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Geographic Variations in the Early Diffusion of Corporate Voluntary Standards: Comparing ISO14001 and the Global Compact

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Abstract

Despite their availability to firms across the world, uptake of global voluntary standards has proceeded unevenly across countries over time. In this article, we seek to provide new insights into how geography shapes these spatio-temporal variations, focusing on two leading examples of codified voluntarism: ISO14001 and the Global Compact (GC). Advancing on previous quantitative studies, which have analyzed domestic and non-domestic influences separately, we examine how the internal attributes of place "condition" the influence of transnational spatial interdependencies. We find that higher levels of ISO14001 certification in other economies are more likely to spillover (via transnational linkages) into higher domestic uptake of the standard in wealthier economies, while domestic receptivity to the influence of higher GC adoptions abroad is greater in more democratic countries. Another important advance on previous studies is that we examine the influence of a larger number of measures of transnational economic linkage. Providing evidence of "trading-up" and "investing-up" dynamics, we show that higher densities of ISO14001 certificates and GC participants in a country's export and inward FDI partners is associated with higher levels of domestic uptake of the respective standard. We also find tentative evidence of "visiting-up" dynamics associated with the cross-border movement of businesspeople.

Introduction

An important feature of the past two decades has been the growth of voluntary corporate responsibility (CR) standards governing the behavior of firms in areas such as environmental sustainability, labor rights and corruption (Angel et al., 2007; Christopherson and Lillie, 2005; Hughes et al., 2007; Klooster, 2006; Nadvi, 2008). Arguably the most prominent amongst these expressions of corporate voluntarism have been "global" standards, such as the Global Compact (GC), ISO14001, Responsible Care and SA9000. Although so-called because they can be implemented by firms all over the world, a common feature of global standards has been geographic unevenness in their uptake (Bennie et al., 2007; Delmas and Montiel, 2008; Neumayer and Perkins, 2004; Stringer, 2006).

Understanding variations in the uptake of CR standards – both across time and space – has spawned a quantitative research literature, which has sought to explain geographic unevenness in terms of spatio-temporal diffusion processes (Albuquerque et al., 2007; Corbett and Kirsch, 2001; Delmas and Montiel, 2008; Neumayer and Perkins, 2004; Potoski and Prakash, 2004; Prakash and Potoski, 2006, 2007). Our large-N, econometric contribution in the present article advances on this previous work in three important areas. First, we attempt to provide a more realistic test of how transnational flows of information, norms and pressures influence the domestic uptake of CR standards. Unique to the literature, therefore, our study uses an interactive model specification whereby the influence of standard adoption in other states working through transnational linkages is "conditioned" by domestic contextual factors of wealth and democracy.

A second contribution is that we analyze three measures of transnational economic linkages through which global standards might plausibly "spillover" (i.e. diffuse) from one country to another. These are exports and inward foreign direct investment (FDI), both of which have featured in previous studies, and international business travel, which has not. Importantly, we go beyond a number of previous studies, which have relied on aggregate measures of total transnational linkages. Instead, we make use of bilateral data to construct spatial lag variables, which capture the density of standard adoption in foreign countries weighted by the degree of connectivity to other states (Corbett and Kirsch, 2001; Delmas and Montiel, 2008; Moon and deLeon, 2005; Neumayer and Perkins, 2004).

A third advance is to examine two global standards with very different characteristics: ISO14001 and the GC. The GC has only been the subject of a single study which, rather than examining spatio-temporal variations across countries, focuses on uneven participation amongst Forbes Global 2000 list companies (Bennie et al., 2007). Through the use of a common methodology, we provide new insights into whether cross-national disparities in the uptake of standards with very different characteristics – ISO 14001 and the GC – are shaped by similar factors and to a similar degree.

ISO14001 and the GC in Comparative Perspective

CR standards are non-state mandated regulatory institutions governing the behavior of firms (Cashore, 2002; Christopherson and Lillie, 2005; Hebb and Wójcik, 2005; Kollman and Prakash, 2002). Also termed voluntary codes, they operate at a number of spatial scales, and cover a multitude of issues (Angel et al., 2007; Nadvi, 2008). CR standards codify a set of rules, roles and expectations in areas of public concern – such as

environmental protection, labor rights, anti-corruption and reporting – not adequately addressed by public law. They signal that a company and/or its products and services are allied to certain "standards" of procedure, performance or commitment (Bansal and Hunter, 2003; Christopherson and Lillie, 2005; Stringer, 2006). Standards allow firms to better comply with stakeholder demands, establish their credentials as good corporate citizens, and create competitively-valuable reputational assets. Moreover, they offer a means for lead firms to manage extra-economic aspects of international value chains, in that universally-applicable standards can be used as a basis for specifying, monitoring and verifying the CR of suppliers and subcontractors (Hughes et al., 2007; Nadvi, 2008).

Our particular concern in the present article is on two influential global standards addressing aspects of CR: ISO14001 and the GC. We chose these standards because they are leaders in their respective fields. ISO14001 is the most widely-adopted standard specifically addressing aspects of corporate environmental management, while the GC is the world's foremost corporate citizenship initiative. At the same time, significant differences exist between the standards, both in their aims, procedural requirements and assurance mechanisms.

Released in 1995, ISO14001 is a process-based environmental management system (EMS) developed and promulgated by the International Organization for Standardization (ISO). Briefly, an EMS comprises a set of formalized and systematized procedures designed to help firms reduce their environmental impacts (Moon and deLeon, 2005). ISO14001 "standardizes" these procedures with the aim of providing a universally accepted framework for continually improving environmental performance that can be implemented worldwide. Organizations wishing to declare themselves ISO14001 certified must undergo

six steps: (1) create an environmental policy; (2) assess current environmental impacts, liabilities and legal compliance; (3) create an internal management system; (4) periodically audit and review environmental performance; (5) prepare a public statement declaring that ISO14001 is being implemented; and (6) employ a registered auditor to confirm that the organization's procedures are consistent with the documented EMS (Neumayer and Perkins, 2004). This last verification stage is known as certification.

The GC, released in 2000, is organized under the aegis of the United Nations (UN). Unlike ISO14001, the Compact does not prescribe formal procedures, but a set of ten generic principles which are intended to guide the practices of corporations. The principles, which derive from fundamental international treaties and declarations, cover four areas of business-society relations: human rights (principles 1-2); labor (3-6); environment (7-9); and anti-corruption (10). By encouraging firms to embed a set of universal, shared values into their strategy and operations, the Compact seeks to promote more responsible, inclusive forms of global corporate citizenship. In order to become a publicly-listed participant, a company's chief executive officer needs to send a letter to the UN's Secretary General, 'expressing support for the Global Compact and its principles' (UN, 2008a). Unlike ISO14001, however, compliance is not independently monitored, verified and assured by third-parties. Moreover, although participants are obliged to periodically submit a report detailing actions that they have taken to achieve the Compact's goals, the UN does not monitor or measure the performance of participants.

Of the two standards, ISO14001 has by far proved the most popular, even taking account of the fact that the standard was released earlier. As of the end of 2005, the last year of our sample, there were 1000 active firms in the GC. By comparison, at the

equivalent number of years after the introduction of ISO14001 (i.e. end of 2000), there were approximately 22,500 certified firms. Yet, as shown in figures 1 and 2 which respectively depict the domestic density of ISO14001 and the GC (i.e. country-level adoption counts normalized by population), these aggregate statistics mask significant variations across countries. Our central goal is to explain these variations which, we argue, are best understood as an example of geographically uneven diffusion.

Conventional Approaches to Diffusion and their Shortcomings

Previous large-N, quantitative work concerned with the diffusion of organizational standards has sought to model spatio-temporal unevenness in terms of two sets of explanatory factors: external and internal (e.g. Guler et al., 2002). The former capture the influence of actors in other states whose adoption decisions, it is suggested, "spillover" across borders by directly or indirectly altering the optimal choices of domestic actors (Pitlik, 2007, 164). Internal determinants, on the other hand, refer to domestic, territorially-bound attributes which accelerate or impede the domestic uptake of new innovations. Understanding diffusion in terms of external determinants, on the one hand, and internal determinants, on the other hand, is undoubtedly useful, drawing attention to two different aspects of "geography" that contribute to the uneven grounding of global standards amongst organizations located in particular territorial spaces. Yet, by failing to consider the ways in which domestic and extra-territorial influences might interact, previous studies into the diffusion of standards have potentially provided an unrealistic account of how geographic unevenness is produced.

Our point of departure in the present article is to argue that, as well as acting as independent determinants in their own right, internal and external influences are likely to combine. In particular, we anticipate the impact of external influences to be conditioned by certain domestic attributes, with the latter amplifying or attenuating the influence of the former. To take one example: the sale of goods to a country which has a high number of adoptions of ISO14001/GC may expose firms in the exporting country to new knowledge about the standard. Yet the extent to which domestic corporate managers respond to this information will plausibly depend on place-based, contextual factors which influence the local demand for CR or firms' ability to supply this demand. The domestic context, in other words, is likely to define receptivity to transnational influences.

Similar points have been made by scholars in other contexts (O'Loughlin et al., 1998; Bridge, 2002). Yet, to the best of our knowledge, our study is the first to explore the conditioning role of domestic attributes on extra-territorial influences in the diffusion of organizational standards. In the next section, we explore the sources of external influences, focusing on transnational contact, communication and exchange.

The Ties that Diffuse

A core theme of the literature is that cross-national diffusion occurs where adoption in other countries stimulates domestic adoption. One stream of work identifies these "other" states as ones which are equivalent in terms of socio-cultural, political and/or economic characteristics (Albuquerque et al., 2007; Guler et al., 2002). Another set of explanations point to countries where the innovation in question has, or appears to have, proved successful (Pitlik, 2007; Simmons and Elkins, 2004). A third set of explanations emphasize

various forms of transnational contact, communication and exchange (Mosley and Uno, 2007; Potoski and Prakash, 2004).

We focus on this third category because we believe the theoretical arguments supporting the influence of transnationally linked countries are stronger than for other "reference" category accounts. Additionally, the role of certain boundary-spanning connectivities in accelerating the domestic uptake of standards has previously been demonstrated in a number of large-N, quantitative studies (Albuquerque et al., 2007; Neumayer and Perkins, 2004; Prakash and Potoski, 2006, 2007).

Following Simmons and Elkins (2004), we point to two mechanisms through which transnational contact, communication and exchange with other countries might plausibly give rise to cross-border spillovers: *altered payoffs* and *information*. Altered payoffs are hypothesized to arise where uptake of an innovation by actors in country A increases its relative profitability to potential adopters in country B. Altered payoffs may be financial, with adoption in other countries increasing the commercial value of a particular standard, or reducing the financial costs of implementation (Bennie et al., 2007; Clark et al., 2001). Altered payoffs may also be reputational, and bound-up with corporate actors' quest for "legitimacy" amongst important stakeholders, with uptake in other countries helping to domestically institutionalize particular standards as "best" or "appropriate" practice (Guler et al., 2002; Mendel, 2002).

A second mechanism implicated in cross-national spillovers by Simmons and Elkins (2004) is new information. Transnational contact, communication and exchange with adopters may increase cross-national learning about the existence, profitability and practical feasibility of CR standards. On the supply-side, such learning may provide ideas

about how standards can help to address existing management challenges. On the demand-side, transnational learning may impart new information, ideas and templates about existing approaches to corporate social and environmental responsibility adopted elsewhere, potentially altering stakeholder expectations, demands and norms of appropriateness.

Whether through one or (more likely) both of these mechanisms, we suggest that the degree to which adoption in one country spills-over into another country will depend on two factors. One is the density of foreign adopters (Perkins and Neumayer, 2004; Prakash and Potoski, 2007). Linkages to countries with a comparatively high number of ISO14001 certificates or GC participants per capita are more likely to increase the payoffs from adoption or expand the availability of relevant information. Another salient determinant is the degree of transnational interdependence in terms of the level of boundary-spanning ties (Guler et al., 2002; Neumayer and Perkins, 2004; Prakash and Potoski, 2006). Domestic actors are more likely to be influenced to implement a standard by adopters in other countries where they interact, communicate and exchange with them more.

Trade

Previous studies have ascribed a central role for exports in the domestic uptake of global CR standards arising from a "trading-up" effect (Vogel, 1997). According to this line of argument, exports may lead to a ratcheting-up of regulatory standards, so long as a country's important trading partners have stringent environmental policies (Prakash and Potoski, 2006).

Trading-up dynamics are typically theorized in terms of altered payoffs. Hence it is suggested that firms exporting to countries with a high number of adopters of CR standards

will face heightened economic incentives to follow suit by adopting similar standards. Most commonly these incentives are portrayed as emanating from the purchasing preferences or requirements of foreign buyers for their suppliers to adopt standards similar to those widely implemented in their own country (Coe and Wrigley, 2007; Mendel, 2002; Nadvi, 2008; Prakash and Potoski, 2006; Stringer, 2006). Yet high levels of uptake in important export markets might also drive domestic adoption by changing domestic expectations of profitability with domestic firms taking cues regarding their technical or economic properties from companies in key exports markets (Kollman and Prakash, 2002). Indeed, growing levels of uptake in export markets might set in motion a competitive bandwagon, as firms adopt out of fear that their foreign counterparts will otherwise gain a competitive advantage (O'Neill et al., 1998).

Implicit in the above is the idea that export ties create boundary-spanning communication networks which act as conduits for the spread of new information. Via these network ties, firms may learn about the range of organizations which have implemented a particular standard in export markets, together with its relative popularity. They may also gain new understanding about the commercial benefits of standards, e.g. via easily-codified "success stories" of companies in export markets which have profitably implemented ISO14001 or the GC.

Foreign direct investment

While discussions of upwards convergence have typically focused on trade, recent work has switched attention to inward FDI and the potential for "investing-up" (Prakash and Potoski, 2007). Through outward FDI, TNCs can directly "export" standards to host

economies, implementing voluntary CR standards in their foreign affiliates and subsidiaries (Bridge, 2002; Garcia-Johnson, 2000). Amongst the reasons why TNCs might choose to deploy an internationally-recognized standard throughout their geographically dispersed network of operations are: to meet local and extra-local stakeholder expectations (Angel et al., 2007; Bansal and Hunter, 2003); to create competitively-valuable "organizational legitimacy" in host economies (Coe and Wrigley, 2007), providing firms with a "social license to operate and expand"; and to save on transaction costs associated with operating different self-regulatory practices in different countries (Angel et al., 2007).

The presence of foreign affiliates and subsidiaries in the host economy may also be instrumental in changing domestic payoffs. Within this capacity, TNCs may use local firms which have adopted a familiar standard as preferred suppliers, or refuse to procure from those which have not (Jeppesen and Hansen, 2004). Foreign affiliates and subsidiaries could also trigger adoption through mimetic effects, as domestic firms "copy" specific CR standards believed to grant foreign transnationals a competitive advantage. Such dynamics, whereby firms competitively emulate rivals in the host economy, have been documented in other contexts (Coe and Wrigley, 2007).Likewise, domestic firms may imitate TNCs for reputational reasons, adopting a particular standard in order to align themselves with the progressive management practices of their high-reputation foreign counterparts.

TNCs can also diffuse new information which, directly or indirectly, stimulates adoption of a particular standard by domestic firms. Through the local presence of transnationals who are adopters, domestic firms may not only learn about the existence of ISO14001 or the GC, but also their benefits. Equally significant, TNCs may help to

redefine the expectations of firms amongst civil society, demonstrating the availability, operation and outcomes of CR standards (Garcia-Johnson, 2000; Perkins, 2007).

Business travel

Although largely neglected in recent work into the diffusion of voluntary CR standards, it is our contention that international flows of businesspeople from countries where there is a high density of a particular CR standard may have a "visiting-up" effect, fostering higher levels of domestic uptake. First and foremost, this is likely to derive from the role of travelers as cross-border carriers of new information (Bunnell and Coe, 2001; Currah and Wrigley, 2004). In their meetings, conversations and dealings, foreign business visitors may well convey information about the existence, uses and wider commercial benefits of particular standards (Bryson, 2000). Received through direct, interpersonal contact, such information is likely to carry more credibility, and therefore have greater influence than distanciated forms of communication. Through face-to-face interactions – which are known to be important in diffusing "cultural" and "behavioral" norms across geographic borders (Jones, 2007, 241) – businesspeople may also be instrumental in socializing domestic managers into CR as best practice, and part-and-parcel of the legitimate responsibility of modern, progressive business organizations (Mendel, 2002). More generally, the mobility of businesspeople across national borders may help to transfer information, including tacit knowledge developed through prior experience with standards in other countries (Bryson, 2000; Gertler 2003). Such knowledge could well accelerate domestic uptake by lowering the associated information and implementation costs of a particular standard.

Inevitably, business travel will be functionally bound-up with both exports and inwards FDI, both of which frequently depend on the movement of people across national borders. However, geographic patterns of business travel are unlikely to be identical to those of trade and investment, such that it cannot be treated as a catch-all measure of the geometry and intensity of these linkages combined. Thus, the amount of business travel associated with trade and investment is likely to vary across countries, while certain forms of business travel (e.g. business association conference travel, visits to trade fairs) may only be partly related, or even entirely unrelated, to trade and FDI. Hence we believe that it makes sense to analyze business travel as a variable in its own right in the present article.

The Conditioning Context

In the present article, we focus on two domestic, contextual factors, GDP per capita and democracy, which we model as interacting with the transnational link-weighted spatial lags. Wealth and democracy are broad-based attributes, whose influence operates through a number of different channels which, theoretically, conceptually and empirically, have been implicated in shaping (uneven) patterns of standard adoptions. They are also two variables at the heart of social science research, respectively comprising foundational *economic* and *political* attributes identified as influencing a wide range of domestic differences.

Economic wealth

Wealth is likely to impact domestic actors' receptivity to transnational influences by increasing domestic demand for many of the same issues addressed by CR standards. For many economists, factors such as environmental quality, labor rights, and good governance

are “normal goods” (Fredriksson et al., 2007; Lederman, Loayza, and Soares, 2005). We would therefore logically expect demand for corporate environmental and social responsibility to rise with GDP per capita (p.c.). This demand could be specified in a number of different ways, but where civic stakeholders come to learn about a particular CR standard widely adopted in other countries, it makes sense that it could well take the form of pressure to adopt a similar standard. Likewise, firms could respond to demands for CR through various initiatives, including company-specific codes. Yet where domestic managers have learnt about codes such as ISO14001 or the GC (e.g. through contact with business travelers), or face other pressures to adopt (e.g. from lead buyers), they might be more inclined to turn to one of these internationally-recognized standards.

More important still, wealth is likely to operate via supply-side effects. Planning, implementing and certifying ISO14001 is known to involve potentially significant financial, managerial and (sometimes) technological resources (Moon and deLeon, 2005). The costs associated with integrating the GC’s principles into business practice are similarly unlikely to be negligible. We therefore expect domestically-owned firms in less wealthy countries to be less responsive to transnational influences (Klooster, 2006; Perkins, 2007).

Democracy

According to the literature, several features of democracies might be expected to support the demand for, and supply of, goods provided by CR codes (Alok, Neil, and Carl, 2004; Payne, 1995). They include the freer flow of information which mean that individuals are likely to be better informed about the nature, existence and solutions to social, political and

environmental “bads” (Lederman, Loayza, and Soares, 2005). Another is greater freedom of expression, with people living in democratic polities better able to give voice to their concerns, preferences and demands, together with the freedom to associate, assemble and organize. Citizens in democratic states also have the right to vote, directly or indirectly, creating incentives for vote-seeking politicians to respond to public demands.

Based on these observations, we surmise that contact with foreign adopters of standards is more likely to spillover into higher domestic adoptions in democratic polities than autocratic ones. For a start, preferences for progressive environmental, social and/or political practices should be stronger in democracies, increasing domestic receptivity to matching innovations. With greater awareness of corporate “misdeeds” in areas such as environmental degradation, corruption and working conditions, and how these affect their well-being, individuals are more likely to demand action to address these negatives. As with wealth, where a country is more strongly linked to states with a high number of adopters of a particular standard (e.g. the GC) , this demand for CR is more likely to be specified in terms of the same standard (i.e. the GC).

Actors in democratic polities will also be better-placed to exercise demands for CR. Hence, compared to the situation in autocratic polities, citizens are far more likely to be able to exert pressure on firms to address their environmental and social aspects, e.g. via labor unions, environmental NGOs, etc. The threat or reality of such pressure will, in turn, raise the payoffs from adopting standards. A failure to respond to societal expectations potentially involves a number of negative consequences for firms. Anticipating these consequences, managers may seek to pre-empt civic activism, implementing measures

which address citizens' concerns, including voluntary CR codes about which they have knowledge.

Previous Work

Although not strictly comparable with our particular approach, previous empirical work provides a number of parallel insights. Several large-N quantitative studies have shown that economies whose export partners have a comparatively high number of adopters of ISO14001 also have a higher domestic number of certified firms (Albuquerque et al., 2007; Potoski and Prakash, 2004; Prakash and Potoski, 2006, 2007). The influence of FDI is more ambiguous. Prakash and Potoski (2006) find that inward FDI has a statistically insignificant effect on domestic ISO14001 counts, while Delmas and Montiel (2008) estimate a negative and statistically significant effect, although it is worth noting that both studies are based on geographically aggregated measures of total FDI inflows, not on a spatial lag variable. Indeed, using a spatial lag operationalization in their estimations, Prakash and Potoski (2007) find that certification count density weighted by FDI inflows from these countries has a positive and statistically significant influence on domestic ISO14001 certification counts. However, their source for FDI data has many gaps, which renders the validity of the FDI-weighted spatial lag questionable.[1] At least within the quantitative literature, the influence of business travel on the cross-national diffusion of CR standards remains unexplored.

Turning to our hypothesized contextual variables, the existing literature provides mixed support for the role of GDP p.c. in influencing the adoption of standards, although none of these works has explored wealth as a conditioning variable. A number of large-N,

[1] We have overcome this problem by purchasing more complete FDI data from UNCTAD.

quantitative studies show that GDP p.c. has a statistically discernable positive effect on the number of ISO14001 certifications (Neumayer and Perkins, 2004; Prakash and Potoski, 2007), but others find that its influence is sensitive to the inclusion of other variables and choice of statistical specification (Potoski and Prakash, 2004; Prakash and Potoski, 2006). Yet quantitative research generally suggests that wealthier economies demonstrate greater policy commitment and/or actual performance with regards to a number of issues underlying ISO14001 and the GC, including: superior environmental commitment and several measures of environmental quality (but not all measures, nor across all income levels) (Dasgupta et al., 2001); a lower incidence of child labor (Shelburne, 2001); better core labor rights (Busse, 2004); and lower levels of corruption (Bohara, Mitchell, and Mittendorff, 2004).

Regarding polity, the existing literature provides very limited insights, at least to the direct question as to whether democracies are more receptive to CR standards. In a bivariate correlation, Bennie et al. (2007) finds that Forbes Global 2000 companies headquartered in full democracies are more likely to join the GC, but this result does not hold in their multivariate analysis. To the authors' knowledge, no studies have previously investigated the influence of polity on the uptake of ISO14001, although previous work generally supports the idea that more democratic countries have a better record on many of the issues addressed by CR standards: superior environmental commitment (Neumayer, 2004) and (possibly) environmental quality (Farzin and Bond, 2005); a lower incidence of child labor (Shelburne, 2001); better core labor standards (Neumayer and de Soysa, 2005); and lower levels of corruption (Bohara, Mitchell, and Mittendorff, 2004).

Method

Dependent variables

We run two separate sets of regressions – one for each of the CR standards. For the ISO14001 estimation, our dependent variable is the number of certified facilities at the national level, normalized by country population size (with data from ISO 2007). Along similar lines, the dependent variable for the GC estimation is the domestic number of "active" business participants, again normalized by population size (with data from UN 2008b). The panels do not cover identical years. The ISO panel spans 1996-2000 and covers up to 151 countries, while the equivalent GC panel covers 2001-2005 with up to 149 countries. The reasoning behind our choice of different sample periods is that the standards were released at different times. Moreover, as documented in the literature, the determinants of innovation diffusion may vary over different stages of diffusion (O'Neill et al., 1998; Rogers, 1995; Rosenkopf and Abrahamson, 1999). For consistency, we purposely focus on the early stages of diffusion for which data are available for both standards, and when transnational influences are likely to be most important. The panels cover a six-year period, of which we lose the first year due to the inclusion of the temporally LDV.[2]

Main explanatory variables

As noted above, all three transnational connectivity variables are measured as spatial lags, which comprise the weighted sum of the dependent variable in other countries. In our research design, the weights capture the level of linkages between one state and others via a particular type of cross-border linkage, while the dependent variable of interest is the

[2] Although the temporal length of our panel is shorter than several other studies concerned with diffusion, it is well-suited to the GMM estimator deployed here, which is designed for temporally short, but cross-sectionally wide panels.

density of standards in these countries. The spatial lag works by linking the density of ISO14001 certificates/GC participants in different countries – effectively allowing a given density of adoptions in one country to "spillover" to another one – through a weighting mechanism represented by a connectivity matrix. Formally, the spatial lag model is defined as follows:

$$y_{it} = \rho \sum_{k} w_{ikt} y_{kt} + ... + \varepsilon_i \quad . \tag{1}$$

The spatial lag $\sum_{k} w_{ikt} y_{kt}$ consists of two elements, namely an $N \cdot T$ matrix of the dependent variable in all other units *k*, multiplied with an $N \cdot N \cdot T$ block-diagonal spatial weighting matrix ω_{ikt}, which measures the relative connectivity between *N* number of units *i* and *N* number of units *k* in *T* number of time periods in the off-diagonal cells of the matrix (the diagonal of the matrix has values of zero as there $i = k$ and units cannot spatially depend on themselves). The spatial autoregression parameter ρ gives the impact of the spatial lag on the dependent variable.

We analyze three distinct spatial lags, for which we use three different connectivity variables constructed as follows: (i) trade, measured as exports from country *i* to countries *k*, with data from UN (2007); (ii) foreign direct investment, measured as inward FDI stock of countries *k* in country *i*, with data from UNCTAD (2008);[3] and (iii) business travel, measured as foreign business travelers from countries *k* visiting country *i*, with data from UNWTO (2007). All weighting matrices are row-standardized, i.e. the entries of each row sum to unity, which in effect means that we use trade shares, FDI shares and business traveler shares, rather than absolute levels of connectivity. Row-standardization of the

[3] We use stock rather than flow data since the latter are notoriously volatile and provide a misleading indication of transnational linkages.

weighting matrices is typically undertaken to allow an easy interpretation of the estimated spatial lag coefficient as the degree of interdependence (Anselin, 2002).[4]

Turning to domestic contextual attributes, GDP p.c. is measured using data from World Bank (2007). The inclusion of GDP p.c. means that we do not seek to include a number of other income-dependent variables which have been identified in previous work into the cross-national diffusion of CR standards. These include the number of environmental treaties (Vastag, 2004), number of environmental NGOs (Neumayer and Perkins, 2004) and number of environmental law firms (Potoski and Prakash, 2004). We capture democracy using Marshall et al.'s (2006) widely-used polity2 indicator. Derived from expert judgments on aspects of institutionalized democracy and autocracy within a country, polity2 runs from -10 to 10, with -10 representing a totally authoritarian political system and 10 a full democracy.

Control variables

Two sets of control variable are included in each of our estimations. The first is a temporally lagged dependent variable (LDV), included to control for bandwagon effects (Rosenkopf and Abrahamson, 1999). Typically, these are explained by network-type externalities whereby the payoffs from adopting a particular standard rise with the number of domestic adopters, e.g. as more firms adopt ISO14001, so does its value as a legitimate, widely-accepted signal of environmental responsibility. Bandwagon dynamics may also arise from expanded information about particular standards that flow from a larger user base. The existence of these self-reinforcing dynamics at the domestic scale has been

[4] Row-standardization also makes substantive sense since our primary interest is in the identity of the major trade, investment and business travel partners, and not the total exposure of countries to these influences.

demonstrated in previous large-N, quantitative studies (Corbett and Kirsch, 2001; Moon and deLeon, 2005; Perkins and Neumayer, 2004; Prakash and Potoski, 2006, 2007),

We also specify controls to take account of the possibility that prior adoption of other voluntary standards might facilitate subsequent uptake. For our ISO14001 estimations, we include a control variable capturing the domestic density of ISO9000 certificates. ISO9000, the quality management system standard released by the ISO in 1987, shares many similarities with ISO14001. Indeed, prior experience of ISO9000 is likely to lower the associated information and implementation costs of ISO14001, increasing uptake of the latter. Most likely this explains previous large-N, quantitative research showing a positive correlation between domestic uptake of ISO9000 and ISO14001 (Delmas and Montiel, 2008; Perkins and Neumayer, 2004). Following a similar logic, we include ISO14001 – released five years earlier than the Compact – as a control variable in our GC estimations. As outlined earlier, the two codes differ in several important areas, more so than is the case for the ISO standards. Yet prior experience of ISO14001 might plausibly reduce firms' reluctance to implement other CR standards (Delmas and Montiel, 2008).

We do not include any further controls in order to avoid over-fitting the empirical model. With a temporally LDV, country fixed effects, year-specific time dummies, spatial lags, two explanatory variables capturing fundamental aspects of the economic and political context, together with variables controlling for prior adoption of potentially complementary standards, the empirical model is already stringently specified. Any further control variable is likely to be either highly correlated with one or the other of the existing variables,

creating multicollinearity problems, or largely uncorrelated with the existing variables, in which case its omission would not bias the estimations.

Challenges of modeling cross-national diffusion

The advantage of using spatial lags in the present context – as opposed to geographically aggregated measures of connectivity, e.g. total exports – is that they capture valuable geographic information about the degree to which countries are exposed to adopters in specific other countries. However, analysts run the risk of attributing the spread of similar innovations across different countries to transnational interdependencies when, in fact, they are independent and driven by common contextual factors across countries (Simmons and Elkins, 2004). We are keenly aware of this potential pitfall. And although we cannot rule out estimating spurious cross-national diffusion effects altogether, we nevertheless seek to minimize this risk in a number of ways.

First, we include country-specific fixed effects to control for unobserved country-specific differences which might be correlated with our explanatory variables, including the spatial lags. Fixed effects take out the between or cross-national variation in adoption levels across countries and estimates are exclusively based on the over-time variation in adoption within countries. They thus eliminate the effect of spatial clustering in adoption levels arising from the presence of similar contextual attributes, such as similar socio-cultural factors, political systems or economic status in countries (Plümper and Neumayer, 2010).

Spatial clustering in *changes* in adoption may still create problems in the estimation of our spatial lag variables. However, we believe that our measures of transnational interdependence (exports, FDI and business travel) are theoretically superior to rather

atheoretical measures of spatial clustering such as contiguity, geographical distance or same region. Our measures actually specify a concrete diffusion mechanism via contact, communication and exchange, whereas these other measures of spatial clustering do not.

A second way in which we seek to minimize the risk of attributing spurious diffusion is that we use year-specific fixed effects to control for common trends and shocks which affect all countries equally, e.g. growing worldwide awareness about a particular voluntary standard over the period of our analysis. Third, we control for temporal dynamics by including the temporally LDV. A failure to control for common trends and shocks as well as temporal dynamics is likely to lead to biased estimates and potentially erroneous conclusions regarding the influence of transnational interdependencies (Plümper and Neumayer, 2010).

The estimation of our model is rendered difficult by the endogeneity of the spatial lags and by what is known as Nickell (1981) bias arising from the inclusion of the temporally LDV. In order to deal with both problems, we estimate the model using Arellano and Bond's (1991) dynamic generalized method of moments (GMM) estimator. This widely-used estimator for dynamic panel data models corrects for Nickell bias by instrumenting the temporally LDV with further lags and also has the advantage that the spatial lag variables can be explicitly specified as endogenous, i.e. their past and contemporaneous values are allowed to be correlated with the error terms, and they are instrumented with further lags similar to the temporally LDV.

Results

Table 1 provides results for ISO14001.[5] Columns 1 to 3 show estimation results when each of the spatial lag variables are entered separately and without interaction effects, whereas columns 4 to 6 report results for each of the lags interacted with democracy and GDP p.c. Concentrating first on columns 1 to 3, the estimations confirm our a priori expectations in that all of the spatial lag variables are statistically significantly positive. Thus, we find that a higher density of ISO14001 adopters in other countries to which a particular state exports comparatively more, from which it has a relatively larger stock of FDI, and from which more business travelers visit spills-over into higher domestic densities of certificates. How important is each diffusion channel relative to the others? Unfortunately, because of the high level of collinearity amongst the spatial lag variables, they cannot be usefully entered together into the estimations. However, through our use of row-standardization, we can evaluate the relative strength of spatial dependence by comparing the estimated coefficients of the spatial lag variables. It seems that the degree of interdependencies through exports and business travel linkages are strongest, whereas interdependence through inward FDI linkages is only half as strong.

As expected, the coefficient of the temporally LDV is positive and statistically significant, lending support to the idea that adoption is self-reinforcing.[6] ISO9000 adoption has a positive effect on ISO14001 uptake which, as per previous studies (Delmas and Montiel, 2008; Perkins and Neumayer, 2004), indicates that the two standards are

[5] The Arellano and Bond (1991) estimator depends on the assumption of no second order autocorrelation. The reported test results suggest that for all estimations we cannot reject this assumption at conventional levels of statistical significance.

[6] Together, the sum of the coefficients of the temporal and spatial lags in columns 1 to 3 are implausibly high, representing at face value a non-stationary process. Yet the coefficients of the temporal lags decrease significantly once the spatial lag variables are interacted. Also, estimating the models for a longer time period (up to 2005 in the case of ISO14001) leads to much lower coefficients for the temporal lags, which are no longer implausibly high.

potentially complements. As can be seen by their statistically insignificant coefficients, neither democracy nor GDP p.c. have an *unconditional* effect on domestic ISO14001 certification density.

Yet, we do find that with the exception of business travel (for which the interaction effect is not far off statistical significance), all the interaction effects between the spatial lag variables and GDP p.c. are statistically significantly positive (see columns 4-6). Spatial interdependence through transnational linkages, in other words, is stronger in wealthier economies. Interestingly, however, none of the interactions between the spatial lags and democracy are statistically significant. Note, with interacted variables, the coefficients of the constituent terms on their own no longer have the same meaning as in non-interacted models. The insignificant coefficients of the spatial lag variables, which constitute one part of the interaction term, do not imply the absence of spatial dependence. Rather, they indicate the absence of spatial dependence only for observations in which GDP p.c. is equal to zero or extremely low. All that matters are the coefficients of the interaction effect which suggest that as incomes grow the effect of spatial dependence becomes increasingly positive.

We now examine our estimation results for the GC (table 2). Entered on their own, all of the spatial lag variables are significantly positive. Interdependence through export linkages is strongest, almost three times as strong as the interdependence through other linkages. The interaction effects are strikingly different compared to the estimations for ISO14001. With one exception (business travel), GDP p.c. has no significant conditioning impact on the spatial lag variables. However, whereas democracy was irrelevant for ISO14001, it has a statistically significantly positive effect on the impact of all spatial lags

for the GC, implying that spatial interdependence through transnational linkages has a greater influence in more democratic countries. Apart from the temporally LDV, none of the other explanatory variables has a consistent effect on GC uptake. Unlike ISO9000/ISO14001, ISO14001 and the GC do not seem to be complementary.

Discussion and Conclusions

Within the context of economic globalization, heightened stakeholder expectations and a shift towards market environmentalism, global CR standards have emerged as increasingly important regulatory institutions governing aspects of corporate environmental and social responsibility (Cashore, 2002; Hebb and Wójcik, 2005; Klooster, 2006; Neumayer and Perkins, 2004; Potoski and Prakash, 2004). Our goal in the present article has been to provide fresh insight into how aspects of geography have underpinned spatio-temporal variations in the early diffusion of two leading standards. Unique to the field of quantitative study, we integrate interdependencies working through transnational linkages and territorial spaces into explanations of (uneven) cross-national diffusion, modeling the latter as exerting a conditioning influence on the former. The statistical findings support our arguments about the role of internal, contextual factors in shaping countries' receptivity to external, transnational influences. Yet, interestingly, we find a clear difference between the two standards in the domestic factors which exert a conditioning influence. In the case of ISO14001, the strength of spatial interdependence through transnational linkages is greater in wealthier economies, but domestic levels of democracy appear to make no difference. Precisely the opposite holds for the domestic uptake of the GC. The strength of spatial interdependence through transnational linkages on domestic GC participation is higher in

more democratic countries while wealth only has a statistically discernable conditioning effect on interdependencies via business travelers.

These differences between ISO14001 and the GC are, on the face of it at least, surprising. Yet it is quite possible that they reflect the very different nature of the respective standards. The idea that democracy should be more likely to have a conditioning influence on domestic receptivity to transnational forces in the case of the GC is therefore plausible. ISO14001's close association with ISO9000, its emphasis on internal ("win-win") cost savings, and potential differentiation advantage in terms of securing access to environmentally-demanding export markets, has meant that the standard has long held a degree of commercial appeal for profit-seeking businesses. As evidenced by its lower uptake, however, the "business" case for the GC has been far less obvious. In the absence of commercial benefits such as improved foreign market access, uptake of the Global Compact is likely to have been more dependent on pressure from domestic stakeholders. This is likely to have increased the conditioning influence of democracy in that effective demand from local stakeholders for the GC more strongly depends on the level of democratic freedoms. Indeed, whereas the GC addresses many issues (labor rights, human rights and corruption) which are characteristically suppressed in less democratic countries, the managerial, environmental aspects addressed by ISO14001 are unlikely to prove especially controversial to autocratic governments. These differences may also explain the particular significance of wealth in conditioning spatial interdependence via transnational linkages in the case of ISO14001. With levels of domestic demand less of a critical limiting factor, as in the case of the GC, uptake of ISO14001 is more likely to have been constrained by internal resources. Although firms in low-income countries may have

anticipated payoffs from adopting ISO14001, limited domestic resources means they are unlikely to have been able to do so, with the result that diffusion is conditioned by domestic GDP p.c.[7]

Another contribution of the present article was to re-examine and, moreover, extend current understanding regarding the role of transnational linkages in diffusing CR standards across national borders. Our findings for ISO14001 confirm several previous studies which similarly show a trading-up effect, but, furthermore demonstrate that the influence of export linkages in increasing domestic certification is greater in wealthier countries (Albuquerque et al., 2007; Neumayer and Perkins, 2004; Prakash and Potoski, 2006). Uniquely, and indicating that trading-up dynamics are not restricted to ISO14001, we also demonstrate that if a country mainly exports to markets characterized by a high density of participants this is associated with higher domestic participation in the GC. Our result for ISO14001 is far from surprising: evidence reveals that a key motive for certification of this "business" standard has been anticipated or real demand from customers in major export markets (Bansal and Hunter, 2003; Kollman and Prakash, 2002; Wu, Chu, and Liu, 2007). However, there is little case-study evidence that similar supply-chain pressures are exercised by lead firms in relation to the GC, suggesting that the influence of exports may also be through non-coercive dynamics such as expanded information. Regardless of the underlying drivers, the fact that trade emerges as the most influential form of transboundary connection-cum-flow lends strong support to arguments about the role of major exchange partners in fostering cross-border convergence (Clark et al., 2001; Prakash and Potoski, 2006; Vogel, 1997).

[7] It is also possible that the difference between ISO14001 and the GC may reflect differences in the sectoral distribution of adopters of the respective standard although, in the absence of comparative data, we cannot say anything definitive on this point.

Investing-up dynamics are also apparent although, of note, the impact of spatial interdependence through FDI on domestic uptake is estimated to be substantially lower than for export linkages. Hence, consistent with work on FDI-related spillovers (Jordaan, 2008), we find that if the main foreign countries with FDI stocks in the domestic country have a high density of ISO14001 certificates, this translates into higher domestic densities of certification. This result confirms similar findings by Prakash and Potoski (2007), but advances on this study by deriving from a larger sample and by being based on a more complete dataset of bilateral inward FDI stocks. We also provide evidence – for the first time – of a similar investing-up effect in the case of the GC.

Novel to the quantitative literature, we additionally find evidence of "visiting-up" effects. A higher density of ISO14001 certificates and GC participants in foreign countries whose businesspeople visit is associated with higher domestic densities of the respective standard in receiving countries. Of course, it is possible that our business travel connectivity variable is simply capturing a broader set of influences related to trade and FDI. Still, our study provides the first large-N, statistical evidence supporting case-study literature which has documented a role for business travel in diffusing new knowledge, organizational practices and norms across territorial boundaries (Beaverstock, 2002; Jones, 2007).

We finish by briefly discussing a couple of wider implications. First, our study's findings highlight the need for diffusion researchers to rethink their approach to modeling cross-national diffusion. Although it might be heuristically useful to draw a distinction between internal and external determinants, our study suggests that it may not always make sense to treat them as functionally independent. Under certain conditions, the territorially-

bounded, contextual attributes of place may be instrumental in amplifying or attenuating the influence of transnational flows of information, norms and competitive pressures. Accordingly, we suggest that there is a need for researchers to explore integrating certain domestic, contextual and transnational, relational aspects in their models of cross-national diffusion.

A second implication of our study is that it is wrong to assume that the cross-national diffusion of different standards is governed by identical geographic factors. Certainly, the influence of boundary-spanning links is very similar in both cases, but our findings also reveal differences in the role of domestic, contextual factors in influencing countries' receptivity to transnational interdependencies. Different aspects of place, in other words, appear to be important for standards with different goals, modalities and mechanisms.

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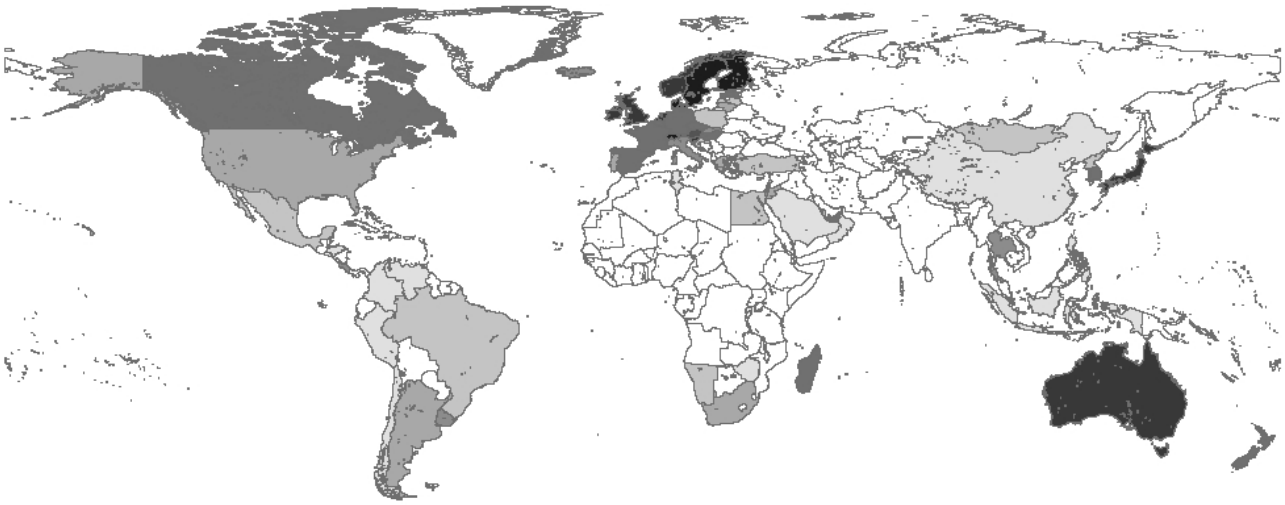
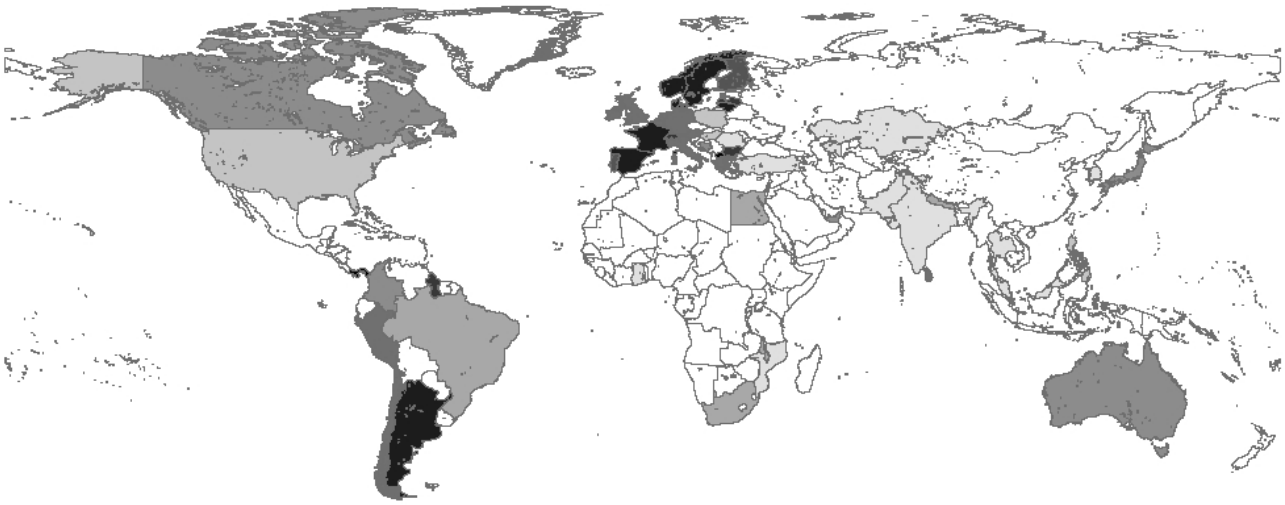
Figure 1. Density of ISO14001 adoptions, 2000



Notes: Darker shades depict a higher number of ISO14001 certificates per capita.
Source: Authors based on data from ISO (2007)

Figure 2. Density of Global Compact (GC) participants, 2005



Notes: Darker shades depict a higher number of GC participants per capita
Source: Authors based on data from UN (2008b)

Table 1. Estimation results for ISO14001.

	(1)	(2)	(3)	(4)	(5)	(6)
ISO14001 p.c. (t-1)	0.944	0.968	0.901	0.728	0.840	0.766
	(9.63)***	(8.48)***	(9.84)***	(5.04)***	(5.54)***	(5.82)***
Spatial lag (export link)	0.318			-0.005		
	(2.16)**			(0.05)		
Spatial lag (FDI link)		0.141			-0.025	
		(2.74)***			(0.48)	
Spatial lag (business travel link)			0.318			0.025
			(1.89)*			(0.49)
Spatial lag * democracy				0.006	0.007	0.005
				(1.26)	(1.64)	(0.85)
Spatial lag * GDP p.c.				0.000	0.000	0.000
				(2.80)***	(2.25)**	(1.54)
Democracy	-0.028	0.001	-0.038	-0.029	-0.053	-0.056
	(1.48)	(0.03)	(1.32)	(0.95)	(1.36)	(1.18)
GDP p.c.	0.001	0.001	0.000	-0.000	0.000	-0.000
	(1.31)	(1.26)	(0.75)	(0.26)	(0.30)	(0.23)
ISO9000 p.c.	0.017	0.017	0.016	0.017	0.018	0.019
	(2.47)**	(2.22)**	(2.26)**	(2.67)***	(2.12)**	(2.67)***
Test no second order	1.42	1.39	1.45	1.59	1.52	1.47
autocorrelation (p-value)	(0.1542)	(0.1645)	(0.1477)	(0.1108)	(0.1279)	(0.1415)
Obs.	599	555	547	599	555	547
Countries	151	142	138	151	142	138

Notes: Arellano and Bond's (1991) GMM estimator. All spatial lag variables as well as their interactions are modelled as endogenous. Coefficients of year-specific time dummy variables and constant not reported. Absolute z-statistics derived from robust standard errors in parentheses.

Table 2. Estimation results for the GC.

	(1)	(2)	(3)	(4)	(5)	(6)
GC p.c. (t-1)	0.563	0.566	0.552	0.525	0.450	0.324
	(5.35)***	(8.00)***	(9.28)***	(5.91)***	(6.97)***	(2.64)***
Spatial lag (export link)	0.878			0.366		
	(2.23)**			(1.19)		
Spatial lag (FDI link)		0.312			0.155	
		(2.12)**			(1.38)	
Spatial lag (business travel link)			0.305			-0.002
			(2.15)**			(0.02)
Spatial lag * democracy				0.030	0.017	0.027
				(1.66)*	(1.80)*	(1.76)*
Spatial lag * GDP p.c.				0.000	0.000	0.000
				(1.01)	(0.70)	(2.37)**
Democracy	0.000	0.006	-0.001	-0.007	-0.003	-0.003
	(0.13)	(0.86)	(0.49)	(1.41)	(0.66)	(1.07)
GDP p.c.	0.000	0.000	0.000	-0.000	-0.000	-0.000
	(1.05)	(0.68)	(1.49)	(0.57)	(0.46)	(0.38)
ISO14001 p.c.	0.002	0.002	0.003	0.001	0.002	0.001
	(1.32)	(1.59)	(1.94)*	(0.55)	(1.14)	(0.71)
Test no second order	0.33	-0.15	0.41	0.09	-0.01	0.64
autocorrelation(p-value)	(0.7395)	(0.8815)	(0.6846)	(0.9299)	(0.9986)	(0.5245)
Obs.	552	553	538	552	553	538
Countries	142	148	137	142	148	137

Notes: Arellano and Bond's (1991) GMM estimator. All spatial lag variables as well as their interactions are modelled as endogenous. Coefficients of year-specific time dummy variables and constant not reported. Absolute z-statistics derived from robust standard errors in parentheses.