



# International standards and international trade: Empirical evidence from ISO 9000 diffusion <sup>☆</sup>



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## ABSTRACT

Empirical scholarship on the standards–trade relationship has been held up due to methodological challenges: measurement, varied effects, and endogeneity. Considering the trade-effects of one particular standard (ISO 9000), we surmount methodological challenges by measuring standardization via national penetration of ISO 9000, allowing standardization to manifest via multiple (quality-signaling, information/compliance-cost, and common-language) channels, and using instrumental variable, multilateral resistance and panel data techniques to overcome endogeneity. We find evidence of common-language and quality-signaling augmenting country-pair trade. Yet, ISO-rich nations benefit the most from standardization, while ISO-poor nations find ISO 9000 to represent a trade barrier due to compliance-cost effects.

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## 1. Introduction

Many trade scholars (e.g., Baldwin, 2000; Casella, 1996; Deardorff and Stern, 1998; Laird and Yeats, 1990; Preeg, 1998) have observed that the substantial decrease in trade barriers over the last few decades has led to technical trade barriers (TTBs) – such as standards – becoming increasingly important determinants of international trade flows. Yet unlike tariffs and common non-tariff barriers (NTBs), standards have the potential to not only decrease but also expand trade. While international standards have been found to promote trade more than national standards (e.g., Blind, 2001; Czubala et al., 2007; Moenius, 2004; Shepherd, 2007),<sup>2</sup> they still have the power to be protectionist

when consumers and large buyer groups require production according to these standards and compliance costs are relatively significant (Moenius, 2006). Despite the recognized importance of the subject, there is almost universal agreement that we lack sufficient empirical evidence concerning the relationship between standards and trade (e.g., Blind, 2004; Maskus et al., 2000; Matutes and Regibeau, 1996; Moenius, 2006). In this vein, Maskus et al. (2000) state that “it is important to obtain as much information as possible about the quantitative implications of standards ... [for] ... trade prospects”. Yet three challenges in particular have held back empirical scholarship on the international trade implications of standardization.

First, measurability difficulties represent a significant challenge that has curtailed efforts to successfully capture the impact of standards on trade. Deardorff and Stern (1998) note that standardization is one of the hardest NTBs imaginable to quantify – a lament echoed by many other studies (e.g., Blind, 2004; Laird and Yeats, 1990; Maskus et al., 2000; Shepherd, 2007). In short, the evidence on standards does not necessarily come in a form that facilitates quantitative analysis. As a result, empiricists have tended to construct a simple count of the number of standards – or the number of documents – in existence in order to capture the applicable degree of standardization in a nation or sector. Yet this inventory approach gives equal weight to all existing standards, and thus cannot differentiate between the effectiveness and significance of different standards (Laird and Yeats, 1990; Swann et al., 1996). Unfortunately,

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<sup>2</sup> Swann et al. (1996) represent an exception in that they found national standards to promote trade more than international standards.

the pre-existing empirical literature appears to lack a natural and straightforward means to measure the intensity of standardization.

Second, the varied effects that standards potentially have make it difficult to identify the particular channels via which standards impact trade, hence empirical scholarship has often tended to elicit net effects. For one, the diffusion of standards can increase the competitiveness of a home-nation's products – signaling quality and safety – therefore leading to enhanced exports (Blind, 2001, 2004; Ganslandt and Markusen, 2001; Swann et al., 1996). Further, the existence of standards in a host-nation can be favorable to trade as it provides crucial information to exporting firms on how to adapt a product for a particular market (Moenius, 2004, 2006). Yet, host-nation standards may also be used in a protectionist manner to raise the costs of foreign competition (Boom, 1995; Gandal and Shy, 2001; Ganslandt and Markusen, 2001). Such protectionist elements can be particularly strong when foreign firms face high adoption costs due in part to their having little influence on the standardization process (Blind, 2001; Maskus et al., 2000). In addition, Bénézech et al. (2001) point out that standards also involve common-language elements that potentially facilitate exchanges between firms from different countries. For instance, Blind (2001) notes that corresponding-knowledge and absorptive-capacity in a country-pair yield efficient use of standards, and Moenius (2004) holds that bilaterally shared standards greatly enhance trade. In light of these multiple potential effects, it is no surprise that Maskus et al. (2004) observe a mixed empirical record with standards sometimes enhancing and sometimes impeding trade.

Third, endogeneity represents an additional challenge to the empirical literature on standards and trade, as the causal inferences concerning the impact of standardization may be inconsistent and biased. The potential for simultaneity between exports and trade barriers has been recognized for some time (e.g., Harrigan, 1993; Lee and Swagel, 1997; Trefler, 1993), yet efforts to deal with endogeneity are a more recent phenomenon (e.g., Baier and Bergstrand, 2002, 2007, 2009; Magee, 2003). In particular, not only might international trade benefit from harmonization of standards due to decreasing trade barriers, but the standardization process might also in turn be determined by foreign trade intensity, as this indicates an economy's openness (Blind, 2002; Casella, 1996). In support of this conjecture, Moenius (2004) employs Granger testing and finds evidence of two-way causality between standards and trade volumes. As a consequence, empirical models of international trade using standardization as an explanatory variable may suffer from endogeneity bias. In addition, Santos Silva and Tenreyro (2006) point out that the parameters from log-linearized models (common in gravity trade equations) can also be misleading due to Jensen's inequality. Thus, endogeneity issues have also held back efforts to successfully capture in a consistent manner the impact of standards on international trade.

With the above issues in mind, we empirically investigate the impact of one particular international standard – ISO 9000 – on bilateral trade flows using a panel of cross-section time-series data at five-year intervals from 1995 to 2005 for 91 nations. The ISO 9000 certification system for quality management represents the most successful standard – close to 777,000 worldwide certificates by 2005 – implanted by the International Organization for Standardization: a post-World War II Geneva-based international institution charged with developing standards to enhance global trade. The merits of studying ISO 9000's impact on trade reside beyond this being – by far – the most successful international standard in existence, as we can employ diffusion data (ISO, 2002, 2006) to capture the degree to which the standard is adopted in a particular nation. We are able to move then beyond the customary inventory approach to measuring standardization, and instead consider the penetration of this seminal standard in a national environment. Furthermore, we can use home-nation and host-nation diffusion rates – and the interaction of the two – in order to identify the different channels via which standardization affects trade. Finally, we attempt to overcome the limitation of 'potential endogeneity' by employing panel-data procedures and instrumental variable (IV) techniques. In particular, we

conduct estimations using first-differencing and country-pair fixed effects, multilateral resistance terms a la Baier and Bergstrand (2009), as well as estimations using ISO 14000 – a sister standard involving environmental procedures – as a potentially powerful and valid instrument. We also test for heteroscedasticity patterns in our estimated gravity equations in line with the Santos Silva and Tenreyro (2006) critique.

The paper is organized as follows in order to support our analysis. Section 2 provides relevant background on the ISO 9000 standard and the data employed in the study. Section 3 considers the different channels via which standards may impact international trade flows. Section 4 sets out the base gravity equation, discusses econometric issues, and presents initial empirical findings. Section 5 concludes.

## 2. Background on ISO 9000 standard and employed data

The main objective of the International Organization for Standardization is to harmonize worldwide standards in order to promote trade and thereby global welfare. To this end, ISO 9000 – as already noted – has been the most successful standard implanted by the International Organization for Standardization. The history of ISO 9000 started in 1987 with the publication of the ISO 9000 Quality Assurance Standards by a Technical Committee (TC 176) of the International Organization for Standardization. The standard spread to over 160 countries by the end of 2005, therefore solidifying its reputation as an international reference for quality requirements in business-to-business dealings (ISO, 2002). Table 1 illustrates the rapid and successful worldwide penetration of this seminal standard by reporting the number of ISO 9000 certificates present in 2005 for each of the 91 countries from our sample.

In general, motivations behind the implementation of ISO 9000 could be divided into three main categories: i) compliance with government regulations, ii) ability to establish business relationships by meeting buyer requirements, and iii) internal efficiency gains. In fact, all the factors influencing managers to seek ISO 9000 certification – as identified by Anderson et al. (1999) in a comprehensive review of practitioner journals – fall into one of these three categories.

ISO 9000 adoption is a firm-based (or better said, premise-based) decision and firms strictly seek certification in their home countries. Each country has one government-designed accrediting agency that certifies the competence of third party registrars to conduct ISO 9000 quality audits – registrars are also charged with the issuing of certificates (Anderson et al., 1995, 1999). National-level governance of ISO certification enables our identification strategy—as explained later in the empirical section—and matters for the interpretation of results. For example, cross-national variation in institutional set-up, efficiency of administration and access to financing may result in the cost of acquiring ISO certification to vary substantially across the different countries in our sample. Such variation allows us to propose an instrumental variable for the level of ISO 9000 standardization that exploits different degrees of institutional quality—the suggestion being that countries suffering from poor-quality institutions face higher costs in adopting standards.

The ISO 9000 family of standards are often referred to as generic quality management standards, as they can be implemented by any organization regardless of its size, activity sector, or managerial/national culture. Quality management reflects what the organization does to enhance customer satisfaction by meeting buyer requirements and expectations (ISO, 2002). Compliance with ISO 9000 indicates consistent use of documents and standardized procedures to produce a good or service. In other words, ISO 9000 certifies that a firm's products – for which a customer contracts – conform to specification.

In our analysis, we treat ISO 9000 as a uniform standard even though it consists of a series of nested standards which evolved over time. Firms originally chose between three core certificates (ISO 9001, ISO 9002, and ISO 9003) that differed in terms of the covered quality-system elements. The nested nature of these standards allowed firms to accommodate

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