Not surprisingly, governments and national trade associations invest substantial resources building or refocusing their country brand (Kotler & Gertner, 2002).

While a country may have a reputation for poor product quality—perhaps well earned—some of its firms may be capable of producing high-quality products at internationally competitive prices. These high-quality firms may be unable to sell

[3] There is some literature on how information asymmetries impede trade in financial assets (Cawley & Philipson, 1999; Portes, Rey, & Oh, 2001) as well as organic foods (Lohr, 1998). Beaulieu and Gaisford (2002) provide an elegant model illustrating the "lemons" problem in the international trade in products that bear upon labor and environmental issues. Scholars have illustrated the "lemons" problem in sectors in which eco-labels are prominent. These include forestry (Haener & Luckert, 1998) and apples (Blend & Ravenswaay, 1999). For a thorough and accessible review of the literature on the economics of businesses in international trade, see Bernard et al. (2007).

their products at the higher prices because buyers fear they will end up purchasing low-quality "lemons." Uncertain legal environments and high costs of shipping replacement products in international markets undermine sellers' attempts to assure quality through guarantees, product exchanges, or refunds. Below we highlight how ISO 9000 adoption might mitigate the "lemons" problem in international markets by providing a mechanism for buyers to signal the high quality of their products and provide assurance that their products are not low-quality "lemons."

ISO 9000 and Quality Signals

The International Organization for Standardization is the preeminent global body for establishing technical standards. Since its launch in 1947, the ISO has established over 15,000 standards for coordinating international trade, including the ISO 14001 environmental standards, the ISO 22000 food safety standards, and the ISO 26000 corporate social responsibility standards. "ISO" brands are well known in international business and technical circles (Mattli & Büthe, 2003; Prakash & Potoski, 2006), providing an umbrella of credibility to its line of product standards. ISO 9000 was explicitly designed to solve the information asymmetry problem in international trade. The ISO's Web site touts the ISO 9000 brand as "a useful basis for organizations to be able to demonstrate that they are managing their business so as to achieve consistent (good!) quality goods and services."[4] Indeed, ISO 9000 has been widely adopted across the world (ISO, 2006). Many ISO 9000 certified organizations are located in China (143,823), Italy (98,028), Japan (53,771), Spain (47,445), and the United Kingdom (45,612). ISO 9000 has also gained a significant foothold in developing countries in Africa (4,379) and Central and South America (22,498), impressive achievements if one takes into account their economies' sizes and stages of development.

ISO 9000's standards specify quality management systems and practices, with the rationale that if appropriate practices are adopted, high-quality products will follow. To become ISO 9000 certified, a facility must establish a written quality assurance policy, specify internal quality targets, regularly review progress via internal audits, provide training to their employees, and designate a manager to oversee the implementation of quality assurance programs. An ISO 9000 quality management system is extensive, requiring substantial investments in personnel, training, and, most critically, in documenting production processes and systems (Sanders, 1996). Depending on the type of facility, an ISO 9000 management system can include detailed, documented internal processes to manage purchase and input acquisition, production, product quality control, research and development (including product and manufacturing design), packaging development, product storage, product transportation, record keeping, audit (including responding to nonconformance with ISO 9000), market research, regulatory responsibilities, continual improvement, marketing and customer communication, and internal communication (Praxiom, 2007).

Receiving formal ISO 9000 certification requires an audit by an accredited third-party auditor.[5] A firm seeking ISO 9000 certification typically hires an external auditor for an initial assessment audit to evaluate its readiness for a subsequent formal certification audit. While there are no systematic data on audit failure rates, anecdotal evidence suggests that more than one-third of the applicants fail their first audit (Nichols, 1993). The cost of the certification audit alone—over and above

[4] http://www.iso.org/iso/iso9000-14000/explore/9001supchain.html; accessed October 10, 2007.

[5] The ISO itself does not supply auditing services but instead accredits national-level organizations that provide formal recognition to auditing and certification organizations. To ensure that the requirements imposed by the national-level accreditation organizations on the auditors are equivalent, the ISO has formulated detailed guidelines for conformity assessment (ISO, 2007d). Further, the national accreditation body is expected to audit the auditors to ensure that the auditors are conforming to ISO guidelines (ISO, 2007a, 2007b, 2007c, 2007d).

the cost of creating and maintaining the management system—is significant, depending on the facility's size and preparation (Barnes, 1998; Anderson, Daly, & Johnson, 1999). Recertification audits are required every three years, and surveillance audits every year. Small- and medium-sized firms routinely cite auditing costs as an important factor for not pursuing ISO 9000 certification (CFIB, 2007). Larger firms are more likely to be exporters (Bernard et al., 2007) and more likely to join ISO 9000 (Terlaak & King, 2006).

ISO 9000's Mechanisms to Increase Trade

Firms join ISO 9000 to signal their commitment to product quality (Terlaak & King, 2006). Research suggests that ISO 9000–certified firms have higher-quality products, although there is disagreement about the extent to which ISO 9000 improves product quality for those that join or simply selects firms that already produce high-quality products (Terziovski, Power, & Sohal, 2003; Rao, Subba, & Raghunathan, 1997). Sorting out these effects has been hampered by methodological difficulties and a paucity of effective controls and exogenous instruments. For our purposes, whether ISO 9000 improves quality as opposed to selecting firms that have already achieved quality is not directly relevant to our inquiry so long as ISO 9000 certification is a credible signal of product quality (Corbett, 2005; Faganel & Piskar, 2007).

ISO 9000 can increase a country's exports through two means. First, if firms do not know how to achieve quality at levels importers demand, ISO 9000 certification can provide a means for learning quality manufacturing processes. If this were the case, firms could learn quality manufacturing processes by simply consulting the ISO 9000 standards—which are freely available—without paying certification expenses. Second, the more plausible means for increasing trade is that ISO 9000 can help exporters overcome information problems by lowering transaction costs for importers to gauge exporters' product quality. For this to occur, buyers must view ISO 9000 as a credible signal of quality. We believe this is true for three reasons.

First, ISO 9000 has a strong international reputation as a quality certification program. The International Organization for Standardization requires firms seeking the ISO 9000 certification to establish extensive quality assurance practices and have their quality management systems certified by accredited, third-party auditors. While third-party audits are not without flaws, it is fair to say that these audits provide some incentives for ISO 9000–certified firms to implement and maintain the management system certification requires, and not free-ride on the program's reputation.[6] Second, ISO has a strong reputation for developing international trade standards (Prakash & Potoski, 2006). Third, the International Organization for Standardization has a diverse membership, with more than 150 national-level standards associations as its primary members. Ad hoc technical committees to develop standards include representatives from business, government, and nongovernmental organizations. Once standards are promulgated, they assume the characteristics of public goods because firms located in any country (even nonmembers) can adopt them. While the standard development process is not perfect, it is fair to say that it tends to be inclusive and transparent, and therefore strengthens the credibility of the ISO brand.

To summarize, the theoretical bases for our analyses are (1) information asymmetries around product quality between international buyers and sellers impede trade (Hummels & Klenow, 2005; Hallak, 2006); (2) the buyers' tendency to infer product quality from the exporters' country of origin impedes exports from developing countries (Tybout, 2000; Hudson & Jones, 2003); and (3) ISO 9000 is a credible quality signal that mitigates information asymmetries (Terlaak & King, 2006;

[6] On the importance of third-party audits in curbing shirking (noncompliance with the program rules) in nongovernmental regimes see King & Lenox (2000), Gereffi, Garcia-Johnson, & Sasser (2001), and Potoski & Prakash (2005).

Corbett, 2005; Faganel & Piskar, 2007). This leads to the expectation that increases in countries' ISO 9000 adoption should be associated with increases in their exports, particularly for developing countries.

Empirical Model and Data

Our analytic approach draws on the international trade literature and is inspired by the work of Rose (2004), Tomz, Goldstein, and Rivers (2007), and Goldstein, Rivers, and Tomz (2007). The empirical model evaluates senders' exports to receivers as a function of the number of exporter and importer ISO 9000 certifications plus controls for exporter, importer, and dyad characteristics. We estimate the model of the following form:

$$\ln(Y_{ijt}) = \beta_0 + \beta_1(\text{ISO9000}_{it} \times \text{Wealth}_{it}) + \beta_2(\text{ISO9000}_{jt} \times \text{Wealth}_{jt}) + \beta_3 X_{ijt} + \varepsilon_{ijt}$$

where i indicates directed dyad sender (exporter), j indicates receiver (importer), and t indicates time. Y_{ijt} is sender country's i's exports to importing country j. ISO9000 is the number of ISO 9000 certifications, with coefficients β_1 and β_0 varying respectively depending on i and j's wealth, measured as rich, medium, and poor according to the World Bank's classification.[7] In alternative model specifications (see Tables 4 and 5), wealth is also measured as OECD member and non-OECD member. The analyses include separate independent variables for both exporter and importer ISO 9000 certifications because certifications may have different effects, depending on whether the country is an exporter or importer. The model includes dyad fixed effects, controls for serial correlation, and time-varying independent variables. Fixed effects control for factors that do not vary over the time period and a lagged dependent variable, a difference in difference specification, or an AR1 adjustment to the error term control for time series dynamics.[8] X_{ijt} is a vector of time variant control variables, including gross domestic product (GDP), population, and GDP per capita separately for exporters and importers, all logged. X_{ijt} also includes measures for whether dyad members share membership in a currency union, the number of common regional trade agreements, and GATT/WTO membership (Frankel, 1997).

The "difference in difference" estimator is based on Arellano and Bond (1991), who show that in panel models, the coefficients for lagged dependent variables can be correlated with the error term, leading to inconsistent estimates. Instead, they propose a "difference in difference" estimator where the dependent variable and independent variables are "differenced" between years (for example, the dependent variable is $Y_t - Y_{t-1}$, and $Y_{t-1} - Y_{t-2}$ is an independent variable). Since $Y_{t-1} - Y_{t-2}$ may still be correlated with the error term, Arellano and Bond suggest using instruments (such as Y_{t-2}) for $Y_{t-1} - Y_{t-2}$.

We first present the main model and then alternative specifications. The main model is limited to cases where sender countries' exports exceed $100,000 per annum, an approach used in Goldstein, Rivers, and Tomz (2007) (other dependent variable specifications are explored in the alternative specifications). The unit of analysis is a directed dyad, where each country year is included twice, as an importer and an exporter, for international trade dyads between 1993 (the earliest year for

[7] Arguably, ISO 9000 certification might serve as a quality signal for industrial buyer relationships, but not for end consumers, who are less likely to know if the exporter has ISO certification. Given that most international trade is routed through intermediaries (industrial buyers such as importers, distributors), a distinction (and empirical control) for exports/sales to end consumers versus industrial buyers is not needed.

[8] The analyses exclude time-invariant gravity model independent variables such as common language and geographic distance.

which countrywide ISO 9000 data are available) and 2002 (the last year for which bilateral trade data are available).[9]

Because we are interested in whether ISO 9000 certifications increase exports from less developed countries to developed countries, the analyses include separate measures of ISO 9000 certifications based on whether the exporter and importer are rich, medium, or poor countries, with categories based on the World Bank's classification. The World Bank (2007) classifies economies in four categories based on 2006 GNI per capita. In the World Bank's classification, countries are low income (less than $906), lower middle income ($906–$3,595), upper middle income ($3,596–$11,115), or high income (greater than $11,115). To simplify interpretation and to keep the number of independent variables more manageable, we collapsed the middle two World Bank categories into a "medium" wealth category. It is worth noting that a "medium" country is still quite poor by developed country standards: The median yearly per capita income in our medium category is $4,876, compared to $34,180 in the U.S. Statistically significant and positive coefficients for the ISO 9000 for poor and medium countries exporting to rich, medium, and poor importers would provide evidence that ISO 9000 increases exports for developing countries.[10] Controls for the importers' ISO 9000 certifications, again with separate measures depending on importers' per capita income, take into account the fact that exports might be influenced by importers' familiarity with ISO 9000.

We take several approaches to address potential endogeneity issues in the analyses. Following standard practice in the international trade literature for evaluating the effect of free trade agreements on international trade (Baier & Bergstrand, 2007; Goldstein, Rivers, & Tomz, 2007; and Tomz, Goldstein, & Rivers, 2007), the ISO 9000 independent variables are lagged by one year to account for delay in the variables' effects on exports and to avoid potential contemporaneous reverse causation. The analyses include fixed effects (FE) for years and directed dyad to control for time-invariant, unmeasured factors including distance; cultural, institutional, and political affinities between dyad members; as well as contemporaneous shocks such as commodity price changes. While FE estimators sacrifice efficiency and between-dyad variation, our data have sufficient within-dyad variation. Baier and Bergstrand (2007) make a strong case for using fixed effects in panel analyses of the effects of trade agreements on international trade using cross-section time series trade data to respond to endogeneity problems.[11] Finally, we also exploit variability in importers' ISO 9000 certifications to control for any remaining sender propensity to join ISO 9000 in anticipation of trade. Trade, or the anticipation of exports, could cause ISO 9000 certifications because exporting firms may adopt ISO 9000 to adhere to the international norms they perceive rather than to signal quality. Since exporters' perceptions of international norms may come directly from the countries importing their products, by controlling for importers'

[9] These are slight divergences from the traditional gravity model, although not untried in the international grade literature (Goldstein, Rivers, & Tomz, 2007). In the traditional approach, the dependent variable in a gravity model is the sum of exports and imports between two countries, and the key independent variables are measured as the interaction between the two countries' characteristics. Thus, in a dyad, what matters is the total volume of flows in a dyad, not the directions of the flows. Given that we are interested in the direction of flow in a directed dyad, we focus on one-way flows (exports from i to j) only.

[10] We also experimented with interaction variables, examining the effect of ISO 9000 certifications on exports contingent on continuous measures of importer and exporter wealth, such as an interaction between sender and receiver GDP per capita and sender (and receiver) ISO 9000 certifications. However, we found that these interaction terms were highly correlated with each other and their lower-order terms, often with $r > 0.9$. In such cases, we were unable to estimate all the model coefficients. Given that three-way interaction terms are difficult to interpret and the effect of ISO 9000 certification on exports varies across sender's and receiver's wealth, we use the more simple three-category (rich, medium, and poor) classification.

[11] The international trade literature also favors fixed-effects models on theoretical grounds (Anderson & Van Wincoop, 2003).

ISO 9000 certifications, the analyses take into account exporters' perceptions of international quality norms.[12]

To confirm that there are no further feedback effects of trade on ISO 9000 adoption, we estimate a model that includes future ($t + 1$) ISO 9000 variables in the base model analysis of countries' exports, including the full fixed effects plus controls, including lagged ISO 9000 variables. According to Wooldridge (2002, p. 285), if the ISO 9000 $t + 1$ coefficients are statistically insignificant in this model, the ISO 9000 variables are "strictly exogenous." Baier and Bergstrand (2007) provide an instructive example of this test in the international trade context. The results of our test are that few of the ISO 9000 $t + 1$ variables are individually statistically significant, their signs are variable, and, more important, their joint effect is not statistically significant. The effects of the ISO 9000 $t - 1$ variables in this analysis remain similar to those presented in Table 2.[13]

The remaining independent variables include the standard trade model controls for income per capita, gross domestic product, population (Frankel, 1997), plus controls for membership in trade and currency treaties.[14] The trade data are from the "Direction of Trade" (DoT) CD-ROM data set developed by the International Monetary Fund (IMF), deflated by the American CPI for all urban consumers (1982–1984 = 100). Exports from country *i* to *j* are coded as the average of the value of *i*'s exports to *j* and *j*'s imports from *i*. Population and real GDP data (in constant American dollars) come from the Penn World Table, the World Bank's World Development Indicators, and the IMF's International Financial Statistics. The World Trade Organization provides information on WTO and regional trade agreement (RTA) memberships, and the International Monetary Fund provides information on currency unions. Data on ISO 9000 certifications are from the Web site of the International Organization for Standardization (www.iso.org). The bulk of the data employed in our analyses were also used in Glick and Rose (2002) and Rose (2004) and are generously made available and extensively documented at Professor Rose's Web site: http://faculty.haas.berkeley.edu/arose/. Our additions were the ISO 9000 data and updates for the measures for the trade variables from the Center of International Data at the University of California, Davis (Feenstra et al., 2005). Table 1 provides variable descriptions and summary statistics for the base model analyses.

Table 2 presents the base Models 1–3, estimating the log of countries' exports to importing countries as a function of exporters' and importers' ISO 9000 certifications using interaction terms that allow the effect of ISO 9000 certifications to vary across directed dyad types, depending on sender's and receiver's wealth classifications, plus time-variant control variables, fixed year and dyad fixed effects, and controls for time series dynamics. Standard errors were adjusted for clustering on the directed dyad. The first three models differ in that Model 1 has an autoregressive disturbance term (AR1), Model 2 has a lagged dependent variable in place of the

[12] Because we cannot identify strong candidates to serve as exogenous instruments, we do not estimate two-stage models (to be effective, instruments must be correlated with the endogenous independent variable and not with errors of the second-stage equation).

[13] Albuquerque, Bronnenberg, and Corbett (2007) find that the ISO 9000 certifications of a country's trading partners influence its own ISO 9000 certifications. Our specification check suggests that countries' ISO 9000 certifications do not increase in anticipation of trade. A reason for these differences might be found in modeling strategies: differences in independent variables, sample size (our study has a larger set of countries), and adjustments for time dynamics and fixed effects. For example, fixed effects would control for the effect of trade on ISO 9000 if it is time invariant.

[14] We also analyzed the main models excluding the population variables. The results do not change from those presented below. The rationale for including exporter (importer) population is that there may be supply (demand) effects not captured in the GDP per capita and GDP measures. Population captures a demand side independent of the size and wealth of the economy. For example, nearly everyone buys some goods (socks), regardless of how big and wealthy their economy, while luxury goods consumption increases with wealth. In the analyses, the population variables tend to be statistically significant, particularly on the importer (demand) side, suggesting that population has some effect not captured by the GDP and GDP per capita measures.

Table 1. Descriptive statistics.

Variable Name	Mean	Std. Dev.	Min	Max
Exports (*i* to *j*)	16.918	2.775	11.52433	26.207
i's ISO 9000:rich *i* to rich *j*	0.665	2.237	0	11.109
i's ISO 9000:rich *i* to medium *j*	0.433	1.520	0	9.780
i's ISO 9000:rich *i* to poor *j*	0.377	1.307	0	10.153
i's ISO 9000:medium *i* to rich *j*	0.694	2.320	0	11.109
i's ISO 9000:medium *i* to medium *j*	0.345	1.398	0	9.780
i's ISO 9000:medium *i* to poor *j*	0.401	1.424	0	10.964
i's ISO 9000:poor *i* to rich *j*	1.150	2.941	0	11.109
i's ISO 9000:poor *i* to medium *j*	0.557	1.790	0	9.780
i's ISO 9000:poor *i* to poor *j*	0.636	1.807	0	10.964
i's ISO 9000:rich *i* to rich *j*	0.668	2.239	0	11.109
j's ISO 9000:rich *i* to medium *j*	0.758	2.410	0	11.109
j's ISO 9000:rich *i* to poor *j*	1.117	2.939	0	11.109
j's ISO 9000:medium *i* to rich *j*	0.421	1.514	0	9.780
j's ISO 9000:medium *i* to medium *j*	0.374	1.483	0	9.780
j's ISO 9000:medium *i* to poor *j*	0.651	1.951	0	9.780
j's ISO 9000:poor *i* to rich *j*	0.457	1.479	0	10.964
j's ISO 9000:poor *i* to medium *j*	0.418	1.496	0	10.964
j's ISO 9000:poor *i* to poor *j*	0.724	1.963	0	10.964
j's ISO 9000:*i* in OECD to *j* in OECD	0.756	2.371	0	11.109
j's ISO 9000:*i* in OECD to *j* non-OECD	2.045	3.602	0	11.109
j's ISO 9000:*i* non-OECD to *j* in OECD	0.880	1.989	0	10.964
j's ISO 9000:*i* non-OECD to *j* non-OECD	1.853	2.751	0	10.964
j's ISO 9000:*i* in OECD to *j* in OECD	0.759	2.380	0	11.109
j's ISO 9000:*i* in OECD to *j* non-OECD	0.866	1.940	0	10.964
j's ISO 9000:*i* non-OECD to *j* in OECD	1.968	3.598	0	11.109
j's ISO 9000:*i* non-OECD to *j* non-OECD	1.665	2.595	0	10.964
Currency union*	0.003	0.054	0	1
Regional trade authority*	0.135	0.927	0	10
One in WTO*	0.976	0.152	0	1
Both in WTO*	0.736	0.441	0	1
Senders' GDP	24.892	1.904	19.307	29.937
Receivers' GDP	24.755	2.045	19.307	29.937
Senders' GDP/capita	8.432	1.483	4.888	10.917
Receivers' GDP/capita	8.413	1.494	4.888	10.917
Senders' population	16.535	1.701	11.184	20.974
Receivers' population	16.414	1.763	11.184	20.974
i's ISO 9000:rich *i*	2.746	4.024	0.00	11.109
i's ISO 9000:medium *i*	1.539	2.772	0.00	9.780
i's ISO 9000:poor *i*	1.755	2.712	0.00	11.235
j's ISO 9000:rich *j*	2.523	3.945	0.00	11.109
j's ISO 9000:medium *j*	1.427	2.649	0.00	9.780
j's ISO 9000:poor *j*	1.695	2.594	0.00	11.235
Dyad dummy: rich *i* to medium *j**	0.094	0.291	0.00	1
Dyad dummy: rich *i* to poor *j**	0.154	0.361	0.00	1
Dyad dummy: medium *i* to rich *j**	0.087	0.281	0.00	1
Dyad dummy: medium *i* to medium *j**	0.069	0.254	0.00	1
Dyad dummy: medium *i* to poor *j**	0.111	0.314	0.00	1
Dyad dummy: poor *i* to rich *j**	0.135	0.342	0.00	1
Dyad dummy: poor *i* to medium *j**	0.102	0.303	0.00	1
Dyad dummy: poor *i* to poor *j**	0.161	0.367	0.00	1

* Unlogged. All other variables logged.

Table 2. The effects of ISO 9000 on dyad trade, 1992–2003.

	Model 1		Model 2		Model 3	
Independent Variables	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value
Exporters' ISO 9000 Certifications						
i's ISO 9000:rich *i* to rich *j*	−0.013	0.53	0.011	0.48	−0.013	0.69
i's ISO 9000:rich *i* to medium *j*	−0.024	0.25	0.007	0.66	−0.002	0.96
i's ISO 9000:rich *i* to poor *j*	−0.035	0.10	0.007	0.68	−0.058	0.12
i's ISO 9000:medium *i* to rich *j*	0.026	0.04	0.024	0.03	0.012	0.58
i's ISO 9000:medium *i* to medium *j*	0.026	0.05	0.029	0.03	0.033	0.25
i's ISO 9000:medium *i* to poor *j*	−0.001	0.96	0.012	0.39	−0.003	0.94
i's ISO 9000:poor *i* to rich *j*	0.035	0.00	0.030	0.01	0.041	0.03
i's ISO 9000:poor *i* to medium *j*	0.063	0.00	0.059	0.00	0.087	0.00
i's ISO 9000:poor *i* to poor *j*	0.036	0.00	0.045	0.00	0.059	0.01
Importers' ISO 9000 Certifications						
j's ISO 9000:rich *i* to rich *j*	−0.016	0.45	−0.001	0.95	−0.029	0.36
j's ISO 9000:rich *i* to medium *j*	0.001	0.91	0.024	0.02	0.011	0.53
j's ISO 9000:rich *i* to poor *j*	−0.013	0.21	−0.005	0.57	0.034	0.05
j's ISO 9000:medium *i* to rich *j*	−0.052	0.01	−0.019	0.26	−0.048	0.16
j's ISO 9000:medium *i* to medium *j*	−0.002	0.85	0.000	0.98	0.016	0.49
j's ISO 9000:medium *i* to poor *j*	−0.016	0.12	−0.014	0.15	0.008	0.67
j's ISO 9000:poor *i* to rich *j*	−0.026	0.22	−0.043	0.03	−0.020	0.61
j's ISO 9000:poor *i* to medium *j*	−0.007	0.60	−0.027	0.04	0.001	0.96
j's ISO 9000:poor *i* to poor *j*	−0.004	0.74	−0.030	0.00	0.030	0.14
Control Variables						
Currency union*	0.062	0.88	0.034	0.17	0.184	0.10
Regional trade authority*	0.055	0.52	−0.007	0.47		
One in WTO*	0.077	0.19	0.145	0.06	0.020	0.79
Both in WTO*	0.113	0.00	0.125	0.00	−0.013	0.77
Senders' GDP	0.726	0.00	0.518	0.00	−0.111	0.55
Receivers' GDP	0.723	0.00	0.792	0.00	0.898	0.00
Senders' GDP/capita	−0.024	0.38	0.021	0.50	0.035	0.52
Receivers' GDP/capita	0.473	0.00	0.419	0.00	0.568	0.00
Senders' population	0.337	0.00	0.144	0.41	0.226	0.54
Receivers' population	0.094	0.22	0.331	0.01	0.758	0.02
i's ISO 9000:rich *i*	0.026	0.12	−0.002	0.90	0.029	0.35
i's ISO 9000:medium *i*	0.036	0.00	0.023	0.08	0.049	0.06
i's ISO 9000:poor *i*	−0.014	0.16	0.009	0.42	−0.010	0.58
j's ISO 9000:rich *j*	0.026	0.15	0.037	0.03	0.033	0.23
j's ISO 9000:medium *j*	−0.014	0.21	−0.020	0.07	−0.021	0.25
j's ISO 9000:poor *j*	−0.003	0.75	−0.005	0.56	−0.005	0.79
Dyad dummy: rich *i* to medium *j*	0.245	0.12	0.214	0.04	−0.009	0.97
Dyad dummy: rich *i* to poor *j*	0.239	0.18	0.175	0.09	0.210	0.50
Dyad dummy: medium *i* to rich *j*	0.019	0.90	−0.130	0.21	−0.073	0.81
Dyad dummy: medium *i* to medium *j*	−0.080	0.62	0.060	0.59	−0.273	0.36
Dyad dummy: medium *i* to poor *j*	0.044	0.80	0.059	0.59	−0.109	0.71
Dyad dummy: poor *i* to rich *j*	0.118	0.50	0.053	0.66	−0.017	0.96
Dyad dummy: poor *i* to medium *j*	0.165	0.33	0.177	0.12	−0.023	0.94
Dyad dummy: poor *i* to poor *j*	0.181	0.30	0.103	0.36	−0.115	0.70
Lagged dependent variable			0.188	0.00	0.620	0.00
Constant	1.533	0.00	−5.887	0.00	−34.268	0.00
N (overall)	52,847		64,056		39,398	
Dyads	11,086		12,025		9,647	
F-statistic (Wald)	364.1		92.62		1,255.5	

Table 3. Alternative specification summaries.

	Model 4		Model 5		Model 6		Model 7	
Independent Variables	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value
Exporters' ISO 9000 Certifications								
i's ISO 9000:rich *i* to rich *j*	0.051	0.00	0.009	0.59	0.062	0.00	0.083	0.05
i's ISO 9000:rich *i* to medium *j*	0.014	0.34	−0.011	0.42	0.015	0.25	0.052	0.10
i's ISO 9000:rich *i* to poor *j*	0.004	0.77	−0.019	0.11	0.003	0.78	0.092	0.00
i's ISO 9000:medium *i* to rich *j*	0.023	0.05	0.031	0.01	0.032	0.00	0.038	0.30
i's ISO 9000:medium *i* to medium *j*	0.040	0.00	0.021	0.08	0.037	0.00	−0.021	0.50
i's ISO 9000:medium *i* to poor *j*	0.011	0.34	−0.020	0.06	0.005	0.57	−0.042	0.09
i's ISO 9000:poor *i* to rich *j*	0.027	0.00	0.018	0.06	0.029	0.00	0.000	0.99
i's ISO 9000:poor *i* to medium *j*	0.039	0.00	0.013	0.17	0.043	0.00	0.027	0.31
i's ISO 9000:poor *i* to poor *j*	0.031	0.00	0.003	0.73	0.025	0.00	−0.031	0.16
Importers' ISO 9000 Certifications								
j's ISO 9000:rich *i* to rich *j*	0.007	0.43	0.002	0.90	0.010	0.288	−0.007	0.87
j's ISO 9000:rich *i* to medium *j*	0.016	0.08	0.004	0.77	0.023	0.010	0.029	0.44
j's ISO 9000:rich *i* to poor *j*	−0.021	0.00	−0.019	0.05	−0.012	0.124	−0.074	0.01
j's ISO 9000:medium *i* to rich *j*	0.001	0.96	−0.020	0.15	0.002	0.892	0.026	0.40
j's ISO 9000:medium *i* to medium *j*	−0.007	0.62	−0.027	0.03	−0.008	0.469	0.081	0.01
j's ISO 9000:medium *i* to poor *j*	−0.013	0.18	−0.015	0.11	−0.006	0.464	0.057	0.03
j's ISO 9000:poor *i* to rich *j*	−0.030	0.02	−0.038	0.00	−0.019	0.124	0.069	0.01
j's ISO 9000:poor *i* to medium *j*	−0.042	0.00	−0.033	0.00	−0.034	0.000	0.049	0.05
j's ISO 9000:poor *i* to poor *j*	−0.032	0.00	−0.015	0.09	−0.023	0.001	0.063	0.01
N (overall)	106,398		91,410		141,251		124,301	
Dyads	16,642		14,379		17,937		17,730	
F-statistic	61.58		518.5		4,975.69		17.34	

Notes: All models add 1 to ISO 9000 variables prior to log transformation and include a dummy variable for observations whose variables (unlogged) are zero. Models 6 and 7 also add 1 to the dependent variable prior to log transformation. Models 4 and 6 include lagged dependent variables and 5 and 7 include an AR1 adjustment to the error term. Not shown are control variables as in Models 1–3.

autoregressive disturbance term, and Model 3 uses Arellano and Bond's (1991) difference in difference estimator. All estimations were conducted in Stata v10 using the xtreg, xtregar, and xtabond commands.

Tables 3 and 4 summarize alternative model specifications by presenting the ISO 9000 coefficients, their standard errors, and the model *F*-statistics. A set of alternative specifications (Table 3) investigates the consequences of dropping cases with zero values in the independent and dependent variables. Many countries had zero ISO 9000 certifications, particularly in the early 1990s, and many directed dyads had sender exports of less than $100,000 and zero dollars, resulting in significant list-wise deletion. Models 4 and 5 replicate Models 1 and 2, but with the ISO 9000 independent variables transformed by adding 1 to all cases and including in the analyses dummy variables scored 1 for cases with zero values in the ISO 9000 variables, otherwise 0 (Cameron & Trivedi, 1998). Models 6 and 7 replicate Models 4 and 5 but with the dependent variable transformed by adding one to all cases before logging, and including values of less than $100,000.[15] Models 4–7 preserve cases that would otherwise be missing, although it is not clear whether the near-zero and zero cases are actually missing values, zeros, or are otherwise noise

[15] Adding 1 to the variables, of course, transforms variables' distributions from a "true" natural log. The effects on the coefficients from this transformation are likely to be small relative to the effects of including additional observations.

Table 4. Alternative specification summaries, OECD classification.

	Model 8		Model 9		Model 10	
Independent Variables	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value
Exporters' ISO 9000 Certifications						
i's ISO 9000:*i* in OECD to *j* in OECD	0.031	0.00	0.039	0.05	−0.084	0.00
i's ISO 9000:*i* in OECD to *j* non-OECD	0.013	0.22	0.018	0.28	0.021	0.17
i's ISO 9000:*i* non-OECD to *j* in OECD	0.033	0.00	0.017	0.07	0.020	0.04
i's ISO 9000:*i* non-OECD to *j* non-OECD	0.038	0.00	0.036	0.00	0.097	0.00
Importers' ISO 9000 Certifications						
j's ISO 9000:*i* in OECD to *j* in OECD	0.029	0.01	0.013	0.49	−0.090	0.00
j's ISO 9000:*i* in OECD to *j* non-OECD	−0.005	0.37	−0.014	0.11	−0.035	0.00
j's ISO 9000:*i* non-OECD to *j* in OECD	0.023	0.09	0.022	0.22	0.018	0.32
j's ISO 9000:*i* non-OECD to *j* non-OECD	−0.017	0.01	−0.010	0.23	0.039	0.00
N (overall)	64,056		52,847		39,398	
Dyads	12,025		11,086		9,647	
F-statistic (Wald)	99.4		632.4		2,970.1	

Notes: Models 8–10 replicate Models 1–3 (Table 2) using OECD classification in place of World Bank's classification of rich, medium, and poor countries. Not shown are control variables as in Models 1–3.

in the data (see Goldstein, Rivers, & Tomz, 2007).[16] Finally, Models 8 through 14 in Tables 4 and 5 replicate Models 1–7, while replacing the World Bank's designation of rich, medium, and poor countries with a measure of whether or not a country is an OECD member.

Coefficients in models with logged independent and dependent variables can be translated as the percentage change in the dependent variable associated with a 1 percent change in the independent variable, holding constant the effects of other variables. The average annual growth in ISO 9000 certification in our sample for countries with at least one ISO 9000 certification was 164 percent for poor countries, 146 percent for medium countries, and 120 percent for rich countries. To provide a further sense of scale for the ISO 9000 variables, the coefficient in our analyses for countries in the WTO suggests that trade increases by about 13 percent when both countries in a dyad are WTO members. Tomz, Goldstein, and Rivers (2007) find that the WTO effect is 62 percent and Rose (2004) finds no WTO effect.

RESULTS

Across model specifications, the results of the analyses indicate that ISO 9000 certifications increase the exports of poor and medium-wealth countries. Table 2 presents

[16] Our specification checks also included analyses replicating Models 1 and 2, but with control variables for senders' levels of economic corruption. In more corrupt countries, the ISO 9000 certification process may not be very rigorous, undermining the credibility of the program. If importers distinguish among firms based on the credibility of their countries' ISO 9000 certification processes, the effect of ISO 9000 certifications on exports should be stronger for countries with more credible certification bodies. To address this issue, we estimated a model with a measure of country corruption (as a proxy for ISO 9000 certification rigor) as an independent variable. We measured countries' corruption using Transparency International's (2008) CPI corruption measures. In the results, the coefficient for the corruption measure was not statistically significant. However, including the corruption measure renders the senders' ISO 9000 coefficients insignificant, while leaving intact the (statistically significant and positive) effects of ISO 9000 on poor countries' exports. Unfortunately, the CPI measure is quite incomplete: The data series begins in 1995 with only 41 countries (by 2008 there are data for over 170). Hence, we exclude this variable from the remaining analyses, although the roles of corruption and certification credibility deserve future analytic scrutiny.

Table 5. Alternative specification summaries, OECD classification (*continued*).

	Model 11		Model 12		Model 13		Model 14	
Independent Variables	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value	Coeff.	*P*-Value
Exporters' ISO 9000 Certifications								
i's ISO 9000:*i* in OECD to *j* in OECD	0.049	0.00	0.033	0.16	0.066	0.066	0.033	0.17
i's ISO 9000:*i* in OECD to *j* non-OECD	0.035	0.00	0.008	0.62	0.056	0.056	0.008	0.63
i's ISO 9000:*i* non-OECD to *j* in OECD	0.035	0.00	0.009	0.20	0.036	0.036	0.009	0.21
i's ISO 9000:*i* non-OECD to *j* non-OECD	0.018	0.00	0.007	0.24	0.022	0.022	0.007	0.25
Importers' ISO 9000 Certifications								
j's ISO 9000:*i* in OECD to *j* in OECD	0.028	0.06	0.016	0.51	0.030	0.030	0.016	0.51
j's ISO 9000:*i* in OECD to *j* non-OECD	−0.014	0.01	−0.015	0.03	−0.009	−0.009	−0.015	0.03
j's ISO 9000:*i* non-OECD to *j* in OECD	0.023	0.15	−0.003	0.87	0.020	0.020	−0.003	0.88
j's ISO 9000:*i* non-OECD to *j* non-OECD	−0.016	0.01	−0.028	0.00	−0.014	−0.014	−0.028	0.00
N (overall)	106,398		91,410		141,251		124,301	
Dyads	16,642		14,379		17,937		17,770	
F-Statistic	98.9		632.4		98.9		22.35	

Notes: Models 11–14 replicate Models 1–3 (Table 3) using OECD classification in place of World Bank's classification of rich, medium, and poor countries. Not shown are control variables as in Models 1–3.

the results of Models 1 through 3. The three models differ only in the corrections for series dynamics: Model 1 uses an AR1 error adjustment, Model 2 uses a lagged dependent variable, and Model 3 uses the Arellano and Bond (1991) difference-in-difference estimator. All three models indicate that exporters' ISO 9000 certifications have a significant and positive effect on exports to rich, medium, and poor importing countries when the exporters are medium and poor countries, *but not* when the exporters are rich countries. In Model 1 a 1 percent increase in poor countries' ISO 9000 certifications increases exports by 0.035 percent to rich countries, 0.063 percent to medium countries, and 0.036 percent to other poor countries, holding constant the effects of other variables in the model. Also in Model 1, a 1 percent increase in medium countries' ISO 9000 certifications increases exports by 0.026 percent to rich countries and 0.026 percent to other medium countries, holding constant the effects of other variables in the model. For a poor country with at least one certification and average poor country ISO 9000 growth rates, this translates respectively into increases in exports of 5.7, 10.3, and 5.9 percent to poor, medium, and rich importing countries. For a medium-wealth country with at least one certification and average medium wealth country ISO 9000 growth rates, this translates into increases in exports of 3.8 percent to both medium and rich importing countries. In Model 2, the coefficients for senders' ISO 9000 certifications have essentially the same substance as Model 1: ISO 9000 certifications increase poor and medium countries' exports to rich, medium, and poor countries. In Model 3, the coefficients for senders' ISO 9000 certifications are statistically significant and positive for poor countries sending to rich, medium, and poor recipient countries, but are not statistically significant for rich and medium wealth sending countries. In Models 1–3, none of the ISO 9000 coefficients for rich exporting countries achieve statistical significance across any of the receiver types. A series of *F*-tests indicates that poor and medium exporters' ISO 9000 coefficients have significantly higher values than rich senders' ISO 9000 coefficients in all three models.

Across Models 1–3, the coefficients for *receivers*' ISO 9000 certifications generally *do not* achieve statistical significance. The statistically significant coefficients are generally negative, suggesting that increasing ISO 9000 certifications suppresses

imports. However, few receiver ISO 9000 certifications achieve statistical significance and there are no discernible patterns among them.

Table 3 summarizes the results for the alternative specification Models 4–7, in which the ISO 9000 variables were transformed by adding 1. In Models 4 and 5, we added 1 to the independent ISO 9000 variables and in Models 6 and 7 we added 1 to both the dependent variable (exports) and the ISO 9000 independent variables. To address series dynamics, Models 4 and 6 use a lagged dependent variable and Models 5 and 7 an AR1 adjustment to the error terms. The results for these models support this paper's central conclusions that ISO 9000 certifications boost trade, particularly for poorer countries: The coefficients for senders' ISO 9000 certifications are generally significant and positive for medium and poor countries and significantly smaller (or not significantly distinguishable from zero) for rich countries. A pattern across all models is that, including observations where the independent variables and dependent variables are zero, reduces—and in some cases renders statistically insignificant—the effect of ISO 9000 certifications on developing country exports. A plausible explanation for these findings is a threshold effect: To stimulate trade effectively, ISO 9000 requires some level of trade engagement between the two countries. For countries not already engaged in trade, ISO 9000 does not increase the likelihood or amount of trade. Finally, as in Table 2, the receiver ISO 9000 coefficients are generally not significant in these models; those coefficients that achieve significance tend to be negative, suggesting that more ISO 9000 certifications in a country reduce imports. Future research should investigate whether ISO 9000 certifications saturate domestic markets, reducing the need for imports.

The models in Tables 4 and 5 replicate the analyses in Tables 2 and 3 while using OECD country classification for wealth instead of the World Bank's wealth classification. The results in Tables 4 and 5 indicate that exporters' ISO 9000 certifications have significant and positive effects on non-OECD members' exports to both OECD and non-OECD countries. In Model 8, for example, a 1 percent increase in non-OECD countries' ISO 9000 certifications increases exports by 0.039 percent to other non-OECD countries and by 0.033 percent to OECD countries, holding constant the effects of other variables. For non-OECD member countries, the effects of ISO 9000 certifications on exports are less consistent. In some cases, OECD member countries' ISO 9000 coefficients are statistically significant and positive, suggesting that ISO 9000 boosts exports, but in others cases the coefficients are insignificant or negative. A series of *F*-tests indicates that the coefficients for non-OECD senders are not statistically different from those of OECD senders. In short, ISO 9000 certifications boost non-OECD members' exports, but have an ambiguous effect on OECD members' exports. These results are in contrast to the sharper distinction on the effects of ISO 9000 certifications on rich and medium/poor countries' exports, using the World Bank's classification. This is likely due to the fact that the OECD includes countries (such as Mexico) that are still in relatively early development stages, while the World Bank's classification provides a sharper, and more realistic, distinction between developed and developing countries.

Overall, the results across all 14 model specifications generally indicate that ISO 9000 certifications increase exports for poorer countries—whether poverty is measured as non-OECD status or as World Bank medium-wealth and poor countries. The coefficients of ISO 9000 certifications on developing country exports range between 0.016 and 0.097, indicating that a 1 percent increase in ISO 9000 certifications leads to a 0.016 to 0.097 percent increase in exports. Given ISO 9000's exponential growth rate, these translate into annual increases between 2 and greater than 10 percent per year. ISO 9000 has a generally insignificant effect on wealthier countries' exports. These results are consistent with the theoretical argument that ISO 9000 boosts international trade by helping buyers discern the quality of developing countries' products.

CONCLUSION

Information asymmetries stifle international trade, particularly exports from developing countries. This paper argues that ISO 9000 mitigates information asymmetries that impede international commerce, credibly signals product quality to international buyers about developing countries' exports, and thus enables international buyers to differentiate between high- and low-quality products sourced in the same country. Through its institutional design and its focus on a salient but less recognized international market failure—informational problems—ISO 9000 mitigates a "lemons" problem and thereby promotes international trade.

Our findings have important implications for the study of international institutions, particularly those designed to promote trade. Our paper focuses on a neglected trade barrier—information asymmetries in international markets—that structurally disadvantages developing countries in world markets. Indeed, developing countries' structural disadvantages in international markets have been recognized since the dependency debates of the 1950s and the 1960s (Frank, 1967). Some features of the General Agreement of Tariff and Trade (the WTO's predecessor), such as the Most Favored Nation status, were designed in part to respond to developing countries' structural disadvantages.[17] Our paper suggests how an innovative nongovernmental policy mechanism can help overcome developing countries' structural disadvantages. However, not all developing countries are likely to benefit from ISO 9000. Future research might investigate the redistributive aspects of ISO 9000 in terms of trade creation and trade diversion, an issue that is well developed in the international trade literature, especially in the context of regional trading agreements. Also, while we have presented a country-level analysis of how country-level ISO 9000 certification levels are associated with levels of bilateral trade, future work should look at this relationship at the sector level, once the International Organization for Standardization makes available such data.

Second, there may be institutional complementarities between intergovernmental and nongovernmental trade promotion regimes. While some suggest that private orderings may crowd out or preempt governmental regulatory efforts in some areas (Maxwell, Lyon, & Hacket, 2000), scholars and practitioners should not overlook the opportunities of exploiting complementarities among the two approaches. The analytical challenge is to specify the areas of comparative advantage for governmental as well nongovernmental efforts and how the two might be coordinated (Potoski & Prakash, 2009). Indeed, the WTO is appreciative of the efforts of the International Organization for Standardization to encourage world trade and views them as complementing its own efforts (WTO, 2005). The international regime research program needs to pay closer attention to the issue of "regime fit" as a driver of "regime efficacy" in the context of the other regimes that populate the issue area.

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