Global Competition, Institutions, and the Diffusion of Organizational Practices: The International Spread of ISO 9000 Quality Certificates

Isin Guler
University of Pennsylvania
Mauro F. Guillén
University of Pennsylvania
John Muir Macpherson
University of Texas at Austin

We use panel data on ISO 9000 quality certification in 85 countries between 1993 and 1998 to better understand the cross-national diffusion of an organizational practice. Following neoinstitutional theory, we focus on the coercive, normative, and mimetic effects that result from the exposure of firms in a given country to a powerful source of critical resources, a common pool of relevant technical knowledge, and the experiences of firms located in other countries. We use social network theory to develop a systematic conceptual understanding of how firms located in different countries influence each other's rates of adoption as a result of cohesive and equivalent network relationships. Regression results provide support for our predictions that states and foreign multinationals are the key actors responsible for coercive isomorphism, cohesive trade relationships between countries generate coercive and normative effects, and role-equivalent trade relationships result in learning-based and competitive imitation.●

Organizational practices tend to diffuse unevenly throughout the world. Using comparative case studies of a small number of countries, researchers have found that national institutions shape processes of diffusion above and beyond the technical characteristics or efficiency of the practice (Cole, 1985, 1989; Gooderham, Nordhaug, and Ringdal, 1999; Guillén, 1994a; Orrù, Biggart, and Hamilton, 1991). These differences in the rates of international diffusion of organizational practices have not been conceptually and empirically examined for a sufficiently large number of countries in order to understand the drivers of diffusion on a truly global scale.

The question of how practices travel from one organization or social setting to another has already been of interest to a variety of fields in the social sciences, the life sciences, and engineering (see Rogers, 1995 for a review) and, with the intensification of globalization has become even more urgent to answer (Guillén, 2001; Meyer, Boli, and Ramirez, 1997). Some researchers have focused on the technical merits of the practice or innovation in accounting for diffusion (e.g., Mansfield, 1961; Williamson, 1970; Davies, 1979), while others have examined the existence of institutional effects on the diffusion of practices in single industries, fields, sectors, or countries, usually the United States (e.g., Baron, Dobbin, and Jennings, 1986; Galaskiewicz and Wasserman, 1989; Davis, 1991; Galaskiewicz and Burt, 1991; Haunschild, 1993; Haveman, 1993; Davis and Greve, 1997). This line of research has established that practices spread from one organization to another following a process of institutionalization driven by resource dependence, social comparison, or network ties linking potential adopters, but most work has not focused on diffusion to different organizations across countries.

Previous research has paid attention to the effects of national institutions and forces on the process of diffusion of certain organizational practices within countries (e.g., Kieser, 1989; Barley and Kunda, 1992; Lazerson, 1995; Abrahamson and Fairchild, 1999). But neoinstitutional theorists have explicitly argued that isomorphism occurs at the country level of analysis as well as at the level of the organizational field or the

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industry (Jepperson and Meyer, 1991; Orrù, Biggart, and Hamilton, 1991; Rosenzweig and Singh, 1991; Kostova, 1999). A few researchers have more specifically considered the institutional factors that shape the cross-national diffusion of practices, focusing on state structures, professionalization, and culture as explanations (e.g., Guillén, 1994a, 1997; Meyer et al., 1997; Westney, 1987).

Most empirical research on cross-national diffusion falls under two rather restrictive categories. The first comprises comparative studies based on a limited number of countries, including Cole's (1985, 1989) analysis of the diffusion of small-group activities in Japan, Sweden, and the United States; Gooderham, Nordhaug, and Ringdal's (1999) comparison of the adoption of human resource management practices by firms in six European countries; and Casper and Hancke's (1999) study of the implementation of quality management practices by automobile firms in France and Germany. The second category of empirical research on cross-national diffusion includes studies based on evidence drawn from a large number of countries, but dealing with practices adopted by governments or nation-states as opposed to by organizations or firms. For instance, cross-national processes of institutional isomorphism have been empirically documented in the cases of the spread of oil nationalizations (Kobrin, 1985), decolonization (Strang, 1990), currency crises (Glick and Rose, 1999), and policies to protect the environment (Frank, Hironaka, and Schofer, 2000). The empirical literature does not contain analyses of diffusion of an organizational practice among firms located in a large number of countries, even though such diffusion is likely to be a powerful force in a globalized economy. Moreover, the literature on cross-national diffusion has made very limited progress in terms of specifying the institutional mechanisms that facilitate or impede acceptance of a given organizational practice internationally. In this paper, we fill this gap as we identify, conceptualize, measure, and test the effects of the institutional forces that produce isomorphic behavior among firms located in different countries. We provide the first empirical test of the cross-national diffusion of an organizational practice (ISO 9000 quality certification) based on 85 countries over a six-year period.

THE DIFFUSION OF ISO 9000 QUALITY CERTIFICATION

Quality certification has emerged as a key organizational practice helping companies worldwide establish rationalized production processes. As such, it provides an appropriate empirical setting for the study of the cross-national diffusion of organizational practices. The most influential and pervasive quality practice in the world is associated with the 9000 family of certificates sponsored by the International Organization for Standardization (ISO), based in Geneva, Switzerland. ISO's goal is to "promote the development of standardization and related activities in the world with a view to facilitating international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity" (ISO, 2001a). To understand the diffusion of ISO standards, some background information is necessary.

Spread of ISO 9000

The ISO 9000 standards were developed by Technical Committee ISO/TC 176, which comprises experts from business and other organizations around the world (ISO, 1998). The first ISO 9000 certificates, attesting that firms were adhering to standards, were issued in 1987 (ISO, 2001b). By the end of 1999, more than 400,000 ISO certificates had been issued to firms in 158 different countries and territories, up from 27,000 certificates in 48 countries in 1993. Having originated in Europe, the ISO standards first diffused among firms in the member countries of the European Union (EU), with the United Kingdom in particular playing an important role in this development and diffusion. The ISO 9000 standards were initially based on the BS5750 series of quality assurance system standards developed by the British Standards Institution (BSI) in 1979 (Peach, 1997). When the first ISO 9000 certificates were issued in 1987, there were already about 6,000 BS5750 certificates in Britain (Abdul-Aziz, Chan, and Metcalfe, 2000). With the support of the British government, BSI played an active role in increasing ISO 9000 certification in many countries around the world, an increase that was further reinforced when the EU recognized ISO 9000 certificates as part of its harmonization effort (Peach, 1997; Anderson, Daly, and Johnson, 1999). In recent years, certification has gradually diffused to other countries in the world. While European certificates comprised 83 percent of all certificates in the world in 1995, the proportion had come down to 54 percent by 2000 (ISO, 2001b). Moreover, while the early certificates were mostly issued to manufacturing firms, the standards have diffused in many other areas, including service sectors, such as information technology, education, and health and social work (ISO, 2001b).

ISO 9000 norms were developed as a set of international standards and guidelines that serve as the basis for establishing quality management systems at manufacturing and service firms (ISO, 1998). Certification is voluntary and is undertaken by various certification bodies called "registrars." Registrars include government laboratories, private testing organizations, firms that were early adopters of ISO, industry trade groups, and accounting firms (Anderson, Daly, and Johnson, 1999). Registrars, in turn, are qualified to conduct audits and award certificates by national accrediting agencies, which typically are the national standards body in each country.

ISO 9000 certificates are not awarded to products or services, but to quality processes within the organization. As such, certification does not concern the quality of the final products or services. Certification requires detailed review and documentation of the organization's production processes, in accordance with the quality system requirements specified by ISO. The requirements span areas such as contract review, design control, document and data control, purchasing, production, installation, servicing, and inspection. The organization prepares the documentation on its quality policy statement and on the purpose, scope, content, and procedure for each activity in a quality manual (Docking and Dowen, 1999). An accredited third-party registrar then audits the documentation and implementation. Organizations that

demonstrate conformity to the standards receive a certificate and can publicize in promotions or advertisements that their systems and organizational processes are "ISO 9000-certified." The certificate is typically awarded for a period of three years. Regular audits are conducted after awarding a certificate to make sure that the firm is in compliance with the standards. Hence, organizations must engage in a continuous effort to remain certified.

Registration, the process of certification, can take anywhere from nine months to over two years. The costs of this process, apart from development and implementation of the management system, include application and document review, the registrar's visits and assessments, issuing the registration and writing the report, and any follow-up visits (Peach, 1997). The average cost of certification to the firm is about $187,000 (1996 figures), ranging between $50,000 and several million dollars, depending on the size and complexity of the production process (Anderson, Daly, and Johnson, 1999; Docking and Dowen, 1999).

The technical literature reports mixed results as to the technical benefits of compliance with the standards. On the one hand, ISO certification reportedly helps companies improve their information gathering and analysis, human resource development, supplier and customer relations, and overall quality levels (Rao, Ragu-Nathan, and Solis, 1997). On the other, the effectiveness of compliance has been questioned by other studies showing that certification does not result in buyers perceiving that products are of higher quality (Guerin and Rice, 1996), improved customer satisfaction (Terziovski, Samson, and Dow, 1995), or better operational performance and foreign sales (Simmons and White, 1999).

The costly process of registration and the mixed evidence concerning the benefits of certification suggest that the widespread diffusion of ISO 9000 certification might be affected by institutional factors beyond technical or efficiency concerns, as has been reported in several previous studies of the diffusion of quality practices. At the organizational level, Zbaracki (1998) described the process through which total quality management (TQM) practices became institutionalized (see also Hackman and Wageman, 1995). At the national level, Abrahamson and Fairchild (1999) studied how Japanese quality control practices affected managerial discourse in the United States. The only large-sample study at the firm level—using a sample of 514 ISO adopters and 1,965 non-adopters in the U.S. and Canada—concluded that industry and product regulation, customer requirements, and previous adoption of TQM was associated with ISO certification (Anderson, Daly, and Johnson, 1999). The importance of institutions in the adoption of ISO 9000 certification has been reported in a study of German organizations by Walgenbach and Beck (2000) and in a comparative study of the German and French automobile industries by Casper and Hancke (1999). But these studies have not examined the impact of institutional factors on the worldwide diffusion of quality certification.

Institutional Factors in Diffusion

The diffusion of innovations has received attention from scholars in sociology, economics, marketing, communication studies, and organizational theory (Rogers, 1995). Models of aggregate processes of diffusion over time have generated two widely accepted insights (Mahajan and Peterson, 1985; Mahajan, Muller, and Bass, 1990). First, the cumulative adoption of an innovation over time follows an S-shaped or sigmoid curve (Bass, 1969). The S curve reflects the fact that relatively few members of a social system adopt an innovation during the early stages. Over time, the rate of adoption of the innovation increases, until the process gets closer to saturation, when the rate again slows down. Second, the process of adoption is affected by influences both external and internal to the system. The mixed-influence model posits that actors external to the social system are important in the introduction of the innovation to the system, whereas the internal influence of members upon each other triggers increasing diffusion (Mahajan and Peterson, 1985; Abrahamson and Rosenkopf, 1997).

Institutional theorists ask why the S-shaped pattern occurs and why some members of the social system adopt earlier than others. Scholars have attempted to uncover those mechanisms that trigger internal and external influences driving adoption decisions over and above the technical efficiency of the innovation. In particular, according to the new institutionalism in organizational analysis, the adoption and implementation of organizational ideas and practices takes place in a taken-for-granted (i.e., institutionalized) social and cultural context, which is different from the technical environment (Meyer and Rowan, 1977; Meyer and Scott, 1983; Scott, 1983; Zucker, 1987; Powell, 1988). While the technical context rewards organizations for effective and efficient control of the work process, the institutional context creates imperatives for conformity in order to gain legitimacy (Meyer and Rowan, 1977; Meyer and Scott, 1983). It is important to note that a single organization is often subject to pressures from both technical and institutional environments to become increasingly similar to other organizations perceived as being its peers, possessing certain desirable features, or being successful (Haunschild and Miner, 1997; Scott, 1987; Suchman, 1995; Zucker, 1987).

There are several mechanisms through which organizations become more similar. A widely accepted idea is that organizations become more like each other as a result of coercive, normative, and mimetic pressures (DiMaggio and Powell, 1983). These three mechanisms of isomorphism operate through the agency of influential (generally large and/or successful) organizations or the knowledge-bearing professions and because of contact diffusion through networks of ties linking adopters to non-adopters (Miner and Haunschild, 1995; Abrahamson and Rosenkopf, 1997). Institutional researchers agree that the study of diffusion, whether within or across countries, requires identifying and measuring those agents and channels of diffusion that account for the increasing isomorphism observed in the world of organizations, one of which is resource dependence.

Resource-dependence as a source of coercive isomorphism. Coercive isomorphism refers to the homogeneity pressures stemming from political influence. Pressures originating from the state and other powerful organizations are the most direct mechanism of institutional diffusion based on coercion (DiMaggio and Powell, 1983). As predicted by resource-dependence and power theories (Perrow, 1986; Palmer, Jennings, and Zhou, 1993), dependent organizations are likely to adopt patterns of behavior sanctioned by the organizations that control critical resources.

As nation-states gain dominance, pressures of conformity to rules institutionalized and legitimated by the state also increase (Meyer and Rowan, 1977; Jepperson and Meyer, 1991). Research has documented that states are key in the diffusion of new practices borrowed from other countries (Westney, 1987; Guillén, 1994a, 1994b; Arias and Guillén, 1998). For instance, Cole (1985, 1989) described how the Japanese state played a prominent role in the diffusion of the quality movement. States may provide incentives (or implement sanctions) for organizational transformation. In addition, as consumers of goods and services, states may exert coercive pressures by asking suppliers and contractors to conform to certain procedures and standards. The state's role in imposing the adoption of certain organizational practices has been reported in a variety of settings, ranging from civil administration reform (Tolbert and Zucker, 1983) to labor and human resource management practices (Baron, Dobbin, and Jennings, 1986; Baron, Jennings, and Dobbin, 1988).

In the case of ISO 9000, the initial thrust for the development of ISO standards and certification came from the energy, defense, and telecommunications equipment industries, in which the state is either a customer or a producer, or both (Conti, 1999). As discussed earlier, the European Union (EU) played an important role in the acceptance of ISO 9000 standards. On the road to the 1992 single-market project, the EU (then known as the EC) adopted ISO 9000 as part of its conformity assessment plan to establish uniform systems for product and quality systems certification (Peach, 1997: 19). As a result of EU directives requiring quality system registration, ISO 9000 has become an imperative for many businesses in Europe, as well as those hoping to work with European firms.

In time, many government agencies in countries around the world have come to require their contractors to be ISO-9000-certified (Balasoglou, 1994; Orsini, 1995; Rao, Ragu-Nathan, and Solis, 1997; Dissanayaka et al., 2001). Over a hundred countries have adopted ISO as a national quality assurance standard. In the United States, the Departments of Defense and Energy, the Food and Drug Administration, the Federal Aviation Administration, and the NASA decided to accept ISO certification for its suppliers during the mid 1990s (Hockman, 1992; *Machine Design*, 1994; Anderson, Daly, and Johnson, 1999).

Multinational enterprises are a second influential type of organization that may cause coercive isomorphism. Enterprises with operations in more than one country are widely rec-

ognized as key agents in the diffusion of practices across national borders because they transfer organizational techniques to subsidiaries and to other organizations in the foreign host countries in which they operate (Vernon, 1979; Kim, 1991; Kobrin, 1991; Westney, 1993; Arias and Guillén, 1998). Manufacturing and retailing multinationals are increasingly relying on global networks of suppliers (Gereffi, 1993). Like the state, multinationals operate following certain procedures and standards that suppliers must meet.

There is considerable evidence that multinationals prefer ISO-9000-certified suppliers when they locate production plants in a foreign country. In Singapore, local suppliers have had to "respond to requests for third-party certification from large locally-based multinational companies" (Huat, 1992: 1). Multinationals such as DuPont and De Beers are reported to prefer supplies from ISO-9000-certified firms (Cullingworth, 1992; Hockman, 1992). More than half of large firms surveyed in 1991 in the Netherlands, Germany, Greece, Spain, and Switzerland required ISO-9000-certified supplies (*ISO 9000 News*, 1992). More recently, some European and American multinationals have proposed asking their suppliers themselves to report their compliance with ISO 9000, rather than requiring certification (Zuckerman, 1998, 1999). Multinationals such as Hewlett-Packard, Motorola, Xerox, and the Big Three automakers use ISO-based criteria to certify their own suppliers and have aligned their internal quality systems with ISO guidelines (Avery, 1995; *Quality*, 1994, 1995; *Purchasing*, 1996). Even if multinationals circumvent the formal ISO certification process, however, suppliers will likely have an incentive to seek ISO certification through a national quality association in order to sell to other multinationals.

As large organizations that are engaged in transactions with hundreds, even thousands of suppliers, states and multinationals contribute to the rationalization and normalization of production processes throughout the economy. States and multinational firms will be more influential in diffusing practices or standards to the extent that they have a strong presence in the economy as purchasers of goods or services. We expect that firms in countries more exposed to the activity of the state and of the multinationals should be more likely to pursue and obtain quality certification:

Hypothesis 1 (H1): The greater the presence of coercive organizations such as the state or foreign multinationals in the economy, the greater the number of ISO 9000 certificates.

Knowledge and professionalization as sources of normative isomorphism. The second fundamental institutional mechanism of diffusion has to do with normative effects that compel organizations to adopt an innovation (DiMaggio and Powell, 1983; Guillén, 1998), including the formal training of the organization's employees or of its technical personnel and managers, can increase the likelihood that practices consistent with that training are adopted. Formal training and professionalization create an institutional environment through shared social rules (Meyer and Rowan, 1977). Members of a profession or occupational community share a common understanding and knowledge base. At the organizational

level, research has supported the existence of normative pressures to adopt similar practices resulting from professionalization and knowledge (e.g., Galaskiewicz, 1985; Galaskiewicz and Wasserman, 1989; Burns and Wholey, 1993). At the international level, we expect a similar effect, especially because professional training and knowledge are often standardized globally rather than nationally, creating a channel for diffusion across countries (Meyer et al., 1997; Arias and Guillén, 1998). Still, countries differ in the extent to which professionalization and technical knowledge have developed, with distinctive consequences for organizational isomorphism (Guillén, 1994a, 1994b).

The adoption of ISO certification, like other quality and organizational practices, depends on the availability of knowledge about production management and of professional personnel with a technical background. The early diffusion of ISO 9000 in manufacturing occurred through the work of engineers and production managers. Moreover, individuals with scientific or engineering backgrounds tend to find it easier to access the technical aspects of quality standards, such as the use of statistical control tools (Zbaracki, 1998). Cole (1985, 1989) reported a connection between the existence of technical knowledge in the areas of quality and production management and the strength of the quality assurance movement in Sweden, Japan, and the United States. We therefore predict:

Hypothesis 2 (H2): The greater the country's knowledge base in the areas of quality and production management, the greater the number of ISO 9000 certificates.

Cohesion in networks as a source of isomorphism. Another normative effect has to do with isomorphism due to cohesive relationships. Organizations observe each other to understand what practices are effective and acceptable in their social system. Therefore, normative institutional isomorphism follows a logic of appropriateness. As the number of organizations adopting an innovation increases, the innovation becomes institutionalized. In addition, institutional mimicry is more likely to arise under conditions of uncertainty, i.e., when the innovation is poorly understood, and the efficiency benefits of adoption are not clear (DiMaggio and Powell, 1983). It is reasonable to expect norm-based institutional pressures to prevail at the international level as well. Institutional theorists have argued that mimetic processes lead to the acceptance of similar practices around the world and that administrative form and the economic organization of countries are subject to isomorphic processes (DiMaggio and Powell, 1983; Jepperson and Meyer, 1991).

An important issue in the analysis of institutional mimicry is identifying whom the focal actor is likely to observe and imitate, by specifying the boundaries of the relevant social system. Institutional theory posits that the diffusion of norms tends to involve actors that are perceived to be peers. Hence, many empirical studies of institutional isomorphism have drawn the boundaries of the social system by reference to similarity in terms of organizational characteristics such as size or age (e.g., Schoonhoven, Eisenhardt, and Lyman, 1990; Haveman, 1993), membership in the same industry (Fligstein,

1985), or geographic region (Burns and Wholey, 1993). The implicit or explicit assumption in these studies is that members sharing similar traits or located similarly become aware of each other's activities and use this information to compare their practices with others. Several institutional theorists (e.g., DiMaggio and Powell, 1983, Zucker, 1987), as well as network theorists (Burt, 1987; Marsden and Friedkin, 1993), have pointed out that network ties may determine whom actors observe and imitate and, hence, act as channels of normative isomorphism between actors.

Many diffusion studies have examined cohesion between actors as a normative source of imitative behavior. The basic social cohesion argument revolves around the notion that actors tied to each other share a culture or set of norms that invites them to behave similarly; cohesive actors influence each other and hence tend to adopt similar patterns of behavior (Durkheim, 1951, 1984; Coleman, 1988). Empirical studies have shown that diffusion occurs through direct ties between actors. For instance, interlocking directorates linking firms have been reported to contribute to the spread of corporate acquisitions (Haunschild, 1993), poison pills (Davis, 1991), golden parachutes (Davis and Greve, 1997), and technological innovations (Ahuja, 2000). Westphal, Gulati, and Shortell (1997) suggested that the adoption of TQM by U.S. hospitals was influenced by institutional mimicry resulting from direct ties, especially at the later stages of adoption. Galaskiewicz and Wasserman (1989) suggested that normative pressures for similarity occur between organizations tied through boundary spanning personnel. Palmer, Jennings, and Zhou (1993) argued that normative effects transmitted by personal contacts of chief executive officers and interlocking directorates increased the likelihood of adoption of the multidivisional form by large U.S. corporations. A study of the diffusion of matrix management programs in hospitals by Burns and Wholey (1993) also reported evidence for normative institutional pressures.

It is important to note that cohesion can generate isomorphism for coercive and mimetic as well as normative reasons. In a seller-buyer relationship in which the latter has more bargaining power than the former, similarity in behavior is likely to be due to a coercive effect (DiMaggio and Powell, 1983). Cohesive ties provide a channel for the transfer of information and tend to generate imitative behavior (Coleman, Katz, and Menzel, 1957; Gulati and Gargiulo, 1999). Whether coercive, normative, or mimetic, the effect of isomorphism is that cohesive actors or organizations tend to adopt similar patterns of behavior.

The logic of cohesion can be readily extended to the phenomenon of cross-national diffusion. Intense trade relationships between pairs of countries produce cohesion, and firms in trade-cohesive countries are likely to have similar numbers of certificates because of the influence of similar customer requirements (a coercive effect; see Corbett, 2002), the impact of shared patterns of behavior (a normative effect), and the attempts to cope with uncertainty through information and experience sharing, which results in imitation (a mimetic effect). Export and import ties between two coun-

tries exist as a result of micro-level interactions between firms and managers, which may result in the transfer of knowledge and experiences about organizational practices. Firms in country A should be influenced by the level of ISO adoption of firms in country B to the extent that A and B have strong, cohesive trade ties between them. Previous research confirms this idea in finding that U.S. and Canadian firms exporting to regions with a high number of certificates (e.g., Europe) tend to have more ISO certificates than other U.S. or Canadian firms (Anderson, Daly, and Johnson, 1999). Therefore, we hypothesize:

Hypothesis 3 (H3): The greater the number of ISO 9000 certificates awarded to firms in countries with which the focal country is strongly related in terms of trade (i.e., cohesion), the greater the number of certificates in the focal country.

Equivalence in networks as a source of learning and competitive mimicry. Imitation among members of a social system can also occur for competitive reasons (DiMaggio and Powell, 1983; Abrahamson and Rosenkopf, 1993; Haunschild and Miner, 1997). Competitive imitation pressures exist when firms learn from each other how to become better at what they do or when they mimic each other so as to minimize the competitive risk of losing a market or a source of supply. Firms may adopt the same practices because not doing so would disadvantage them relative to the competition and erode their edge in the marketplace. As the number of adopters increases, the pressure on non-adopters also rises, increasing rates of diffusion.

The social network literature first conceptualized competitive imitation in terms of structural equivalence. In this view, two actors related to the same set of third parties are likely to exhibit similarity in behavior, regardless whether there are direct ties between them. The literature on contagion provides some evidence for the effect of structural equivalence as a diffusion mechanism. For instance, Burt (1987) and Galaskiewicz and Burt (1991) found that structural equivalence between actors is a better predictor of the diffusion of certain practices or innovations than cohesion.

The concept of structural equivalence, however, is open to two alternative interpretations (Mizruchi, 1992, 1993). On the one hand, structural equivalence may highlight competition between actors for the same resources and trigger imitation between actors who could substitute for each other in the social system (Burt, 1987). By analogy, countries occupying an equivalent structural position in the network of international trade, by virtue of trading with the same set of third countries, compete with each other for the same export markets or import sources and thus would be expected to exhibit a similar pattern of behavior. On the other hand, similar behavior by structurally equivalent actors may be attributed to the homogenizing effect of influences coming from a shared set of third-party ties, an interpretation first outlined by Simmel (1950: 145–169) in his analysis of dyadic and triadic relationships. This second view of structural equivalence highlights the fact that if two actors are connected to the same set of third parties, then they share a "common influence," with

cohesion between them "viewed as an outcome of common relations with other members of the system" (Mizruchi, 1992: 45). Thus, shared third-party ties create a situation of "ecological influence": actors may behave similarly because they are influenced by the same set of third actors, i.e., they are indirectly cohesive. Common influence may include similar economic circumstances, or normative implications, that cause parties to adopt similar behavioral patterns (Mizruchi, 1993; Marsden and Friedkin, 1993; Shah, 1998). In the international trade network, countries that export to a similar set of countries may be subject to a similar influence in terms of ISO 9000 certification. For instance, if ISO 9000 certification is widespread in country A, the firms in other countries that transact with country A but not among themselves are likely to feel a similar pressure toward certification.

Because the concept of structural equivalence has alternative interpretations, we prefer to use the concept of role equivalence to capture the competitive aspects of mimicry. Two actors are said to be role equivalent to the extent that they have similar kinds of relationships with third parties (Winship and Mandel, 1983; Winship, 1988; Burt, 1990; Mizruchi, 1993), whether relationships are based on advice, information, a desired input, money, socializing, or other factors. Actors that play similar roles in a social structure are likely to behave alike even if they are not cohesive (not linked to each other) or structurally equivalent (they do not relate to the same set of third parties). Such role-equivalent actors would exhibit similarity in behavior for competitive reasons because they are substitutes for each other in the social structure.

Our approach to role equivalence is a modification of Winship and Mandel's (1983). Like them, we rely on the concept of the social role as defined by role relations and role sets (Merton, 1968). A relation is a specific way in which two actors can interact, for instance, friendship or advice relations. A role set is the collection of all the different types of relations in which an actor engages. Since our unit of analysis is the country, we focus our theoretical argument on relations between countries. We define a relation as the export or import of a particular type of product and a role set as a country's total exports and imports by reference to each type of good, an approach pioneered by sociologists working in the world-system research tradition (Smith and White, 1992; Van Rossem, 1996; see also Koka, Prescott, and Madhavan, 1999). Winship and Mandel further defined role equivalence using a nested pair of dyad-by-dyad distance measures but noted that other approaches are possible. We take advantage of one alternative they mention and define role equivalence as the overlap between two actors' role sets. Given this definition, when countries A and B trade in the same products but with a different set of countries, they are role equivalent but may not be structurally equivalent. Conversely, countries may be structurally equivalent but not role equivalent if they trade in different types of products but with the same set of countries.

Firms in countries A and B should be more likely to adopt similar patterns of behavior, including ISO 9000 certification, to the extent that A and B export or import the same types

of products. This argument is consistent with the emphasis in neoinstitutional research on isomorphic processes within industries (Fligstein, 1985; Haveman, 1993; Scott, 1995: 56). Role-equivalent countries operate in the same product markets but not necessarily in the same geographical markets. Even when firms in country A and country B operate in different geographical markets, an increasing number of certifications in country A will likely prompt firms in country B to pursue certification, for two mutually reinforcing reasons. First, firms in country B may learn from firms in country A how to make their products more attractive to their own customers. In fact, the literature on the multinational corporation has long emphasized that firms learn from others in their industry as they expand throughout the world (Vernon, 1979; Johanson and Vahlne, 1977), and recent empirical analyses have corroborated this idea (Henisz and Delios, 2001; Guillén, 2002). This learning argument also applies to imports, because firms or countries that need to secure from abroad the same product (i.e., they are role-equivalent in terms of imports) may learn from each other what is the best source or the best procedure to secure the needed input.

The second reason for imitation based on role equivalence is the risk of a country's losing export markets or import sources to firms based in a competing country if its own firms do not keep up with the competing country's level of ISO 9000 certification. This argument is analogous to the idea that actors occupying equivalent positions in a social structure (peers) tend to imitate each other so as to enhance their own performance. As Burt (1997: 345) noted, structural situations in which an actor has "many peers create a competitive frame of reference." Competition invites the actor to be "tuned to peers' job performance." Therefore, we expect firms in role-equivalent countries to behave similarly because they learn from their industry peers how to become more effective at exporting or importing and because they wish to anticipate potential sources of competition in export or import markets.

Hypothesis 4 (H4): The greater the number of ISO 9000 certificates awarded to firms in countries with which the focal country shares a common pattern of trade by product category (role equivalence), the greater the number of certificates in the focal country.

It is important to reiterate that the three institutional mechanisms of coercive, normative, and mimetic isomorphism may operate simultaneously through the agency of the state, the multinationals, the knowledge-bearing professions, and/or because of contact diffusion through networks of ties linking adopters to potential adopters. For instance, we have elaborated above how cohesive trade ties might generate coercive, normative, and mimetic effects. Thus, while the three isomorphic effects can be distinguished conceptually, in empirical reality they may prove difficult to disentangle.

DATA AND METHODS

Dependent Variable

We have compiled a cross-national and longitudinal data set of the number of ISO 9000 quality certificates between the

years 1992 and 1998 using an annual survey initiated by Mobil Corp. and then continued by ISO (ISO, 2001b). Unfortunately, the survey did not collect detailed information for earlier years. One of the authors visited the ISO in Geneva to search for the annual breakdown of certificates in each country prior to 1992, but these data did not exist. Given that the process of certification is highly decentralized, and many quality associations and commercial organizations are accredited to extend certificates, obtaining cross-national data on certification from any other source, especially for the early years, is extremely difficult. The reference month for the number of certificates was December of each year, except for 1992 (January 1993), 1993 (September), and for 1994 (June), due to irregularities in the original survey (ISO, 2001b). Table 1 provides a sample of the data for 34 countries, to illustrate the diversity in ISO certification across countries in 1993 and 1998.

Explanatory Variables

We obtained measures for the independent variables from other secondary data sources. To rule out the possibility of reverse causation, we measured all independent variables with a one-year lag, which effectively reduces our sample to

Table 1

Number of ISO 9000 Certificates, Selected Countries, 1993 and 1998

Country	Sept. 1993	Dec. 1998
Algeria	0	2
Argentina	9	807
Australia	2695	14170
Brazil	113	3712
Cameroon	0	5
Canada	530	7585
China	35	8245
Czech Republic	18	1443
Equatorial Guinea	0	0
France	1586	14194
Germany	1534	24055
Greece	46	764
India	73	3344
Israel	170	3700
Italy	864	18095
Japan	434	8613
Kenya	0	416
Netherlands	1502	10570
New Zealand	489	2581
Nigeria	0	20
Peru	0	46
Saudi Arabia	10	280
Singapore	523	3000
South Africa	1007	2166
Spain	320	6412
Sweden	365	3489
Switzerland	569	6426
Thailand	9	1236
Tunisia	1	70
Turkey	65	1607
United Kingdom	28096	58963
United States	2059	24987
Venezuela	9	163
Vietnam	0	29
World total	46571	271847

the years 1993–1998. As independent variables had highly skewed distributions, they were entered into the analyses in logarithmic form.

We included in the analysis two measures of resource dependence on powerful organizations. The role of the state in the economy was measured by general government consumption. One can argue that this variable includes many other expenses other than those incurred by the government as a buyer and hence is an imperfect measure. In particular, government expenditures in education, health, or welfare may not seem directly related to its coercive power as a buyer or contractor. While we acknowledge this limitation, we believe that a larger government presence in these areas still implies a larger base of transactions with commercial entities in the economy. Moreover, ISO 9000 standards have been applied in sectors such as healthcare and education as well as manufacturing (ISO, 2001a, 2001b). Nevertheless, we calculated this measure in two alternative ways: first, by excluding public education spending and then by further excluding public health care spending. For the set of countries for which these data are available, the two measures are very highly correlated with the original measure (.96 and .78, respectively). Given the high correlations and the missing data problems with the latter measures, we report results with the original measure, general government consumption, obtained from the CD-ROM of the World Bank's 1999 *World Development Indicators*. We measured the coercive effect of the presence of foreign multinationals by the value of inward foreign direct investment (FDI) stock, obtained from the United Nations' *World Investment Report* for 1994–1999. Both government consumption and inward FDI were normalized by gross domestic product (GDP), to control for the size of each country's economy.

We originally measured the country's technical knowledge base by the number of scientists, engineers, and technicians in each country, obtained from UNESCO's 1995 *Statistical Yearbook*, but this information was only available for a small sample of countries and for a limited number of years. Therefore, we employed a second measure of the shared knowledge base on quality practices. We counted the number of articles on "operations," "engineering," "manufacturing," and "quality" authored by residents of each country during each year using the *Science Citation Index* (*SCI*). Coauthored papers by residents in different countries were attributed to each of the countries. The number of articles published in academic, technical, and trade journals is an indicator of knowledge exchange and exposure among members of a community to a certain practice or idea. In a parallel application, Burns and Wholey (1993) measured the information transmission effects of network embeddedness on the adoption of matrix management by counting the number of reports of matrix management in health administration research and trade journals. Walgenbach and Beck (2000) and Cole (1985, 1989) tracked the institutionalization of the quality management movement in various countries through publications on quality management. The early awareness about total quality management was found to reach firms through

magazine articles and media reports (Zbaracki, 1998). The correlation between the article count and the number of scientists, engineers, and technicians for the observations for which both variables were available was .58 ($p < .001$). To control for the size of the country, we normalized the article count by population.

So as to approximate the effects of cohesive trade relationships, we developed a measure that captures how strongly a country is tied to other countries and the extent to which ISO 9000 certificates have already diffused in those other countries. In a network model of trade, the impact of direct ties on diffusion for a given country i can be captured by the strength of the trade ties between country i and all other countries (country i's trade with each country j as a proportion of country i's total trade), multiplied by the extent of diffusion of certificates in each country j. The cohesion effect is highest when a country has strong trade ties with other countries that have a large number of certificates as of the previous year. Given that those countries with which the focal country has strong ties may have a substantially higher impact than those with which the country has weak ties, we squared the strength of ties for each country before multiplying it by the number of certificates to account for the idea that stronger ties may have a larger impact than weaker ties.[1] Formally, our measure of cohesion in trade for country i at time t is,

$$\text{Cohesion in Trade Effect}_{it} = \Sigma_j \, \text{ISO}_{jt-1} \times (\text{Trade}_{ijt-1}/\text{Trade}_{it-1})^2$$

where ISO_{jt-1} is the number of certificates for country j at time t-1, Trade_{ijt-1} is the total trade between country i and country j during year t-1, and Trade_{it-1} is country i's total trade during the same period. This measure is non-negative but has no upper bound, as the number of certificates in other countries can grow indefinitely. A simple numerical illustration helps to make this point. If all of country A's trade is with just one other country, B, then its cohesion measure for a given year equals the number of certificates in country B as of the year before, which can range between zero and a very large number. If country A evenly divides its trade among one hundred other countries in the world, then the cohesion measure would equal the sum of the number of certificates of the other 100 countries multiplied by .0001 (the square of 1/100).

To capture the effect of role equivalence in trade, we calculated how much a country's pattern of exports and imports by product category overlaps with those of other countries, weighted by the extent to which ISO 9000 certifications have already diffused in each of the other countries. For each country i and year t, we constructed export and import industry share vectors. These indicate the share of industry k in country i's total exports (imports) during year t, for each of the 34 industry categories.[2] Formally, the export and import industry share vectors (EISV and IISV, respectively) are defined as follows:

1
We also calculated the measure without squaring the strength of trade ties. The correlation between the two measures was .69 ($p < .001$), and the regression results with one or the other measure were similar.

2
We used the U.S. Bureau of Economic Analysis industry classifications to categorize trade flows by industry, as provided in Feenstra (2000).

$$EISV_{it} = Exports_{ikt-1}/\Sigma_k\ Exports_{ikt-1}$$

$$IISV_{it} = Imports_{ikt-1}/\Sigma_k\ Imports_{ikt-1}$$

where $Exports_{ikt-1}$ is the dollar value of exports from country i in industry k and year t-1, and $Imports_{ikt-1}$ is the dollar value of imports to country i in industry k and year t-1. Following Wasserman and Faust (1994), we stacked the export and import industry share vectors to form a single vector ISV_{it-1} for each country i during year t-1. The correlation coefficient between the trade-by-industry vectors for two countries indicates the extent to which the two countries compete in the same industries, regardless of whom they trade with, i.e., the degree to which they are role equivalent.[3] As with cohesion, we also multiplied role equivalence between countries i and j by the number of certificates in j as of the previous year. Thus,

$$\text{Role Equivalence in Trade Effect}_{it} = \Sigma_j\ ISO_{j,t-1} \times r\,(ISV_{it-1}, ISV_{jt-1})$$

where $ISO_{j,t-1}$ is the number of certificates held by country j in year t-1 and *r* is the Pearson correlation coefficient between the industry share vectors for countries i and j during year t-1. This measure is not bounded, and it can be negative or positive depending on whether country i's trade-by-industry vector is, on balance, mostly negatively correlated with those of other countries or mostly positively correlated.[4] Our approach deviates from Winship and Mandel's (1983) in that we did not consider indirect relations and in that the role set is a sum of relations rather than merely a list of those present. The first change was made to eliminate the "common influence" problem and the second to accommodate the longitudinal process of diffusion. We obtained the annual trade matrices used to calculate our measures of cohesion and role equivalence from Feenstra (2000).

Control Variables

We also included in all analyses several control variables: the size of the labor force as a measure of country size; GDP per capita as a measure of the level of economic development; membership in the EU to control for this institution's role in promoting ISO 9000 certification; outward foreign direct investment over GDP, to account for the extent to which each country's firms are internationally oriented; and a time trend. All of the above explanatory and control variables are time varying in nature and were obtained from the World Bank's 1999 *World Development Indicators* or the United Nations' *World Investment Report* for 1994–1999. Regressions also included the initial count of certificates as of the end of 1992 and country fixed effects to remove other sources of time-invariant unobserved heterogeneity, including cross-national differences in patterns of ISO adoption prior to the beginning of our observation period, technical requirements, state administrative structures, or structural positions in the world-system of nation-states, which can be safely

3
Correlation is generally more appropriate than Euclidian distance for measuring equivalence with continuous data because it automatically normalizes for mean and variance (Wasserman and Faust, 1994).

4
Only two countries, Equatorial Guinea (dropped because of missing data) and Kenya, actually had negative role equivalence scores. It is also possible, though extremely unlikely, for a country to have a measure of role equivalence exactly equal to zero.

assumed to be fairly stable over a six-year period (Smith and White, 1992).

Analysis

Our dependent variable, the number of ISO 9000 certificates, has certain important characteristics: (1) it is non-negative; (2) it is integer-valued, denoting counts of certificates in each country every year; (3) it exhibits overdispersion, as observations range from zero to thousands; and (4) it is longitudinal. When the outcome variable is non-negative and integer-valued, certain assumptions of the ordinary least squares (OLS) regression are violated, such as uncorrelated error terms and homoskedasticity (Berry, 1993). Therefore, the use of Poisson models of regression is more appropriate than OLS. When the data are overdispersed, the standard distribution used is the negative binomial, i.e., the Poisson assumption of equal mean and variance is relaxed (Hausman, Hall, and Griliches, 1984; Cameron and Trivedi, 1998).

We used fixed-effects negative binomial analysis and maximum likelihood estimation on our data of countries pooled over the 1993–1998 period. Thus, our model measures the impact of a change in the independent variable on the rate of diffusion of ISO 9000 certificates from one year to the next. The final sample includes an unbalanced panel of 468 country-year observations (85 countries, 6 years), after losing observations due to missing data on one or more of the explanatory or control variables. The countries in the sample account for 98 percent of the total number of certificates in the world, 96 percent of world GDP, and 94 percent of world trade as of 1998.[5]

RESULTS

Table 2 presents the sample statistics and correlation coefficients. Regression results are reported in table 3. Model 1 includes the control variables only. Not surprisingly, the size of the country, the level of economic development, and the time trend exerted significant effects on the number of certificates. Membership in the EU, which is also time varying, did not reach significance, perhaps because our period of observation starts in 1993, when early adoption had already taken place, or because of high covariance with the country fixed effects.[6] Outward foreign direct investment was not significant either, indicating that the international orientation of firms does not necessarily lead to certification.

Our predictions about the effects of institutional variables received strong support that is robust to the number of explanatory variables included in the equation (models 2 through 8 in table 3). Considering the full specification of model 8, we found strong support for hypothesis 1 about the coercive effect of resource dependence. The number of certificates significantly increased with the presence of the state or of foreign multinationals in the economy, as measured by government consumption and inward foreign direct investment, respectively. Hypothesis 2, on the normative effect of the availability of scientific and technical knowledge about operations, engineering, manufacturing, or quality, received

5
When compared with countries excluded from the sample due to missing data, our study includes countries with a significantly higher average GDP per capita than excluded countries ($9,511 compared with $6,284, $p < .05$).

6
We also calculated another measure that accounts for the role of the EU in the diffusion of certificates more specifically, obtained by multiplying the dichotomous membership in EU variable (0 or 1) by the average number of certificates in all other EU member countries as of the previous year. Because results are qualitatively similar to those reported with the EU membership variable, we report only the latter. The lack of significance of EU membership seems to detract from our argument about coercive isomorphism, although this result may be due to the methodological constraints mentioned.

Table 2

Sample Means and Correlations

Variable	Mean	S.D.	Min.	Max.	1	2	3
1. Number of certificates	1894.52	6209.72	0	58963			
2. Log (Gov. consumption/GDP)	2.67	.36	1.09	4.02	.16•		
3. Log (Inward foreign investment/GDP)	2.44	1.12	−3.81	4.34	.03	−.09	
4. Log (Tech. publications/Population)	4.03	5.66	−13.82	8.94	.20•	.17•	−.06
5. Log (Cohesion in trade)	6.31	1.14	3.07	9.38	.02	.03	.16•
6. Log (Role equivalence in trade)	10.27	.89	6.63	11.83	.19•	.06	.04
7. Log (Size of labor force)	15.67	1.62	11.80	20.42	.24•	−.25•	−.20•
8. Log (GDP per capita)	8.28	1.50	5.03	10.70	.31•	.36•	−.01
9. Log (Outward foreign investment/GDP)	.60	2.46	−13.63	4.36	.25•	.29•	.14•
10. Initial number of certificates/100	3.58	20.97	0	185.77	.88•	.15•	.06
11. European Union membership	.16	.37	0	1	.39•	.27•	.09

Variable	4	5	6	7	8	9	10
5. Log (Cohesion in trade)	.02						
6. Log (Role equivalence in trade)	.27•	.59•					
7. Log (Size of labor force)	.19•	−.20•	.20•				
8. Log (GDP per capita)	.54•	.08	.22•	−.17•			
9. Log (Outward foreign investment/GDP)	.34•	.16•	.08	−.15•	.60•		
10. Initial number of certificates/100	.12•	−.08	.01	.13•	.18	.17•	
11. European Union membership	.29•	.10•	.23•	.06	.49•	.30•	.30•

• $p < .05$.

no support, whether other explanatory variables were in the equation or not (see models 4 and 8).

The results also corroborated our predictions about the effects of trade networks on the diffusion of quality certification. Hypothesis 3, on the impact of cohesive trade relationships, received strong and robust support. Thus, the number of certificates significantly increased when the country was strongly tied in terms of trade to other countries with a high number of certificates as of the previous year. Finally, our results also provided strong and robust support for hypothesis 4, on the effect of role equivalence in trade: the number of certificates significantly increased when the country's trade distribution by industry overlapped with that of other countries with a high number of certificates as of the previous year.[7] Thus, we obtained support for three of our four hypotheses about the effects of institutional variables on the cross-national diffusion of ISO 9000 quality certification.

The control variables in the full model behaved as reported above. The effect of the year time trend decreased in magnitude and significance after cohesion and role equivalence were entered, which means that the increase in quality certification from one year to the next is distributed across countries in systematically different ways that operate through trade networks. When compared with the baseline model with the control variables and the fixed effects, the full model provided a significant improvement in goodness of fit ($p < .001$, following a chi-squared distribution with 5 degrees of freedom).

We conducted three additional analyses to check for the robustness of the results presented in table 3 to changes in the estimation method. First, we estimated the number of certificates in each country with a fixed-effects Poisson regression model, although the assumption of equal mean

7
To test for the influence of structural equivalence on the number of ISO 9000 certificates, we calculated a measure from the import and export matrix by country using UCINET. This measure is highly correlated with our cohesion measure (.75, $p < .001$), and the results of the analyses substituting structural equivalence for cohesion are qualitatively similar to those reported below. This leads us to believe that structural equivalence captures an indirect (or common influence) cohesion effect rather than a separate competitive effect on the diffusion of ISO 9000 certificates (see Mizruchi, 1993, for an explanation of the two interpretations of structural equivalence). In light of these results, we decided to continue using our role equivalence measure.

Table 3

Fixed-Effects Negative Binomial Analysis of the Number of ISO 9000 Certificates, 1993–1998*

Variable (hypothesis, sign)	1	2	3	4
Government consumption (H1 +)		.417•	.434•	
		(.201)	(.202)	
Inward foreign investment (H1 +)			.277•••	
			(.071)	
Technical publications (H2 +)				.019
				(.015)
Cohesion in trade (H3 +)				
Role equivalence in trade (H4 +)				
Size of labor force	.188•••	.215•••	.275•••	.180••
	(.057)	(.059)	(.061)	(.058)
GDP per capita	.545•••	.545•••	.646•••	.523•••
	(.077)	(.076)	(.082)	(.078)
Outward foreign investment	.001	−.008	−.041	−.002
	(.046)	(.045)	(.049)	(.046)
Initial number of certificates	−.007••	−.008••	−.009••	−.008•
	(.003)	(.003)	(.003)	(.003)
European Union membership	−.002	−.033	−.099	−.005
	(.158)	(.151)	(.149)	(.156)
Year	.465•••	0.468•••	.440•••	.461•••
	(.018)	(.018)	(.018)	(.018)
Constant	−50.801•••	−52.571•••	−52.379•••	−50.211•••
	(1.952)	(2.115)	(2.184)	(2.005)
Log likelihood	−1861.626	−1859.382	−1851.403	−1860.741

Variable (hypothesis, sign)	5	6	7	8
Government consumption (H1 +)				.463•
				(.200)
Inward foreign investment (H1 +)				.369•••
				(.070)
Technical publications (H2 +)				.017
				(.014)
Cohesion in trade (H3 +)	.674•••		.672•••	.722•••
	(.073)		(.073)	(.067)
Role equivalence in trade (H4 +)		.238••	.163••	.146••
		(.081)	(.063)	(.060)
Size of labor force	.345•••	.176••	.327•••	.438•••
	(0.059)	(.059)	(.061)	(.065)
GDP per capita	.635•••	.485•••	.603•••	.711•••
	(.075)	(.081)	(.078)	(.087)
Outward foreign investment	−.033	−.004	−.036	−.108
	(.048)	(.047)	(.049)	(.056)
Initial number of certificates	−.008••	−.008••	−.009••	−.012•••
	(.003)	(.003)	(.003)	(.003)
European Union membership	.082	.024	.085	−.049
	(.136)	(.160)	(.135)	(.125)
Year	.164•••	.388•••	.112••	.071•
	(.034)	(.032)	(.039)	(.037)
Constant	−29.324•••	−45.160•••	−25.45•••	−26.424•••
	(2.746)	(2.818)	(3.116)	(3.167)
Log likelihood	−1828.455	−1857.007	−1824.926	−1806.103

• $p < .05$; •• $p < .01$; ••• $p < .001$

* Standard errors are in parentheses; all explanatory variables except the Initial number of certificates and Year are logged and measured using one-year lags; country fixed effects are included in all models.

and variance does not hold in this sample. The coefficient estimates for the hypothesized effects follow the same pattern of significance reported above using the negative binomial model, except that technical publications became significant ($p < .001$). Not surprisingly, the overdispersion parameter α was significantly different from zero (31.62, with a standard error of 3.52), suggesting that the Poisson model

is not appropriate in this case. Second, we estimated the logged number of certificates, using OLS with country fixed effects. Coefficient estimates for inward foreign direct investment and cohesion in trade were correctly signed and significant, consonant with the results obtained with negative binomial regression. The coefficient estimates for government consumption and role equivalence in trade were correctly signed but did not reach significance. This is likely due to the violation of key OLS assumptions.

In the third robustness check, we analyzed our data using negative binomial regression with random effects instead of fixed effects. All the hypothesized effects reported in table 3 held, and the point estimates were also very similar. Moreover, the number of technical publications per capita was also positive and highly significant when using random effects. We suspect that the country fixed effects are capturing structural differences across countries in the availability of technical knowledge relevant to ISO 9000 that do not change much over a six-year period. Therefore, the fixed-effects model provides a more conservative test of our hypotheses that yields results largely consistent with those obtained with other estimation methods.

DISCUSSION AND CONCLUSION

This paper contributes not only to the empirical literature on the worldwide diffusion of organizational practices, but also to organizational theory by extending the basic postulates of the new institutionalism to the study of international diffusion and isomorphism. In this view, the agency of powerful organizations such as the state and foreign multinationals generates coercive pressures for diffusion and isomorphism to the extent that potential adopters depend on them for resources. The availability of scientific and technical knowledge provides a normative template that may facilitate diffusion. Finally, mimetic isomorphism in the world occurs to the extent that cohesive ties between countries generate coercive or normative imitation and role equivalent network positions increase learning and competition. Our paper is the first to apply the concept of role equivalence to capture the impact on diffusion of the extent to which countries—and hence firms—compete with each other in the global economy. Our argument was that role-equivalent firms are likely to imitate each other's practices in order to boost their own performance. We proposed learning and anticipation of competition as the basic behavioral mechanisms underlying imitation among role-equivalent actors. This argument is consistent with the well-established view that the set of equivalent actors in a social structure provides a competitive frame of reference (Burt, 1997).

Our empirical results provided strong and robust support for the coercive effects of powerful organizations, such as the state and the multinationals, for the coercive or normative imitation processes that result from cohesive trade ties between countries, and for the competition-based mimicry that is generated by role equivalence in trade. Our analysis, however, provided no robust evidence for the independent impact of knowledge-based normative isomorphism as mea-

sured by scientific and technical publications in the areas of operations, engineering, manufacturing, or quality. The absence of supporting evidence on the normative effect of knowledge on isomorphism invites more research using alternative indicators at various levels of analysis to see if the results reported in this paper are affected by the validity of our indicator of knowledge or by measurement error. Future research could develop alternative indicators of knowledge-based normative effects, perhaps even measure them for country dyads. Another possibility is to measure flows of technical personnel between countries. These data, however, are not readily available for a large number of countries and over time.

An important corollary of our research is that the trade and foreign investment policies of countries have a significant influence on organizations because they affect the rate at which practices are adopted. The field of organization studies has downplayed international variables such as the position of countries in trade networks. The approach and findings reported in this paper may act as a reminder that, in an age of globalization, institutional context needs to be defined and measured internationally. Future research may further investigate the effect of the international context by specifying how certain attributes of states may be more likely to create coercive, normative, or mimetic pressures toward the diffusion of practices. For example, Murtha and Lenway (1994) have argued that the role of the state in the strategy and performance of firms depends on several attributes of the state, including domestic political institutions, the impact of ideology and domestic interest groups, and trade and foreign policies.

Our finding that the diffusion of certificates across countries is strongly influenced by how countries relate to each other in the global trading system is in line with the work of network theorists, who argue that the contagion of innovations occurs through imitation among actors in the same network (e.g., Burt, 1987, 1997; Abrahamson and Rosenkopf, 1997). While the importance of imitation among network members in the diffusion of practices has often been shown at the interpersonal and interorganizational levels, our study showed support for a similar mechanism operating at the international level.

Our approach and findings run against the conventional wisdom that globalization is an inexorable, uniform, and homogenous process tending toward unmitigated isomorphism across countries, at least in the adoption of organizational practices. Discernible cross-national patterns in rates of diffusion exist, and they shed light on the forces driving the process. Our results indicated that organizational practices diffuse across the world in contingent ways, depending on the extent to which firms in each country are exposed to coercive, normative, and mimetic effects, a finding consistent with recent social science work arguing that globalization is a complex process affecting organizations and countries in different ways and to different degrees (e.g., Gereffi, 1993; Guidry, Kennedy, and Zald, 2000; Guillén, 2001). These findings provide impetus to the study of the diffusion of organiza-

tional practices in the global economy as a process shaped by the characteristics of countries and by their position in global networks, rather than as a process overdetermined by the supposedly sweeping effects of globalization.

We recognize that our study is limited in several ways. First, missing data forced us to drop a number of countries from the analysis. Still, our final sample accounts for 98 percent of all ISO 9000 quality certificates, and for about 95 percent of world GDP and trade. Second, our panel includes only six years of data, which prevents us from observing the process of ISO 9000 diffusion since its inception in 1987. In particular, this limitation made it difficult for us to differentiate between early and late adoption patterns. Because our analyses pertain only to later adoption of ISO 9000 certificates, it may be that some of the institutional factors that we find important to the diffusion process do not operate during the early stage of diffusion (see Tolbert and Zucker, 1983; Westphal, Gulati, and Shortell, 1997).

A second limitation is that our data did not allow for an analysis of different applications of ISO 9000 standards. Institutional theorists have argued that practices adopted to ensure institutional legitimacy may be "decoupled" from the technical activities of the organization and exist only on a symbolic basis (Meyer and Rowan, 1977). Empirical research has also shown that institutionalized forms of a practice may be different from its original, technical form (Westphal, Gulati, and Shortell, 1997; Zbaracki, 1998). This may be the case for the adoption of ISO 9000 standards, especially considering the decentralized process of certification in each country. Our claims are limited to the diffusion of certificates, rather than applying to the implementation of actual quality practices. This decoupling process may also be a reason why we found no significant effect for the technical knowledge base in a sample that does not cover the early stages of diffusion.

Third, our empirical measures may be simultaneously capturing the effects of the different institutional mechanisms of coercive, normative, and mimetic isomorphism. States, foreign multinationals, and network ties may facilitate diffusion through multiple channels, but it is difficult to disentangle them empirically. Finally, the adoption of certificates depends on many industry and organizational factors, which undoubtedly play a role in a firm's decision to get certified. Unfortunately, our analysis cannot speak to those effects because of the level of aggregation at which the data are available. Still, we were able to test predictions based on neoinstitutional theory and to advance our understanding as to the coercive, normative, and mimetic drivers of cross-national diffusion. The fact that we included country fixed effects in all of our regressions removes industry composition or other country-level effects that are mostly invariant over such a short period of time as six years. These limitations provide the opportunity for future theoretical and empirical research on this topic.

While globalization is a powerful isomorphic force in the world, it operates within the constraints and channels created by institutions. Our findings highlight that the diffusion of

practices in the global economy is shaped by the activities of such large organizations as the state and multinational firms and that cross-national isomorphism follows trade relationships, especially cohesive ones. These results have implications for both governments and organizations. Governments can affect rates of diffusion of innovative practices not only as purchasers of goods and services, but also through trade policy. In the global economy, organizations wishing to adopt the most innovative practices should look to the state, multinational firms, and their foreign trade partners and competitors for new models and opportunities.

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